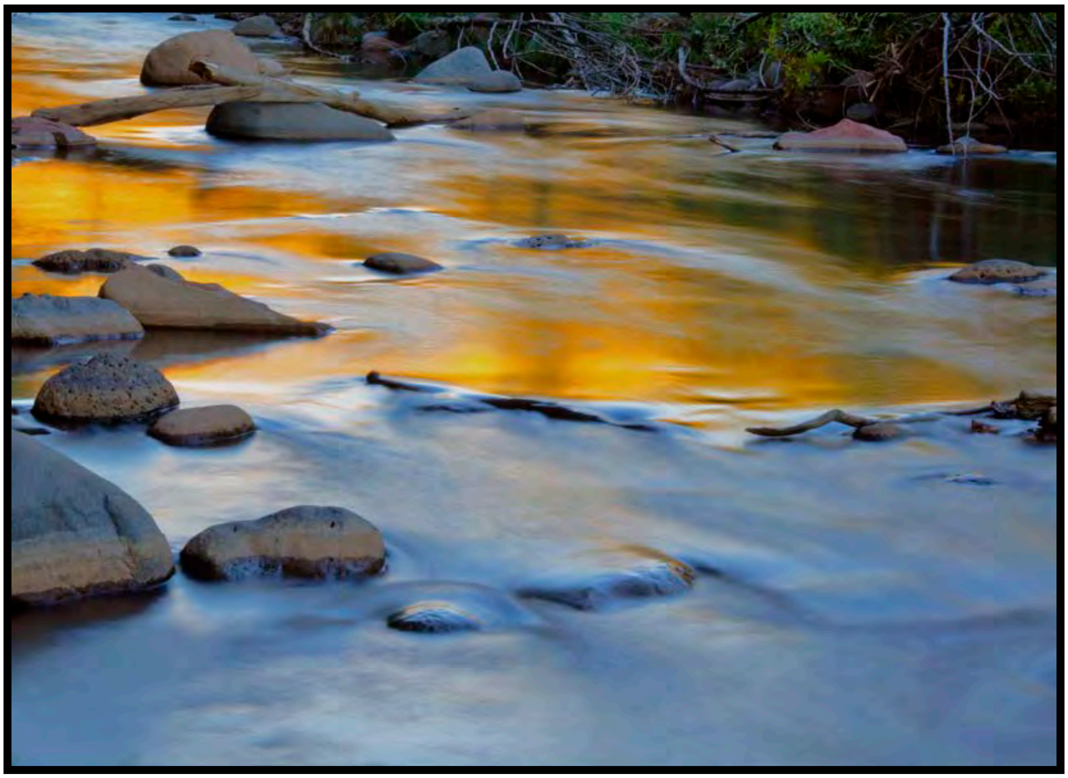
South Platte River Basin
Water Resources Planning Model
User's Manual



August, 2017

Colorado's Decision Support Systems

Colorado Water Conservation Board · State of Colorado · 1876 · 1937

Colorado Division of Water Resources

Department of Natural Resources

Table of Contents

Table of Figures

Table of Tables

1. Introduction

1.1 Background

The Colorado's Decision Support System (CDSS) consists of a database of hydrologic and administrative information related to water use in the State of Colorado, and a variety of tools and models for reviewing, reporting, and analyzing the data. The CDSS water resources planning models, of which the South Platte River Basin Water Resources Planning Model (South Platte Model) is one, are water allocation models, which determine availability of water to individual users and projects, based on hydrology, water rights, and operating rules and practices. They are implementations of "StateMod," a code developed by the State of Colorado for application in the CDSS project. The South Platte Model Historical dataset, which this document describes, extends from calendar year 2012 back to 1950. It simulates demands changing through time, current infrastructure and projects coming on-line, and the current administrative environment.

The South Platte Model was developed as a tool to test the impacts of proposed diversions, reservoirs, water rights and/or changes in operations and management strategies. The model can simulate proposed changes using a highly variable physical water supply constrained by administrative water rights. The Historical dataset can serve as the starting point, demonstrating condition of the stream absent the proposed change. It is recommended the user compare the Historical simulation results to results from a model to which they have added the proposed features, to determine the performance and effects of the proposed changes.

Information used in this model dataset is based on available data collected and developed through the CDSS, including information recorded by the State Engineer's Office. The model dataset and results are intended for basin-wide planning purposes. Individuals seeking to use the model dataset or results in any legal proceeding are responsible for verifying the accuracy of information included in the model.

1.2 Development of the South Platte River Basin Water Resources Planning Model

The South Platte Decision Support System (SPDSS) Feasibility Study, completed in 2001, outlined the data collection and model enhancements that would be necessary to develop the consumptive use, surface water allocation, and ground water models in the South Platte River basin. In subsequent years, data that would ultimately be included in the SPDSS models were developed, collected, reviewed, and formatted for use in the modeling effort. These data collection efforts were summarized in a series of task memos, as listed in Section 7.7. Data included, but is not limited to:

- Development of seven historical irrigated acreage coverages, including mapping surface and ground water supplies and crop type information.

- Collection and review of daily and monthly climate data to support the development of calibrated crop coefficients.

- Collection and review of historical call records to characterize the historical call regime.

- Interviews with Water Commissioners from each basin and numerous water providers in order to document system operations, develop initial modeling approaches, and collect user-supplied data.

- Collection and review of transmountain diversions and streamflow gage data.

- Development of modeling approaches for operations not previously used in CDSS models, including off-channel reservoir systems, augmentation plans, and changed water rights.

- Alluvial and bedrock well construction and testing for development and calibration of aquifer parameters.

In addition, several enhancements were made to the StateCU and StateMod modeling platforms, including, but not limited to:

- Enhancement of StateCU to allow four land use types (sprinkler/flood/surface water/ground water) to better represent conjunctive use and changes in application efficiency over time.

- Development of the StateCU GUI and Wizard interfaces, and inclusion of binary output.

- Addition of significant functionality to StateMod in order to handle more complex municipal and ground water operations. This included implementing a new structure type (plan structures), which required several new model input files and operations.

- Addition of new operations to account for the South Platte Compact.

Much of this data and information was used to develop the basin-wide consumptive use analysis and ground water models, which were completed in 2010 and 2013 respectively. While technical consultants were developing the consumptive use and ground water models, DWR staff was developing an initial Lower South Platte StateMod Model. This model was critical to testing and developing modeling approaches that would be used throughout the overall South Platte Model. This model was ultimately completed by consultants in 2013 and served as the template for the remaining modeling in the upper basin, which kicked off in the same year. Individual models were first developed at the sub-basin level, and then integrated into an overall basin-wide model. Shortly after sub-basin model development began, it was determined that additional StateMod enhancements were desired to better account for transmountain diversions and changed water rights operations, and to add functionality to instream flow operations. The sub-basin models were integrated into a full model by the end of 2016. The South Platte Model was developed to an initial calibration level, and, like other CDSS models, will be updated and further enhanced in the future.

1.3 Results

The key results of the South Platte Model efforts are as follows:

- A water resources planning model was developed that can make comparative analyses of historical and future water management policies in the South Platte Basin. The model includes 100 percent of the irrigation consumptive use, a large majority of the municipal and industrial uses, and all transmountain imports.
- Input data for the South Platte Model using a monthly time-step for the period 1950 through 2012 were developed.
- The model was calibrated for a study period extending from year 1993 through 2012. This calibration period is appropriate for the South Platte to represent the changes that have occurred in the basin in recent years due to complex municipal and augmentation/recharge operations.
- A complete dataset of natural flows from 1950 through 2012 at key stream gage locations throughout the basin has been developed (excluding the Cache la Poudre). Natural flows remove the impacts of transmountain diversions, reservoir operations, and consumptive use from the stream flow record.
- The calibration of the Historical simulation is considered good, based on a comparison of historical to simulated streamflows, reservoir contents, and diversions.

1.4 Acknowledgements

CDSS is a project of the Colorado Water Conservation Board (CWCB), with support from the Colorado Division of Water Resources. The South Platte Model was developed as individual sub-basin models by the following consultants and was integrated by Wilson Water Group.

- Water District 4 – Riverside Technology, inc., ParsonsWater Consulting, LLC, and Wilson Water Group
- Water District 5 –Brown and Caldwell and DiNatale Water Consultants
- Water District 6 – Amec Foster Wheeler and Lynker Technologies, LLC
- Water Districts 2, 7, 8, 9, 23, and 80 – ParsonsWater Consulting, LLC, Ecological Resource Consultants, Inc., Williams and Weiss Consulting, LLC, and Leonard Rice Engineers

- Water Districts 1 and 64 – preliminary development by Colorado Division of Water Resources staff and completed by Wilson Water Group

2. What's in this Document?

2.1 Scope of this Manual

This reference manual describes the CDSS South Platte River Water Resources Planning Model, an application of the generic water allocation model StateMod and one component of the Colorado's Decision Support System. It is intended for the reader who:

- Wants to understand basin operations and issues through review of the model,
- Needs to evaluate the model's applicability to a particular planning or management issue,
- Intends to use the model to analyze a particular South Platte River Basin development or management scenario,
- Is interested in estimated conditions in the South Platte River Basin under historical development over a range of hydrologic conditions, as simulated by this model, and in understanding the modeling estimates.

For this manual to be most effective, the reader should have access to a complete set of data files for the South Platte Model, as well as other CDSS documentation as needed (see below).

The manual describes content and estimates in the model, implementation issues encountered, approaches used to estimate parameters, and results of calibration. Limited general information is provided on the mechanics of assembling datasets and using various CDSS tools.

2.2 Manual Contents

This manual is divided into the following sections:

Section 3: The South Platte River Basin – describes the physical setting for the model, provides general review of water resources development and issues in the basin.

Section 4: Modeling Approach – provides and overview of methods and techniques used in the South Platte Model, addressing an array of typical modeling issues, such as:

- Physical extent and spatial detail
- Study period
- Aggregation of small structures
- Data filling methods

- Simulation of processes related to irrigation use, such as delivery loss, soil moisture storage, crop consumptive use, and returns flows
- Development of baseflows
- Calibration techniques

Section 5: Historical Dataset - refers to the Monthly Historical dataset input files for simulating demands changing through time, current infrastructure and projects coming on-line, and the current administrative environment as if it were in place throughout the modeled period. The dataset is generic with respect to future projects, and could be used as the basis against which to compare a simulation that includes a new use or operation. The user is advised, before appropriating the dataset, to become fully aware of how demands and operations are represented. Elements of these are subject to interpretation, and could legitimately be represented differently.

This section is organized by input file. The first is the response file, which lists the other files and therefore serves as a table of contents within the section. The content, source of data, and particular implementation issues are described for each file in specific detail.

Section 6: Historical Calibration and Results – describes the calibration process and demonstrates the model's ability to replicate historical conditions. Comparisons of streamflow, diversions, and reservoir levels are presented generally by basin and include discussion on calibration efforts.

Section 7: Appendices – detailed information on model and data development**.**

2.3 What's in other CDSS documentation

There is some overlap of topics both within this manual and between this and other CDSS documentation. To help the user take advantage of all sources, pointers are included as applicable under the heading "**Where to Find More Information**," throughout the manual.

The user may need to supplement this manual with information from other CDSS documentation. This is particularly true for the reader who wants to:

- Make significant changes to the South Platte Model to implement specific future operations,
- Introduce changes that require regenerating the baseflow data file,
- Regenerate input files using the Data Management Interface (DMI) tools and HydroBase,
- Develop a StateMod model for a different basin.

An ample body of documentation exists for CDSS, and is still growing. A user's biggest challenge may be in efficiently finding the information they need. This list of descriptions is intended to help in selecting the most relevant data source:

Consumptive Use Report – the report "Historic Crop Consumptive Use Analysis: South Platte Decision Support System" from March 2010 provided the basis for information on the consumptive use analysis. The StateCU analysis was updated to incorporate the most recent irrigated acreage data in order to develop the inputs required for the variable efficiency method.

Basin Information – in order to develop the South Platte Model, interviews were conducted with water commissioners and water users throughout the South Platte Basin. These interviews served as the basis for understanding and implementing operations in the model. They are documented as Task 3 and Task 5 Technical Memorandum and are available on the CWCB website.

DMI user documentation – user documentation for **StateDMI** and **TSTool** is currently available, and covers aspects of executing these codes against the HydroBase database (Creating datasets for StateMod is only one aspect of their capabilities). The DMIs preprocess some of the StateMod input data. For example, StateDMI computed coefficients for distributing baseflow gains throughout the model and aggregated water rights for numerous small structures. TSTool filled missing time series data and computed headgate demands for irrigation structures. Thus the documentation, which explains algorithms for these processes, is helpful in understanding the planning model estimates. In addition, the documentation is essential for the user who is modifying and regenerating input files using the DMIs.

StateCU documentation – StateCU is the CDSS irrigation consumptive use analysis tool. It is used to generate structure-specific time series of irrigation water requirement, an input to StateMod. A model change that involves modified irrigated acreage or crop-type would require re-execution of StateCU.

StateMod documentation – the StateMod user manual describes the model in generic terms and specific detail. Section 3 - Model Description and Section 7 - Technical Notes offer the best descriptions of StateMod functionality, and would enhance the South Platte Model user's understanding of results. If the user is modifying input files, they should consult Section 4 - Input Description to determine how to format files. To analyze model results in detail, they should review Section 5 - Output Description, which describes the wide variety of reports available to the user.

Self-documented input files – an important aspect of the StateMod input files is that their genesis was documented in the files themselves. Command files that directed the DMIs creation of the files were echoed in the file header. Generally, the model developers have incorporated comments in the command file that explain use of options, sources of data, etc.

Technical Memoranda – many aspects of the modeling methods adopted in CDSS were explored in feasibility or pilot studies before being implemented. Historical technical memoranda and reports for these activities are listed in Section 7.7 and are publically available on the CDSS website.

3. The South Platte River Basin

The South Platte River Basin is one of seven major rivers that have their headwaters in the State of Colorado. In terms of area, it covers about one quarter of the State. It includes the largest municipal area in Colorado and a significant portion of the State's irrigated farmland. Meeting the needs of these two large water users, in addition to wildlife and recreational users, has been the theme of water development through time.

3.1 Physical Geography

The South Platte River Basin begins in the South Park area of the Rocky Mountains in central Colorado and flows southeast toward Elevenmile Reservoir (see Figure 3-1). From the reservoir, the river turns sharply northeast and flows to the Front Range via Waterton Canyon, where it emerges onto the plains southwest of Denver. From Denver the river continues its northeastern course towards Greeley, Colorado, where it bends eastward to Sterling, Colorado and North Platte, Nebraska. It covers approximately 19,300 square miles in the northeast portion of Colorado. Major tributaries include Bear Creek, Boulder Creek, Cherry Creek, Clear Creek, St. Vrain Creek, Big Thompson River, and the Cache la Poudre River (CWCB, 2006).

In general, most of the precipitation falls as rain in the late spring and as snow during winter, with dry conditions in between. The average October-April precipitation in the basin varies from 3 inches in the lower plains to 22 inches in the mountains, and 6 and 15 inches, respectively, for the plains and mountains during May-September (CWRRI, 1990).

The hydrology of the South Platte Basin is highly variable, with an approximate average annual native flow volume of 1.4 million acre-feet (af). About 70 percent of the annual streamflow occurs during spring runoff. From 1993 – 2012, native water supply in the current model domain[1] was supplemented by approximately 390,000 af of transmountain diversions from the Colorado River Basin and non-tributary groundwater pumping. Currently, the South Platte Basin has approximately 8,000 decreed points of diversion and 54,000 decreed wells (CDSS Basin Fact Sheet). From 1993-2012, the surface water diversions averaged approximately 3.5 million af annually. The amount of diversion in excess of native flow highlights the return flow-dependent nature of the basin's hydrology. On average (1993-2012) approximately 370,000 af leaves the basin, flowing past the Julesburg gage into Nebraska (CWCB, 2015).

[1] Current model domain reflects the South Platte River Basin excluding the Cache La Poudre River Basin.

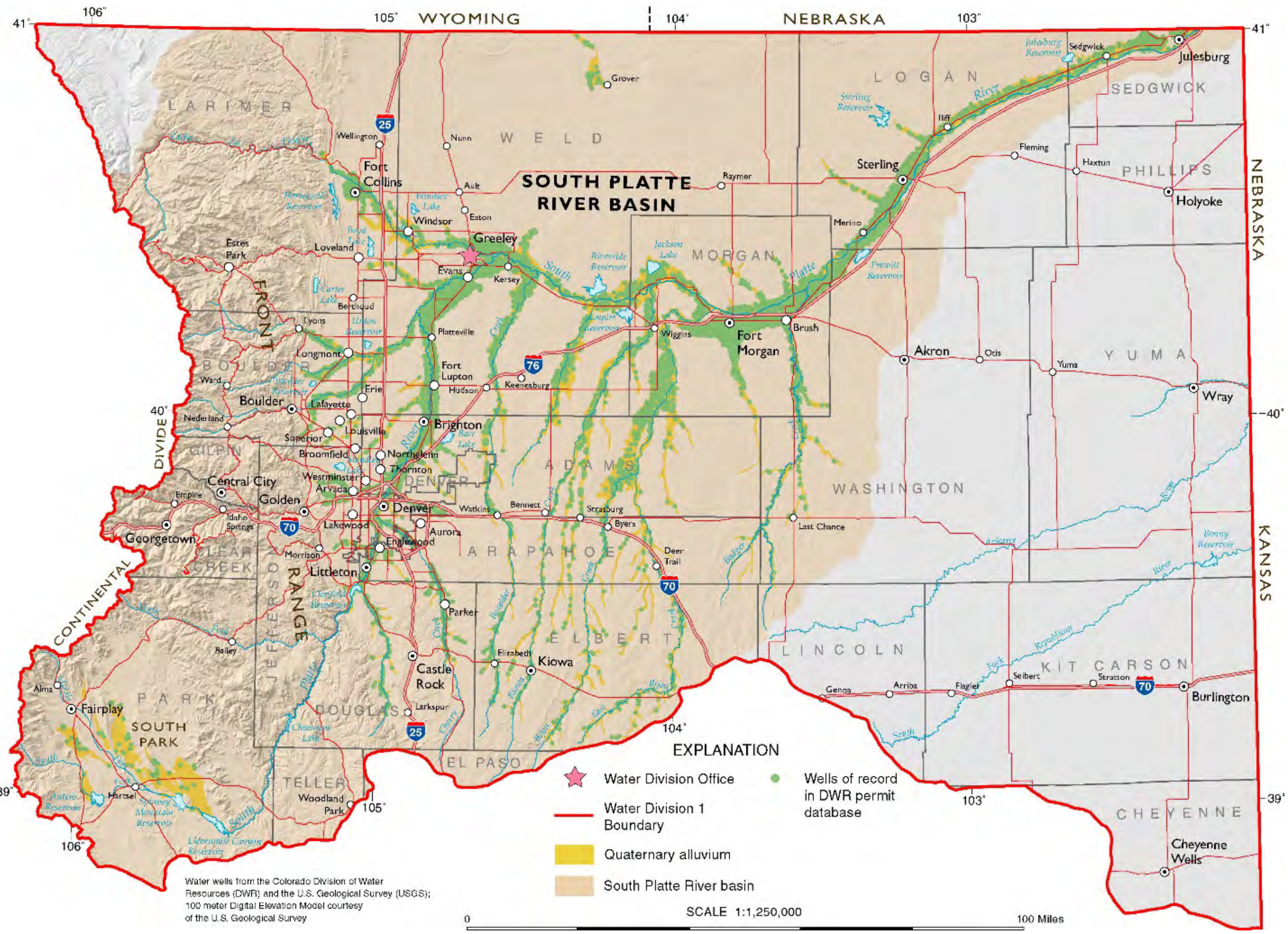


Figure 3-1: South Platte River Basin (Source: Colorado Geological Survey)

The subsurface hyrogeology of the South Platte Basin consists predominantly of a relatively shallow unconfined alluvial aquifer along the mainstem and tributaries and the deeper Denver Basin confined aquifers below some areas of the basin. The alluvial aquifer system is generally in hydrologic connection with the surface water system.

3.2 Human and Economic Factors

The South Platte River Basin is the most populous basin in the State. A majority of the population in the basin is located in the Front Range corridor. In 2008, the South Platte River Basin was home to a population of 3.5 million people. By 2050 the population is expected to grow to six million people (CWCB, 2015). Denver is the capital city and most populous municipality in the state of Colorado with an estimated population of 600,000 in 2010 (US Census, HydroBase census).

The South Platte is fully appropriated, and these appropriations are diverted for to meet many uses. The principal water uses are municipal, irrigation, and industrial. Urban business and industry within the Basin drive the majority of the State's overall economy. In 2010, the irrigated acres totaled approximately 700,000, accounting for approximately 72% of Colorado's agricultural outputs (CWCB, 2016).

3.3 Water Resources Development

A majority of Colorado's population and agricultural production exist on the eastern slope, and a majority of the water supply originates on the western slope. Early water leaders recognized the need for transmountain diversion projects to supplement the native eastern slope supplies.

The largest transmountain project is the Colorado-Big Thompson (C-BT). Project water is diverted from the Colorado Basin and delivered through Adams Tunnel to the Big Thompson River. From there, water is delivered through a system of tunnels, channels, and reservoirs to municipal and agricultural water users throughout the South Platte Basin. The C-BT project is owned by the U.S. Bureau of Reclamation and managed by Northern Colorado Water Conservancy District (Northern).

The next largest transmountain diverter is Denver Water, which also has numerous South Platte diversions. Transmountain and South Platte water is supplied by a 4,000 square mile collection system extending across eight counties – Park, Grand, Jefferson, Summit, Teller, Douglas, Clear Creek, and Gilpin. Main water sources are the South Platte, Blue River, Williams Fork, and Fraser River watersheds, but Denver Water also diverts from South Boulder Creek, Ralston Creek and Bear Creek watersheds (Denver Water, 2013). Water collected on the West Slope is transported to the East Slope primarily through Moffat Tunnel and Roberts Tunnel.

In addition to transmountain diversions, a number of large reservoirs are located in the South Platte Basin. Major municipal water supply reservoirs on the main stem of the South Platte River include Antero, Spinney Mountain, Eleven Mile Canyon, and Cheeseman.

The plains are dominated by irrigation use and have experienced their own increase in water resources development over the years. Many of the off-channel reservoirs in the lower basin were constructed in the early 1900s to provide late season irrigation supplies. Most of the well development in the South Platte ocurred in the mid 1950s in response to drought and the new availabilility of power from the Federal Rural Electrification Act. As well pumping became more prevalent however, its impacts to surface water and senior direct flow rights on the South Platte lead to the Water Rights Determination Act of 1969. Early well augmentation plans such as Bijou, Ft. Morgan, and the Poudre Plan began to take shape in the mid 1970s, however the outcome of the *Empire Lodge* case and subsequent legislation in the early 2000s significantly increased the number of rechange plans and brought about the administration and enforcement of these plans.

Irrigators in the lower basin have also experienced changes as municipalities purchased senior irrigation water rights, changed them over to municipal uses in water court, and dried up this irrigated acreage. The “buy and dry” process continues today, with municipalities reaching out to irrigators farther and farther downstream.

3.4 Water Rights Administration and Operations

The South Platte River is over-appropriated; water management and administration in the basin has always been challenging with more demand than supply in most years. Adding to this challenge are the following relatively recent factors:

- Increased demand for municipal and industrial water supply along the Front Range corridor has emphasized the need for efficient and effective management and administration.
- Transfers of water from agriculture to municipal uses, along with other water right transfers, are becoming increasingly complex in order to fulfill the demand for growing urban areas and industry while maintaining historical return flow patterns for existing users.
- Augmentation plan accounting that allows out of priority pumping depletions to be offset from a variety of sources including recharge pits, augmentation wells, reservoirs, etc.
- Recent years of below average streamflow in the South Platte River have increased the competition for water supplies for both direct use and for augmentation purposes.

The Water Commissioners in the South Platte River Basin work hard to administer the many different users in their basins, including administering the various aspects of water court decrees and water provider agreements part of decrees. A majority of the tributaries are managed by “internal” calls in that mainstem river calls do not generally call out tributary structures.

There are water rights administration issues and operations in the South Platte River Basin that have not been encountered in previous CDSS modeling efforts. These include primarily well pumping, extensive municipal uses with imported supplies and changed water rights, and the South Platte Compact. These unique modeling challenges are discussed in more detail below.

3.4.1 Ground Water Management – Legal Development

Ground water management and administration in the South Platte essentially began in 1957; prior to 1957, no permit was required to construct a well, and ground water was not managed or allocated by the State. The Colorado Ground Water Law of 1957 required a permit from the State Engineer as a prerequisite to drilling a new well and required the registration of existing wells, with the exception of certain stock watering, domestic and artesian wells. The Colorado Ground Water Management Act of 1965 created the Ground Water Commission and designated ground water basins. This allowed for management districts that regulated the spacing of wells and set limits on production rates. In response to the Supreme Court's findings regarding tributary wells and surface water, the Water Rights Determination Act of 1969 was enacted. The act required that surface water and tributary ground water be administered conjunctively.

There are four main types of ground water: 1) Tributary ground water, 2) Designated Basin ground water, 3) Non-tributary ground water outside of Designated Basins and 4) Denver Basin ground water of the Dawson, Denver, Arapahoe, and Laramie-Fox Hills aquifers.

Tributary ground water rights were required to be adjudicated in order to protect their priority and their depletions must be augmented to prevent injury to senior water rights holders. Designated Basin ground water was the first statutory departure from the "all ground water is tributary to stream" rule recognized by the Colorado Supreme Court to protect surface water appropriators. Unlike tributary ground water, designated ground water is administered as "hydrologically disconnected" from the alluvial aquifer. Designated ground water is regulated by the Ground Water Commission and is subject to a modified prior appropriation system within the basin. The Commission balances the full economic development of designated ground water resources while protecting prior appropriators in the basin and allowing for reasonable depletion of the aquifers.

Use of non-tributary ground water outside of designated basins and Denver Basin ground water is subject to the 1965 Ground Water Management Act, but not to the jurisdiction of the Colorado Ground Water Commission. Non-tributary ground water is defined as pumping that, in 100 years, will not deplete the flow of a natural stream at an annual rate greater than $1/10^{th}$ of one percent of the annual rate of withdrawal from the well. Senate Bill 5 analyses determine the total volume of non-tributary ground water associated with a parcel of overlying land. Additionally, not all the water withdrawn from the non-tributary Denver Basin aquifers can be consumed; 2 percent must be replaced, often met by return flows from outdoor watering or other sources.

3.4.2 Municipal Operations and Transmountain Imports

Municipal operations in the South Platte River basin are extremely complex. Municipalities generally have a diverse water rights portfolio, including imported supplies, changed water rights, storage, and ground water supplies. Municipalities are able to make operational decisions with these various supplies on a day-to-day basis in order to provide a reliable supply to their customers. The administration of their in-basin supplies is based on strict prior appropriation: they are entitled to divert their supplies when water is physically and legally available. Transmountain supplies are subject to strict administration in their source basins and often also by operational agreements, however once they are imported to the South Platte Basin they are not subject to additional administration. These imports are sheparded to their place of beneficial use, but are still subject to transit losses when delivered via stream and administered in exchanges or augmentation plans when it is a source of substitute supply, replacement, or re-diverted for another use.

3.4.3 Platte River Recovery Implementation Program

In 1994, the U.S. Secretary of the Interior and the Governors of Colorado, Nebraska and Wyoming entered into a Platte River Memorandum of Agreement (MOA). An outgrowth of this effort was the development and signing of a Cooperative Agreement (CA) in 1997. Under the CA, the three States and the Federal government agreed to develop a program to implement certain aspects of the United States Fish and Wildlife Service's (Service) recovery plans for the whooping crane, interior least tern, piping plover, and pallid sturgeon. Specifically, the program would seek to secure defined benefits for the subject species and to serve as a reasonable and prudent alternative to offset the effects of existing and new water related activities within the Platte River Basin. The program would also try to help prevent the need to list, under the Endangered Species Act, any additional Platte River Basin associated species.

Pursuant to the CA, a Water Action Plan has been developed to improve the Platte River flows. The Service has developed species target flows and the Water Action Plan is focused on reducing shortages to the target flows by an average of 130,000 to 150,000 acre-feet per year. The first 70,000 acre-feet of water will be provided in part by (1) restoring the storage capacity of Pathfinder Reservoir in Wyoming, (2) establishing an environmental water account in Nebraska's Lake McConaughy, and (3) utilizing a groundwater recharge and river re-regulation project on the Tamarack State Wildlife Area in Colorado. The plan identifies other water conservation or water supply means for further enhancing flow conditions by an additional 60,000 to 80,000 acre-feet per year from water conservation or new water supply sources within the three States (Governance Committee of the Cooperative Agreement for Platte River Research 2000).

3.4.4 South Platte Compact

The South Platte River Compact of 1923 establishes Colorado and Nebraska's rights to use water from the South Platte River. From April 1 to October 15th of each year, if the mean daily flow of the South Platte River at Julesburg, Colorado drops below 120 cubic feet per second (cfs) and water is needed for beneficial use in Nebraska, diversion by water rights in Colorado between the western boundary of Washington County and the Stateline with priorities junior to June 14, 1897 shall be curtailed (Colorado Revised Statutes 1990). Between October 15th and April 1st Colorado has the right to fully use water from the South Platte River under Compact rules. Refer to Section 5.10.11 for more information on how the South Platte Compact was implemented in the model.

3.5 Section References

- Census and Population Estimate Data, HydroBase Data.
- South Platte Basin Implementation Plan, South Platte and Metro Basin, CWCB, 2016.
- SWSI Fact Sheet for South Platte Basin, CWCB, 2006.

- South Platte River System, Colorado Water Resources Research Institute, 1990
- A Decade of Colorado Supreme Court Water Decisions, Justice Greg Hobbs, CFWE, 2006.
- History of Denver Water. 2016. Retrieved from http://www.denverwater.org
- Colorado-Big Thompson Project. 2016. Retrieved from http://www.northernwater.org
- Ground Water Administration and Well Permitting. Colorado Division of Water Resources. 2016. Retrieved from http://water.state.co.us/

4. Modeling Approach

This section describes the approach taken in modeling the South Platte River Basin, from a general perspective. It addresses scope and level of detail of this model in both the space and time domains, and describes how certain hydrologic processes are parameterized.

4.1 Modeling Objectives

The objective of the South Platte modeling effort was to develop a water allocation and accounting model that water resources professionals can apply to evaluations of planning issues or management alternatives. The resulting input dataset represents water use changing through time, current infrastructure and projects coming on-line, and current administrative conditions, which can serve as the base in paired runs comparing river conditions with and without proposed future changes. By modifying the dataset to incorporate the proposed features to be analyzed, the user can create the second input dataset of the pair.

The model estimates the basin's current consumptive use by simulating 100 percent of irrigation demands and the majority of municipal and industrial uses in the basin. This objective was accomplished by representing large or administratively significant structures at model nodes identified with individual structures, and representing many small structures at "aggregated" nodes. The model was developed from 1950 to 2012 and calibrated for the period from 1993 forward. This long-term dataset reflects a wide variety of hydrologic conditions.

Another objective of the CDSS modeling effort was to achieve good calibration, demonstrated by agreement between historical and simulated streamflows, reservoir contents, and diversions. This objective was achieved, as demonstrated in Section 6.

4.2 Model Coverage and Extent

The South Platte Model represents the South Platte Basin located within the State of Colorado, with the notable exception of Water Districts 3, 48, and 76. These Water Districts cover the Cache la Poudre River Basin, which is currently being studied as part of several EIS processes. The State determined it was in the best interest of the water users to have the EIS processes completed before additional modeling effort focused on this area was undertaken.

4.2.1 Network Diagram

The network diagram for the South Platte Model can be viewed in StateDMI. It includes more than 1,000 nodes, beginning near the headwaters of the South Platte River and ends at the Colorado-Nebraska Border.

4.2.1.1 Key and Non-Key Structures

Early in the SPDSS process it was decided that, while all consumptive use should be represented in the model, it was not practical to model every single water right or diversion structure individually. Therefore, while a majority of uses in the basin is represented at correct river locations with correct priorities relative to other users (i.e. key structures), there are several structures that are modeled in aggregate. Aggregate structures, or non-key structures, are included in aggregates if they generally exhibited one or more of the following characteristics:

- Active structures (CIU indicates active) that currently (in the period since 2001) divert for irrigation
- Sparse or no diversion records during the 1950 to current digitized (2006) year SPDSS study period
- Diversion source is a small tributary that will not be included in the water resources planning model
- Relatively small acreage, generally less than 100 acres

The South Platte Model includes approximately 360 key diversion structures, with approximately 100 non-key diversion structures modeled in aggregate. Over half of the non-key diversion structures are located in South Park, and are administered in aggregate at specific gaged locations (refer to Section 5.10.8.2). The remainder of the non-key diversion structures and all irrigated acreage that is supplied only by ground water supplies are aggregated using a spatial process.

In GIS, a single coverage for diversion and ground water aggregates was created by dividing water districts into subsets based on the location of non-key irrigated lands, confluences, designated basins, stream gage locations, and the alluvial ground water boundary. Areas were subdivided until less than 5,000 acres of irrigated lands were assigned to each aggregate node. Each subarea was assigned a unique nine character identifier that included the Water District, ADP (Aggregate Diversion Platte) or AWP (Aggregate Well Platte), and a unique number. For example, 01_AWP001 indicates an aggregated ground water only structure located in Water District 1.

Aggregated structures were assigned all the water rights associated with their constituent structures. Their historical diversions were developed by summing the historical diversions of the individual structures, and their irrigation water requirement is based on the total acreage associated with the aggregation.

Key structures located on the same tributary that operate in a similar fashion to satisfy a common demand are sometimes modeled as a “diversion system.” In a diversion system, the acreage, demands, and water rights of the associated structures are combined and modeled as one explicit key structure.

Where to find more information

- SPDSS Task Memorandum 3, “Key Diversion Structure,” available on the CDSS website
- SPDSS Task Memorandum 3, “Aggregate Non-Key Agricultural Diversion Structure,” available on the CDSS website.

4.2.1.2 Municipal and Industrial Uses

Key municipal and industrial uses were identified using the Key Diversion Structure criteria above. Additional municipal uses were included as key structures in order to represent changed water rights and because of their importance to administration in the basin. Water use is based on information from HydroBase and data collected from the key municipality.

Domestic use that is not supplied by a key municipal water provider is represented in an aggregated fashion. Non-key municipalities are aggregated by water districts and county. The aggregated nodes are assigned a nine character identifier that includes the Water District, AMP (Aggregated Municipal Platte), and a unique number. For example, 06_AMP002 indicates the second group of non-key municipal structures in Water District 6. Water use from populations living in un-incorporated areas is generally assumed to be met by well water. The un-incorporated aggregates are assigned a nine character identifier that includes the Water District, AUP (Aggregated Unincorporated Platte), and a unique number.

For both key and aggregated structures, municipal demand is divided between indoor and outdoor demands, because of the differences in return flow percentages and timing. Indoor demand structures are represented with the water district, a shortened version of the municipal name and _I. Outdoor demand structures are represented with the water district, a shortened version municipal name and _O. For example, Lafayette outdoor demand is at node 06LAFFYT_O.

For large, self-supplied industrial water users, information was collected from the water users through interviews. See the DDS section below for details on self-supplied industrial water users.

Where to find more information

- SPDSS Task Memorandum 66.2, “Collect and Develop Municipal and Industrial Consumptive Use Estimates,” available on the CDSS website.

4.2.2 Reservoirs

In StateMod, reservoir structures are used to represent reservoir storage, aggregated reservoir storage, and recharge areas. For details on the reservoirs that are represented in the South Platte Model, see Section 5.6.

4.2.2.1 Key Reservoirs

Under Task 5, reservoirs with decreed capacities greater than or equal to 10,000 af were considered key reservoirs. Additional smaller reservoirs were identified as key reservoirs due to their impact on administration and operations in the basin during interviews with water commissioners and water users and as part of model development. Similar to diversion systems, reservoir systems were also defined. A single reservoir node represented a group of reservoirs either on the same tributary, filled by the same diversion structures, or operated in a similar fashion to satisfy a common demand. Section 5.6 lists the constituent reservoirs in a reservoir system. Key reservoirs and reservoir systems are explicitly modeled.

There are 67 key reservoirs with a combined total capacity of approximately 1,556,000 af, or 67 percent of the total modeled storage capacity of the basin. The physical parameters of the key reservoirs were collected from HydroBase or from the reservoir owner.

Where to find more information

- SPDSS Task 5 Memorandum, "Summary – Key Reservoirs," available on the CDSS website.
- SPDSS Task 5 Memorandum on individual systems, available on the CDSS website

4.2.2.2 Aggregation of Reservoirs

In keeping with CDSS's objective of representing all consumptive use in the basin, the evaporation losses associated with small reservoirs and stock ponds were incorporated using 15 aggregate reservoir structures and 9 aggregate stock pond structure. Each aggregate reservoir and stock pond was assigned one account and an initial storage equal to its capacity. A GIS process was used to find all of the reservoir surface area in each water district that was not associated with key reservoirs. HydroBase was queried and non-key reservoirs larger than 30 acres were grouped as aggregated reservoirs. Non-key reservoirs smaller than 30 acres were grouped as aggregated stock ponds. The elevation of the non-key reservoirs was also considered. Water Districts were split into upper and lower aggregates at elevation 6,500 feet. Aggregated reservoirs were assumed to be 17 feet deep. Aggregated stock ponds were assumed to be 10 feet deep. For details on the physical parameters of aggregated reservoir and stock ponds, please see Section 5.6.

Aggregate reservoirs and aggregated stock pond do not release to the river in the model. However, they evaporate and fill to replace the evaporated amount. The effects of small reservoirs filling and releasing are left “in the gage” in the model, and are reflected in CDSS baseflow computations. The aggregate reservoirs and stock ponds are assigned storage rights with a priority of 1.0 (very senior) so that the evaporation use is not constrained by water rights.

Where to find more information

- SPDSS Task 69 Memorandum, “Estimate Reservoir and Stock Pond Evaporation,” available on the CDSS website.
- SPDSS Task 89.10 Memorandum, “Mapping of Water Features,” available on the CDSS website

4.2.2.3 Recharge Areas

Numerous individual recharge areas exist in the South Platte River Basin, all with different return flow timings to better mimic the variable depletion timing generated from the wells included in the plan. The modeling approach for the South Platte Model was to aggregate the individual recharge areas by ditch and by augmentation plan, as they are generally served by the same water rights and operated similarly under the augmentation plan. The primary recharge pits under a ditch were identified using HydroBase diversion coding. The recharge area sizes were based on the physical properties stored in HydroBase.

From conversations with recharge area operators, the design goal of a recharge pit is to have all of the water seep into the ground within 10 days. In StateMod, the seepage patterns for recharge areas were developed to empty the recharge area three times in a month. Note that the majority of recharge pits do not have a physical mechanism for releasing water to the river directly. The only way for water to leave the pit is through seepage or evaporation. The exception is Bijou No. 2 Reservoir, which was originally designed to be a storage reservoir. However, the reservoir has a large amount of natural seepage and is now used for recharge. The seepage pattern was developed using a mass balance approach, considering diversions to the reservoir, releases, evaporation and end-of-month contents.

4.2.3 Instream Flow Structures

The model includes instream flow reaches representing instream flow rights held by CWCB, minimum reservoir release agreements, filings by the U.S. Department of the Interior, and recreational instream channel diversions. These are a subset of the total CWCB tabulation of rights because many instream flow decrees are for stream reaches very high in the basin, above the model network.

4.3 Modeling Period

The South Platte Model dataset extends from January 1950 through December 2012 and operates on a calendar year. The calibration period was 1993 through 2012; selected because this period is after most of the large water infrastructure development and is after a large number of changed water right cases were settled. This 20 year period includes both drought (2000-2007) and wet periods (1996-1998, 2011).

4.4 Data Filling

Data filling efforts were completed early in the South Platte modeling effort. Data was primarily collected from HydroBase. Water users were asked to provide any missing data, which was incorporated into the model input. When no values were available from HydroBase or the water user, the data filling techniques summarized in this documented and described in detail in the relevant Task Memos were employed. A brief summary is provided in the section below. For details on data filling, please refer to the Task Memos listed in the box.

Where to find more information

- SPDSS Task 2 Memorandum, "Identify Key Streamflow Gages," available on the CDSS website.
- SPDSS Task 3 Memorandum, "Key Diversion Structures," available on the CDSS website
- SPDSS Task 4 Memorandum, "Identify and Fill/Resolve Conflicting Records for Key Transmountain Diversion Structures", available on the CDSS website
- SPDSS Task 5 Memorandum, "Key Reservoirs", available on the CDSS website
- SPDSS Task 66 Memorandum, "Collect and Develop Municipal and Industrial Consumptive Use Estimates", available on the CDSS website

4.4.1 Stream Gage Filling

It is essential that steam gages have complete data for the model run. The model calibration will be compared to streamflow and baseflow estimates at ungaged location primarily depend on gaged records. Key stream gages were picked based on the completeness of their records, but some missing data cannot be avoided completely. Regression equations were developed using upstream, downstream, or nearby gages. TSTool was used to fill missing streamflow data using either monthly equations or a single linear equation, depending on the goodness of fit. For details on the filling by regression, see the Section 5.3.4.

Stream gages records were combined if a gage had been relocated. Some additional steps were required if the relocation significantly changed what the gage was reading. In some instances, stream gages had poor periods of record, but were at critical locations in the model. These gages required special techniques to fill this data. For details on these stream gages, see the Section 5.3.4.

4.4.2 Historical Diversions for Irrigation

For Key diversion structures that divert primarily for irrigation, the total diversions at the headgate from HydroBase were the primary source of information. For key structures, missing values were first filled with infrequent data, if available. Next, diversion structures were filled using water commissioner comments. Remaining missing values were filled using a Wet/Dry/Average pattern. In this approach, an index stream gage is assigned to each water district. Monthly stream flow volumes from January 1950 through December 2012 are categorized as Wet, Average, or Dry, with Wet representing the top 25% of a particular month and Dry representing the bottom 25% of a particular month. When a month is missing from the diversion data, the corresponding index gage category is assigned to the missing month. Based on the category, the average diversion value for that month is used to fill the missing value. For example, March 1993 is missing from the diversion records and the index gage for March 1993 is categorized as Wet. The average of all other Wet Marches from the diversion record is used to fill March 1993. The Wet/Dry/Average pattern filling approach only works if enough other data is present in the diversion record. Any other missing diversion values are filled with the historical monthly average of the diversion record.

For structures that diverted to both irrigation and off-channel reservoir storage, please refer to the “Off-Channel Reservoir and Irrigation Structures” section below for details on how total diversions and demand at irrigation structures were developed.

For aggregated structures, the time series from the constituent structures were filled using the same approach as key structures before being combined.

Care was taken to identify structures that originally diverted surface water, but then switched to ground water only sources. These structures were removed from the automated filling process and had their recent missing values set to zero.

Water District 2 required a special approach for 2011 and 2012. Structures frequently did not have a “Diversion Total” tabulated in HydroBase, but did have diversions recorded under various “Diversion Classes”. Each structure was examined individually and a total diversion was created from the representative diversion classes.

Table 4-1: Pattern Gage Assignment

Water District	Index Gage ID	Index Gage Name
1	06754000	SOUTH PLATTE RIVER NEAR KERSEY

Water District	Index Gage ID	Index Gage Name
2	06720500	SOUTH PLATTE RIVER AT HENDERSON
4	06695000	SOUTH PLATTE RIVER ABOVE ELEVEN MILE RESERVOIR
5	06724000	ST. VRAIN CREEK AT LYONS
6	06727000	BOULDER CREEK NEAR ORODELL
7	06719505	CLEAR CREEK AT GOLDEN
8	06714000	SOUTH PLATTE AT DENVER
9	06710500	BEAR CREEK AT MORRISON
23	06695000	SOUTH PLATTE RIVER ABOVE ELEVEN MILE RESERVOIR
64	06764000	SOUTH PLATTE RIVER AT JULESBURG
80	06695000	SOUTH PLATTE RIVER ABOVE ELEVEN MILE RESERVOIR

4.4.3 Historical Municipal Demand

Whenever available, municipal demand was collected from the municipality. Frequently, water treatment plant data from the municipality needed to be supplemented with headgate diversion data that recorded raw water diversions and deliveries to parks, golf courses, cemeteries, etc. Many of the municipalities explicitly included in the model did not have monthly volumetric water use information for more than the past ten to fifteen years. To extend the record back in time, diversion data from HydroBase and from Northern Water's accounting of CBT/Windy Gap deliveries was considered. Finally, if this information was not available for a particular municipality (and for all of the aggregated municipal demand nodes), diversion information was developed based on population and water use per capita estimates. For details on this approach, refer to the SPDSS Task 66 Memo.

For population based estimates, US Census Bureau data was the primary source, but is only available ever 10 years. If appropriate, the annual estimates from the State of Colorado were incorporated. For municipalities, the population for the municipality was used. For aggregated municipalities, the population for the constituent municipalities was used. For aggregated un-incorporated areas, population was considered on a county level (with the municipal population subtracted out) and then pro-rated based on the area of the county located inside each water district. Per capita water estimates were developed in the Task 66 Memo for different areas in the South Platte Basin.

Both Key and Aggregated municipal demand is divided into indoor and outdoor components. This is necessary due to the difference in timing, amount, and return flows. Indoor demand is modeled as near-constant throughout the year. For key municipals, the minimum monthly demand for each year is used as the indoor demand. For aggregated municipals, an annual ratio of 44% indoor use and 56% outdoor use is used. Outdoor demand is distributed based on representative average monthly bluegrass crop irrigation water requirement.

4.4.4 Historical Transmountain Imports

For the South Platte documentation, transmountain refers to water that was diverted from the Colorado, Arkansas or North Platte River basins and imported to the South Platte River. Water that is transferred from one sub-basin in the South Platte to another sub-basin is not considered transmountain.

Many of the transmountain imports had incomplete periods of records in HydroBase. As detailed in the Task 4 Memo, data was collected from the Colorado Division of Water Resources (DWR), the United States Geologic Survey (USGS), and from the transmountain import owners and operators. Data sources were compared and conflicts were resolved. For information on each individual transmountain import, refer to the Task 4 Memo.

4.4.5 Historical Reservoir Contents

Reservoir end-of-month storage contents are primarily from HydroBase. As part of Task 5, any missing values were first filled with data from Water Commissioner field books and annual reports. These values have been incorporated into HydroBase. Next, information was requested from water users.

Remaining missing values were then filled with data filling techniques. Missing data for a two-month period or less were filled using linear interpolation between recorded values. Remaining missing data were filled using the Wet/Dry/Average pattern approach (see description under Historical Diversions to Irrigation Section above). Finally, if any values were still remaining, they were filled with historical monthly averages. During model calibration, filled end of month contents were revisited and some values were individually set based on a water balance approach, using diversion records and stream gage records.

4.5 Consumptive Use and Return Flow Amounts

Consumptive use and return flow are key components of both baseflow estimation and simulation in water resources modeling. StateMod's baseflow estimating equation includes a term for return flows. Imports and reservoir releases aside, water that was in the gage historically is either natural runoff or delayed return flow. To estimate the natural runoff, or more generally, the baseflow, one must estimate return flow. During simulation, return flows affect availability of water in the stream in both the month of the diversion and subsequent months.

For non-irrigation uses, consumptive use is the depletive portion of a diversion, the amount that is taken from the stream and removed from the hydrologic system by virtue of the beneficial use. The difference between the diversion and the consumptive use constitutes the return flow to the stream.

For irrigation uses, the relationship between crop consumptive use and return flow is complicated by interactions with the water supply stored in the soil, i.e., the soil moisture reservoir, and losses not attributable to crop use. This is explained in greater detail below.

4.5.1 Variable Efficiency of Irrigation Use

Generally, the “on-farm” or field application efficiency of irrigation structures in the South Platte Model is allowed to vary through time, up to a specified maximum efficiency. Setting aside soil moisture dynamics for the moment, the predetermined crop irrigation water requirement is met out of the simulated headgate diversion that is delivered to the field, and efficiency (the ratio of consumed water to diverted water) falls where it may – up to the specified maximum efficiency. If the diversion is too small to meet the irrigation requirement at the maximum efficiency, maximum efficiency becomes the controlling parameter. Crop consumption is limited to the diverted amount, times the ditch conveyance loss, times maximum efficiency, and the balance of the diversion returns to the stream.

The model is supplied with the time series of irrigation water requirements for each structure based on its crop type and irrigated acreage. This information is generated using the CDSS StateCU model. Two types of delivery efficiency are modeled: conveyance or ditch transit efficiency and on-farm or field application efficiency. Conveyance efficiency is assigned to each ditch, based on the ditch characteristics and is a fixed parameter throughout the simulation. Maximum application efficiency is also input to the model, but StateMod determines the actual application efficiency for every time step. Maximum flood irrigation system efficiencies for the South Platte Basin are estimated to be 60 percent and sprinkler irrigation is estimated at 80 percent.

Headgate diversion is determined by the model, and is calculated in each time step as the minimum of 1) the water right, 2) available supply, 3) diversion capacity, and 4) headgate demand. Headgate demand is input as a time series for each structure. In the Historical dataset, headgate demand for each structure is simply its historical diversion time series. Historical efficiency is defined as the smaller of 1) average historical diversion for the month, divided by average irrigation water requirement, and 2) maximum efficiency. In other words, if water supply is generally plentiful, the headgate demand reflects the water supply that has been typical in the past; and if water supply is generally limiting, it reflects the supply the crop needs in order to satisfy full crop irrigation requirement at the maximum efficiency.

StateMod also accounts for water supply available to the crop from the soil. Soil moisture capacity acts as a small reservoir, re-timing physical consumption of the water, and affecting the amount of return flow in any given month. Soil moisture capacity is input to the model for each irrigation structure, based on NRCS mapping. Formally, StateMod accounts for water supply to the crop as follows:

Let **DIV** be defined as the river diversion, η_{ditch} be defined as the conveyance efficiency, η_{max} be defined as the maximum application efficiency, and let CU_i be defined as the crop irrigation water requirement.

Then,	$SW = DIV * \eta_{ditch} * \eta_{max}$;	(Max available water to crop)
when	$SW \geq CU_i$:	(Available water to crop is sufficient to meet crop demand)
	$CU_w = CU_i$	(Water supply-limited CU = Crop irrigation water requirement)
	$SS_f = SS_i + \min[(SS_m - SS_i),(SW - CU_w)]$	(Excess available water fills soil reservoir)
	$SR = DIV - CU_w - (SS_f - SS_i)$	(Remaining diversion is "non-consumed")
	$TR = SR$	(Non-consumed is total return flow)
when	$SW < CU_i$:	(Available water to Crop is not sufficient to meet crop demand)
	$CU_w = SW + \min[(CU_i - SW), SS_i]$	(Water supply-limited CU = available water to crop + available soil storage)
	$SS_f = SS_i - \min[(CU_i - SW), SS_i]$	(Soil storage used to meet unsatisfied crop demand)
	$SR = DIV - SW$	(Remaining diversion is "non-consumed")
	$TR = SR$	(Non-consumed is total return flow)

where **SW** is maximum water available to meet crop demand

CU_w is water supply limited consumptive use;

SS_m is the maximum soil moisture reservoir storage;

SS_i is the initial soil moisture reservoir storage;

SS_f is the final soil moisture reservoir storage;

SR is the diverted water in excess of crop requirement (non-consumed water);

TR is the total return to the stream attributable to this month's diversion.

For the following example, assume the ditch efficiency is 75 percent and the field is flood irrigated with a maximum efficiency of 60 percent, resulting in a maximum system efficiency of 45 percent; therefore a maximum of 45 percent of the diverted amount can be delivered and available to the crop. When this amount exceeds the irrigation water requirement, the balance goes to the soil moisture reservoir, up to its capacity. Additional non-consumed water returns to the stream. In this case, the crop needs are completely satisfied, and the water supply-limited consumptive use equals the irrigation water requirement.

When 45 percent of the diverted amount (the water delivered and available to meet crop demands) is less than the irrigation water requirement, the crop pulls water out of soil moisture storage, limited by the available soil moisture and the unsatisfied irrigation water requirement. Water supply-limited consumptive use is the sum of diverted water available to the crop and supply taken from soil moisture, and may be less than the crop water requirement. Total return flow is the 55 percent of the diversion unable to reach the crops (non-consumed).

With respect to consumptive use and return flow, aggregated irrigation structures are treated as described above, where the irrigation water requirement is based on total acreage for the aggregate.

4.5.2 Constant Efficiency for Other Uses and Special Cases

For non-irrigation diversion structures, a specified annual or monthly efficiency was assigned to the diversion structure in order to determine consumptive use and return flows. Although the efficiency may vary by month, the monthly pattern is the same in each simulation year. This approach was also applied to irrigation diversions structures for which the irrigation water requirement is not representative. For more details on these structures, see Section Irrigation Structures Assigned Constant Efficiency below.

Where to find more information

- StateCU documentation describes different methods for estimating irrigation water requirement for structures, for input to the StateMod model.
- Section 7 of the StateMod documentation has subsections that describe "Variable Efficiency Considerations" and "Soil Moisture Accounting"
- Section 5 of this manual describes the input files where the parameters for computing consumptive use and return flow amounts are specified:
  - Irrigation water requirement in the Irrigation Water Requirement file (Section 5.5.3)
  - Headgate demand in the Direct Diversion Demand file (Section 5.4.4)
  - Historical efficiency in the Direct Diversion Station file (Section 5.4.1)
  - Maximum efficiency in the CU Irrigation Parameter Yearly file (Section 5.5.2)
  - Soil moisture capacity in the StateCU Structure file (Section 5.5.1)
- Loss to the hydrologic system in the Return Flow Delay Table file (Section 5.4.2)

4.5.2.1 Irrigation Structures Assigned Constant Efficiency

Several irrigation diversion structures were assigned acreage that is not representative. This generally occurred for diversion structures that serve acreage located within municipal boundaries. Because the acreage assigned to the structure is too small, the irrigated water requirement is too small and the efficiencies are too low. These structures were removed from the irrigated water requirement file (*.ddc) and their monthly efficiencies were set in the diversion station file (*.dds). These structures are listed in the table below.

Monthly efficiencies for the Water District 7 structures were based on the average variable efficiency for the Reno Juchem Ditch (0700647), which is considered representative. For 0600554, the annual efficiency is set to 50 percent, which assumes a ditch efficiency of 84 percent and a flood irrigation efficiency of 60 percent. For 05_ADP002, the annual efficiency is set to 48 percent, which assumes a ditch efficiency of 80 percent and a flood irrigation efficiency of 60 percent. For Water District 8, the Nevada Ditch (0801009_D) efficiency was set based on the decreed amount in Case 90CW172. Last Chance Ditch 2 and City Ditch Pipeline were set as the same as Nevada Ditch. Highline Canal was set based on a report from Denver Water.

Table 4-2: Irrigation Structures Assigned Constant Efficiency

WDID	Name	Annual Efficiency (%)
05_ADP002	Water District 5 Aggregated Diversion Structure 2	48
0600554	Smith Goss Ditch	50

WDID	Name	Annual Efficiency (%)
0700502_I	Agricultural Ditch Irrigation Demand	43
0700527_D	Slough Ditch Diversion System	43
0700540_I	Church Ditch Irrigation Demand	43
0700549_I	Colorado Agricultural Ditch	43
0700551	Cort Graves Hughes Ditch	43
0700570_I	Fisher Ditch Irrigation Demand	43
0700597_I	Kershaw Ditch Irrigation Demand	43
0700601_I	Lee Stewart Eskin Ditch Irrigation Demand	43
0700614	Manhart Ditch	43
0700632	Ouelette Ditch	43
0700652_I	Rocky Mountain Ditch Irrigation Demand	43
0801004	Highline Canal	40
0801007	Last Chance Ditch 2	47
0801008	City Ditch Pipeline	47
0801009_D	Nevada Ditch Diversion System	47

4.6 Return Flow Timing and Locations

There were two main approaches taken to develop return flow timing for the South Platte Model depending on the aquifer information available in each sub-basin. For sub-basins that have significant pumping from the alluvial aquifer, Glover analyses were performed to develop a set of return flow patterns that varied based on the distance of irrigated acreage from the river. For sub-basins with limited aquifer data, return flow patterns were gleaned from water court decrees or other user-supplied or anecdotal information. In general, the return flow patterns reflect the sub-surface returns; overland return portions are not included in these delay patterns. The return flow patterns reflect 100 percent of the return flow; no losses to phreatophytes (i.e. incidental losses) are included. Overland flows, ranging from 5 to 40 percent, were included based on user-supplied information, proximity of irrigated land to drainages or tributaries, information from water court decrees, or adjusted during calibration.

Return flow timing for municipal and industrial uses varied based on the use type. Municipal indoor uses and the majority of the industrial uses returned in the same time step, municipal outdoor uses were generally lagged based on their general distance from the river.

For irrigation structures, return flow locations were generally determined based on visual review of irrigated acreage and topographical maps in GIS. As several of the irrigation structures have undergone a reduction in irrigated acreage over time, in some cases affecting return flow locations, more recent irrigated acreage coverage was used to develop these locations. Some return flow locations were adjusted during calibration. For non-irrigation structures, the point of discharge into the river was used as the return flow location.

4.7 Baseflow Estimation

In order to simulate river basin operations, the model starts with the amount of water that would have been in the stream if none of the operations being modeled had taken place. These undepleted flows are called “baseflows”. The term is used in favor of “virgin flow” or “naturalized flow” because it recognizes that some historical operations can be left “in the gage”, with the assumption that those operations and impacts will not change in the hypothetical situation being simulated.

Given data on historical depletions, basin imports/exports, and reservoir operations, StateMod can estimate baseflow time series at specified discrete inflow nodes. This process was executed prior to executing any simulations, and the resulting baseflow file became part of the input dataset for simulations. Baseflow estimation requires two steps in StateMod and one step in TSTool: 1) StateMod adjusts USGS stream gage flows using historical records of operations to get baseflow time series at gaged points, for the gage period of record; 2) TSTool fills remaining baseflow by regression; 3) StateMod distributes baseflow gains above and between gages to user-specified, ungaged inflow nodes. These three steps are described below.

Note that modeling the full Cache la Poudre River Basin was not included in this phase of the modeling effort. The Cache la Poudre River inflow is currently reflected in the model by the historical streamflow from the Cache la Poudre River near Greeley gage, and an estimate of historical return flows that accrue to the South Platte River downstream of the Greeley gage. As such, these gages do not represent baseflow at these locations.

4.7.1 Baseflow Computations at Gages

Baseflow at a site where historical gage data is available is computed by adding historical values of all upstream depletive effects to the gaged value, and subtracting historical values of all upstream augmenting effects from the gaged value:

$$Q_{baseflow} = Q_{gage} + Diversions - Returns - Imports +/- \Delta Storage + Evap$$

Historical diversions, imports, and reservoir contents are provided directly to StateMod to make this computation. Evaporation is computed by StateMod based on historical evaporation rates and reservoir contents. Return flows are similarly computed based on diversions, crop water requirements, and/or efficiencies as described in Section 4.5, and return flow parameters as described in Section 4.6.

Where to find more information

- When StateMod is executed to estimate baseflows at gages, it creates a Baseflow Information file *(*.xbi*) that shows this computation for each gage and each month of the time step.

4.7.2 Baseflow Filling

For the South Platte Model, the preferred approach was to fill historical stream gage data before creating baseflows in StateMod. However, there were three gage locations in Water District 6 that could not be filled prior to baseflow generation. Therefore, these locations had their baseflows filled using regression equations.

- 06727500 – Fourmile Creek at Orodell. This gage was operational from 1947 through 1953, then from 1983 through 1995, and restarted in 2011. Currently, the gage is only operated seasonally from April through October. In TSTool, monthly regression equations against baseflow at 06725500 (Middle Boulder Creek at Nederland), 06730300 (Coal Creek at Orodell), or 06729500 (South Boulder Creek near Eldorado Springs).

- 06730200 – Boulder Creek at North 75th St, Near Boulder. This gage became operational in 1986, but is at a critical location in relation to City of Boulder waste water discharge and City of Lafayette diversions. To extend the record back to 1950, monthly regression equations against baseflow at 06729500 (South Boulder Creek near Eldorado Springs), 06730500 (Boulder Creek at Mouth near Longmont), or 06_BC_N (BEAR CREEK NATURAL FLOW).

- 06730500 - Boulder Creek at Mouth near Longmont. This gage is missing values from 1956 through 1977. To fill this large gap, monthly regression equations against baseflow at 06730200 (Boulder Creek at North 75th St, Near Boulder), 06729500 (South Boulder Creek near Eldorado Springs), 06727000 (Boulder Creek near Orodell), or 06727500 (Fourmile Creek at Orodell).

4.7.3 Distribution of Baseflow to Ungaged Points

In order for StateMod to have flow on tributary headwaters, baseflow must be estimated at all ungaged headwater nodes. In addition, gains between gages are modeled as entering the system at locations to reflect increased flow due to unmodeled tributaries. During calibration, ungaged baseflow nodes were added to better simulate the water supply that supported historical operations.

StateMod operating mode “9” distributes a portion of baseflows at gaged locations to ungaged locations based on drainage area and average annual precipitation. The default method is the “gain approach”. In this approach, StateMod pro-rates baseflow gains above or between gages to ungaged locations using the product of drainage area and average annual precipitation.

Figure 4-1 illustrates a hypothetical basin and the areas associated with three gages and three ungaged baseflow nodes.

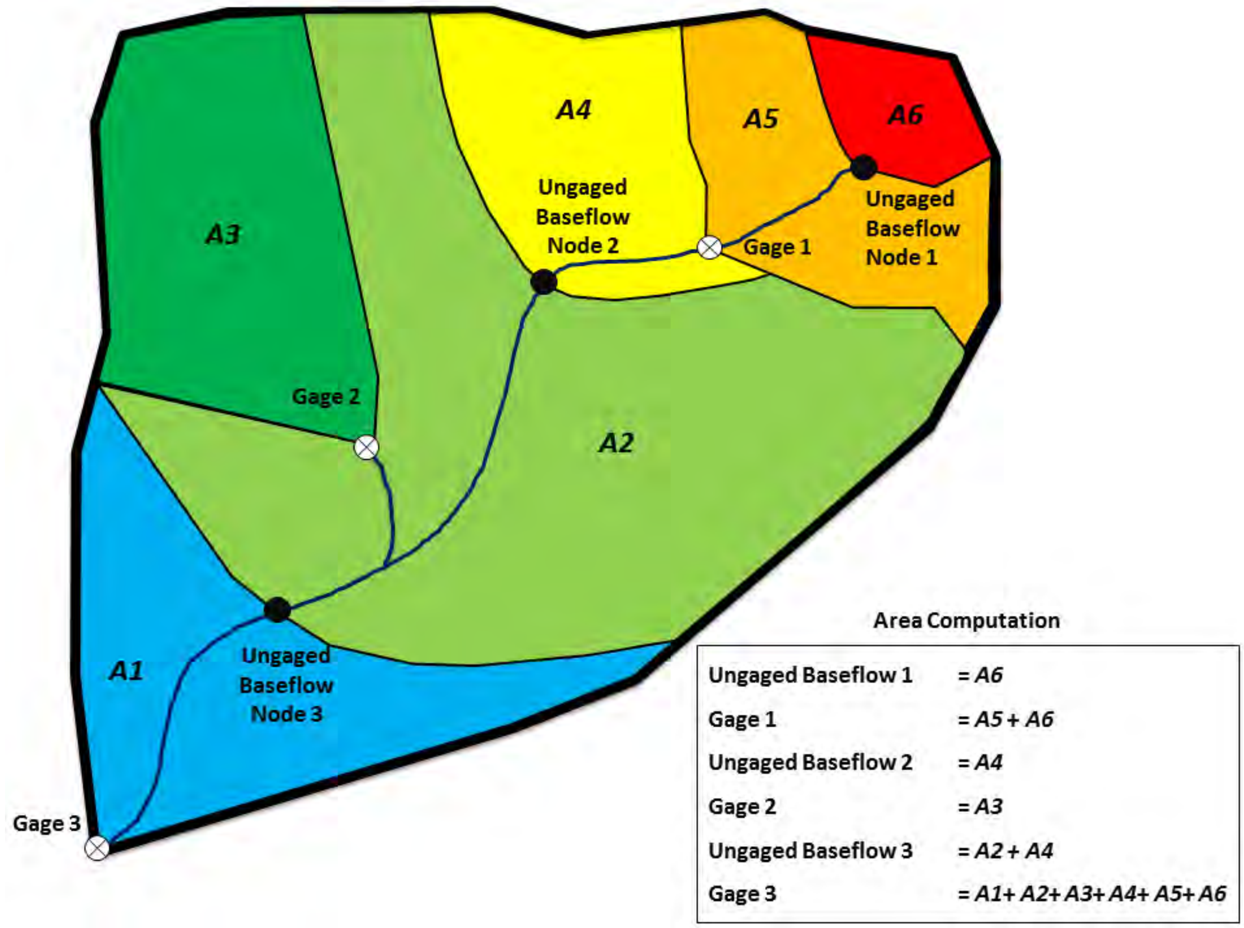


Figure 4-1: Hypothetical Basin Illustration

The area associated with gages is the total upstream area. The area associated with ungaged nodes only includes the incremental area from the ungaged location to the next upstream gage or gages. For example, Gage 3 area includes the entire basin. Ungaged Baseflow Node 3 area (light green) includes the upstream area between the Ungaged Baseflow Node 3 and Gage 2 and Gage 1.

In Figure 4-1, there are three ungaged baseflow nodes; the StateMod "gain approach" computes the total baseflow at each ungaged node based on the following:

The baseflow gain distributed to Ungaged Baseflow Node 1 is the baseflow gain above Gage 1 pro-rated on the A*P terms.

$$Gain_{ungaged,1} = \left(\frac{(A*P)_{ungaged,1}}{(A*P)_{gage,1}}\right)(BF_{gage,1})$$

Total baseflow at Ungaged Node 1 is equal to the $Gain_{ungaged,1}$ term.

The baseflow gain distributed to Ungaged Baseflow Node 2 is the baseflow gain between Gage 1, 2, and 3 pro-rated on the A*P terms.

$$Gain_{ungaged,2} = \left(\frac{(A*P)_{ungaged,2}}{(A*P)_{gage,3} - (A*P)_{gage,2} - (A*P)_{gage,1}}\right)\left(BF_{gage,3} - BF_{gage,2} - BF_{gage,1}\right)$$

Total baseflow at Ungaged Node 2 is equal to the $Gain_{ungaged,2}$ term plus the baseflow at Gage 1.

$$BF_{ungaged,2} = Gain_{ungaged,2} + BF_{gage,1}$$

Ungaged Baseflow Node 3 calculations are very similar. The baseflow gain distributed to Ungaged Baseflow Node 3 is the baseflow gain between Gage 1, 2, and 3 pro-rated on the A*P term.

$$Gain_{ungaged,3} = \left(\frac{(A*P)_{ungaged,3}}{(A*P)_{gage,3} - (A*P)_{gage,2} - (A*P)_{gage,1}}\right)\left(BF_{gage,3} - BF_{gage,2} - BF_{gage,1}\right)$$

Total baseflow at Ungaged Node 3 is equal to the $Gain_{ungaged,3}$ term plus baseflow at Gage 1 and Gage 2.

$$BF_{ungaged,3} = Gain_{ungaged,3} + BF_{gage,1} + BF_{gage,2}$$

A second option for estimating headwater baseflows can be used if the default "gain approach" method created results that do not seem credible. This method, referred to as the "neighboring gage approach", creates a baseflow time series by multiplying the baseflows at a specified gage by the ratio $(A*P)_{headwater}/(A*P)_{gage}$. This approach is effective when the runoff at an ungaged location does not follow the same pattern as the gains along the main stem. For example, a small ungaged tributary that peaks much earlier or later than the main stem should use the neighboring gage approach with a streamgage in a similar watershed. The user is responsible for ensuring that the overall reach water balance is maintained when using the neighboring gage approach.

Where to find more information

- The **StateDMI** documentation in section 5.10 "Stream Estimate Data" for describes computation of baseflow distribution parameters based on A*P, incremental A*P, and the network configuration.

4.8 Imports

Imported supplies serve as a significant portion of the supplies used to meet in-basin demands, primarily those imported by C-BT, Denver Water Board, and the City of Aurora. Special consideration of imported water in StateMod is recommended to make sure it is not reflected as natural flow or distributed as natural flow gains; it can be distributed to various users in the basin based on a specified order; and it can be tracked as a reusable supply as appropriate. In general, the imported water is brought into the system and stored in a plan structure at a very senior priority, and then released from the plan structure to specific users generally at a priority that is junior to users other supplies. Note that for many municipalities, this may be the most senior priority and represent the “first” supply used to meet their demands. Any unused imported supplies are released to the river in their destination basins.

If imported water is allowed to be reused, additional operations are used to “transfer” the imported water into a plan structure type that can be used with reusable operations. The non-consumed portion of the imported water released from these plan structures is tracked as a reusable supply, which can then be released to meet additional demands in the same time-step. Refer to Section 5.8 for more information on import and reusable plans.

4.9 Changed Water Rights

In general, StateMod allows owners of changed water rights to temporarily divert the changed water right in priority, but use the water right at a more junior priority within the same timestep. This allows the changed water right to be used in conjunction with other supplies in their water rights portfolio, in order to represent actual operations.

Operations with changed water rights are represented in the StateMod model based on the flow that is legally available to the changed water right priority at the original ditch location on the river system. The changed water rights are constrained by the pro rata percentage of the water right that has been changed and user-input monthly and annual diversion limits. The divertible yield of the changed water right stored in an accounting plan can be released to meet various demands. The unconsumed portion of the changed water can be assigned to a reuse plan, which is available for other uses (e.g., to meet return flow obligations or stored in a reservoir). Ditch losses and augmentation station delivery locations, along with return flow obligations can be calculated on the diversion and/or use of the changed rights.

Note the StateMod operating rules typically allow only one Demand (e.g., ditch demand, off-channel municipal demand, reservoir storage) when the Source of supply is a water right. In order to use a single water right to meet multiple demands, the water right must first be “stored” in an accounting plan. The “stored” water is released from the accounting plan to meet multiple demands with operating rules. In general, any time a single source water right is used to meet multiple demands, the approach described below must be used.

The general approach developed for the representation of changed water rights is summarized below and illustrated in Figure 4-2. The example below uses the Fisher Ditch (0700570) changed water rights. More detail regarding operating rules can be found in Section 4.13 of the StateMod documentation. More details on the representation of Fisher Ditch in the South Platte Model, specifically the changed water rights operations found in the SP2016.opr file, can be found in Section 5.10 below.

Fisher Ditch originally was an irrigation structure located on Clear Creek. Over time, shares in the ditch have been purchased by Xcel Energy (formerly known as Public Service Company) and the City of Thornton. These shares have been converted to other uses through the water court process. Xcel Energy uses the water to meet demands at the Cherokee Power Plant. The City of Thornton uses the water to meet municipal demands, return flow obligations, and for storage in Standley Lake. The senior water right is now being split between the remaining irrigators under Fisher Ditch, Xcel Energy, and the City of Thornton.

Modeling changed water rights is a four step process. Each step will be explained in detail below:

1. Take water rights off river to Changed Water Right Plan
2. Split Changed Water Right Plan to User Plans
3. Release from User Plans to demands
4. Release remaining plan contents.

For **Step 1 "Take water rights off river to Changed Water Right Plan"**, divert the legally available pro rata water right to a Changed Water Right Accounting Plan when in priority. For Fisher Ditch, this is the *FishSplPln*. In the SPDSS Model, Changed Water Right Accounting Plans typical have "Pln" in the model ID. When plans are used to represent the water rights for multiple users, the model IDs typically include "Split" or "Spl" (e.g., FishSplPln).

Usually under the water court decree, volumetric limitations on the amount of the changed water rights have been imposed. These limits are represented as monthly and annual volumes and are a required input. The volumetric limits consist of 13 values (12 months and an annual value). These 13 values are used for each year of the simulation period, and therefore do not explicitly represent multi-year volumetric limits or maximum monthly/annual limits. It is important to consider at what location volumetric limits have been imposed. StateMod "sees" everything at the river. Many changed water rights include limitations on the augmentation station deliveries. This limit is after the ditch loss that occurs between the river headgate and the augmentation station. Therefore, the ditch loss is added back into a volumetric assigned at the headgate. For example, if the decreed April augmentation station delivery limit is 100 af and a 10% ditch loss occurs below the river headgate, the StateMod operating rule has 111 af as the monthly volumetric in April (111 minus 10% = 100) in order to accurately represent the volumetric limits on the use of the changed water rights.

For cases where there is only one owner of the pro rata water right to be used for multiple purposes, the limits in the operating rules are generally derived from long-term average volumetric limits in the change decree (e.g., 20-year annual total af) that are distributed monthly based on long-term average historical diversions to irrigation. Seasonal limitations on the use of the changed water rights are effected by setting the monthly limits to zero outside of the season of use (e.g., November through March).

For cases where there are multiple owners of the prorate water right, the limits in the operating rules are generally set to sufficiently large values to allow 100 percent of the Source water right to be “stored” in the Changed Water Right Accounting Plan. In order to represent decreed limitations on the uses of the changed water rights, the releases of water from the plan (see Step 3 below) are limited by Release Limit Plans. For the Fisher Ditch, there are three owners of the senior water right. The volumetric limitations are a required input, so they have been set large enough to allow 100% of the Source water right to be “stored” in the *FishSplPln* (a Changed Water Right Accounting Plan).

Step 2 “Split Changed Water Rights Plan to User Plans” only applies if there are multiple owners of the changed water right. Operating rules divide the “stored” water in the Changed Water Right Accounting Plan into individual users’ accounting plans according to ditch share percentages. Note each operating rule can be turned on and off for any number of years. Therefore, rules that start and stop in different years and have different split percentages are used to track very closely with different water right change decrees.

For Fisher Ditch, the Changed Water Right Accounting Plan is only sent to the irrigators prior to 1989. Starting in 1989, the Changed Water Right Accounting Plan is sent to three Account Plans that represent ownership of the City of Thornton, Xcel Energy, and ditch irrigators. The year 1989 is selected because it is generally consistent with the adjudication dates of the change decrees.

Under **Step 3 “Release from User Plans to demands”**, water is delivered from the individual Accounting Plans to user demands. Releases of changed water rights from the plans are typically carried through the Source ditch (e.g., 0700570) so as to simulate a portion of the conveyance capacity being used by the water right. This approach also allows representation of ditch losses that must remain in the ditch as a consequence of the change of use. For example, Fisher Ditch has a 10% ditch loss that must remain in the ditch and is not available for the changed use.

Carrying water through the Source ditch also allows for augmentation stations to be simulated. Augmentation station operations can be represented by then turning water out of the ditch to a downstream location on the river. For the Fisher Ditch example, this enables Thornton to use their changed water rights to meet other return flow obligations.

As discussed under Step 1, when there are multiple owners of a source water right, the preferred approach is to divert 100 percent of the source water right into the Changed Water Rights Accounting Plan and then impose the decreed limits on the releases to each user, based on their individual decrees. This is the approach taken for the Fisher Ditch. Xcel Energy and Thornton have separate Accounting Plan Limit rules. Their Accounting Plan Limit rules are referred in other operating rules that release water to their demands.

For the Fisher Ditch example, the City of Thornton uses their portion of the changed water right to meet return flow obligations and to store water in Standley Lake by exchange. Xcel Energy uses their portion of the changed water right to meet the Cherokee Power Plant demand. Note that the use of these changed shares also creates return flow obligations; refer to the Fisher Ditch plan operations in Section 5 to more discussion on the terms and conditions associated with these changed water rights.

Step 4 "Release remaining plan contents" is a requirement in StateMod. Any supply from the changed water rights that remain in the changed water rights plans must be returned to the river since this water cannot be carried over between subsequent time steps. This is done with a Type 29 operating rule.

Example Model Representation of Fisher Ditch Changed Water Rights

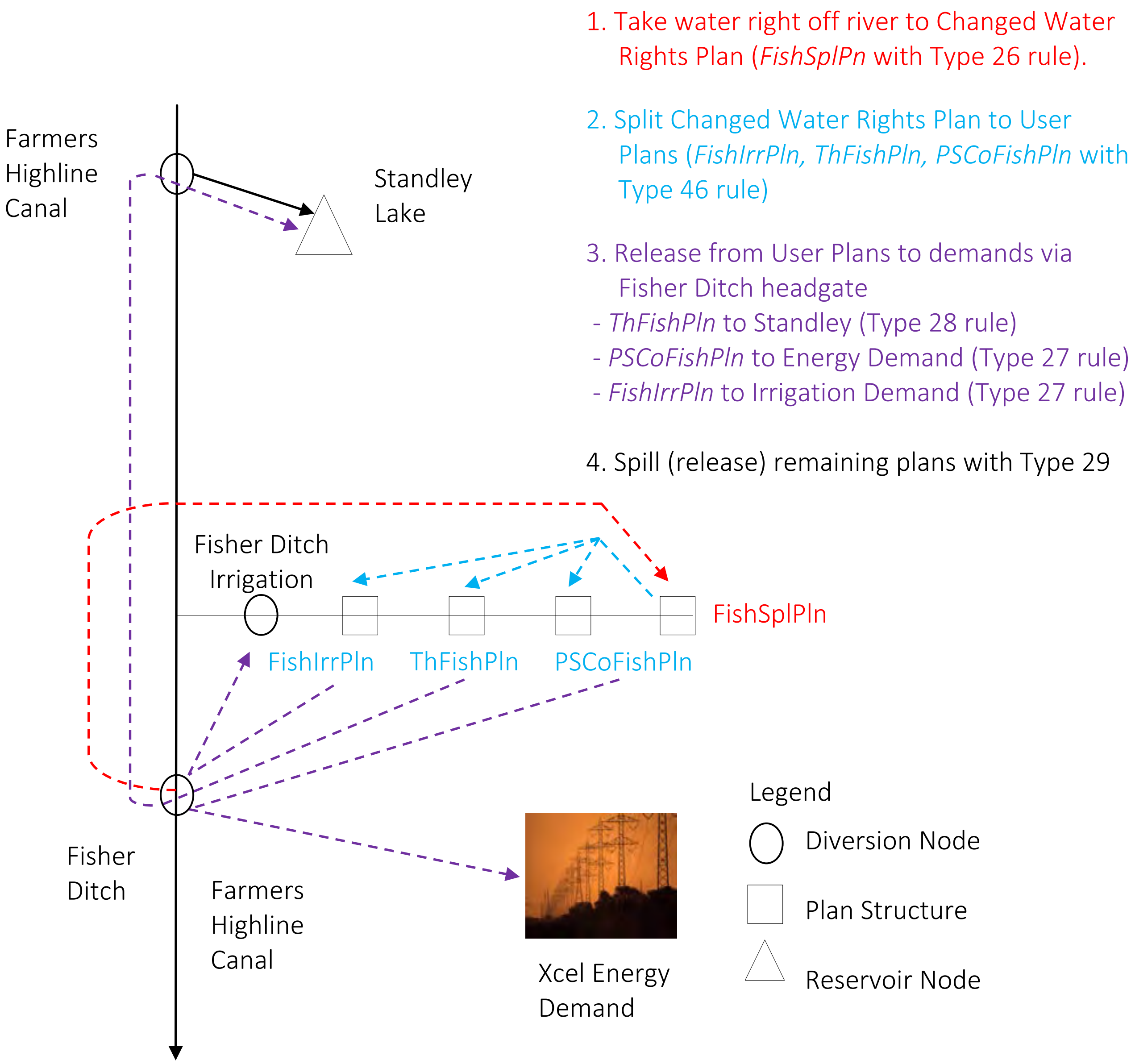


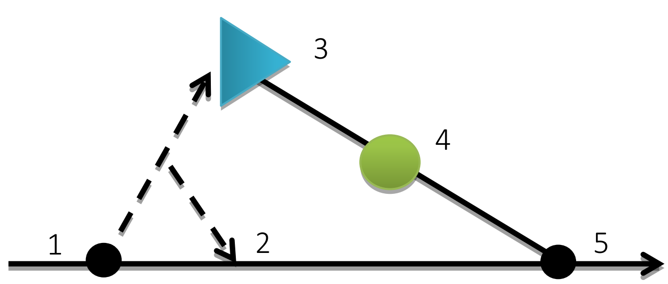
Figure 4-2: Illustration of changed water rights approach using Fisher Ditch

4.10 Off-Channel Reservoirs and Irrigation Structures

In the South Platte Basin, diversions from the river at a single headgate often meet multiple demands, such as irrigation, off-channel reservoir storage, augmentation, and municipal. To address the complexity of structures that carry water to more than one destination, the following general approach was developed. It is specific for structures that divert to both irrigation and off-channel storage, but can be applied to any number or type of end use.

The key aspects of this approach allow:

- Baseflows are calculated correctly without special considerations of baseflow gage locations,
- Total historical diversion from the river to remain at the river location,
- End-Of-Month (EOM) contents in the reservoir to be represented by historical values,
- Return flows to be accounted for at the correct locations and operated either by variable efficiency (for irrigation structures) or by a constant efficiency (for carrier structures),
- This approach requires the SPDSS dataset to have two diversion station files (*.dds). The SP2016_N.dds file is used to generate baseflows and the SP2016.dds is used in simulation.



1. River Diversion
2. Carrier Return Flow
3. Off-Channel Reservoir
4. Off-Channel Demand
5. Demand Return Flow

Figure 4-3: Off-Channel Reservoir System Schematic

4.10.1 Off-Channel Reservoir River Network Setup

The off-channel system is represented as a "mock" tributary in the network diagram and connected to the network at the furthest downstream location of return flows from the off-channel demand(s). It is recommended that the off-channel demands use their primary source WDID as an identifier if appropriate, or an appropriate suffix attached to the river diversion WDID (e.g. 0100503_I for irrigation demands served by 0100503).

4.10.2 Off-Channel Reservoir Baseflow Calculations

The baseflow (or natural flow) calculations on the main stem of the river network will be calculated correctly because of the following considerations:

- The river sees the entire historical diversion at Location 1
- Return flows from carrier losses are accounted for in their correct location
- Returns from the river diversion to the off-channel tributary are balanced by increases in storage and diversion at off-channel demand structure(s)
- Reservoir releases are balanced by diversions at off-channel demand structure(s),
- Return flows from off channel demands are accounted for in their correct location.

The following approach was implemented at off-channel reservoir system in natural flow calculations. The return flow location(s), percentage(s), and delay pattern(s) are found in SP2016_N.dds.

River Diversion (Location 1)

- Historical diversions are equal to total river diversions, including all water diverted to storage and to other demands from this location. Note that in some cases total diversions may need to be calculated, especially winter diversions, due to lack of diversion records and changes in diversion coding over time. Winter diversions to storage can be estimated based on the change in reservoir end-of-month content from one month to the next and accounting for evaporation.
- The structure is 0% efficient, as set in the direct diversion station (SP2016_N.dds) file, which results in 100% of the water diverted at this structure to be returned as follows:
    - Use the return flow location(s), percentage(s), and delay pattern(s) in the direct diversion station (SP2016_N.dds) file to route the conveyance loss back to the correct location. *This is represented by Location 2 in the figure above*.
    - Use the return flow location(s), percentage(s), and delay pattern(s) in the direct diversion station (SP2016_N.dds) file to return the total diversions less ditch loss to the upstream most node in the off-channel system in the same time step. *This is represented by Location 3 in the figure above.*
    - Continuing with WDID 0100503 as an example, Location 1 is the diversion structure (0100503_D) and is 75 percent efficient, meaning that 75 percent of the total diversions arrive at the intended destination. Therefore, 25 percent of the diversions lag back to the river at Location 2. For 0100503_D, 20 percent returns above structure 0100507_D with delay pattern 1100 and 5 percent returns above structure 0100513 with delay pattern 1100. 75 percent returns in the same time step to Location 3. For 0100503_D, Location 3 is off-channel reservoir 0103651.

- Additional information needs to be set in the direct diversion station (*.dds) file so that the basin wide summary tables do not double account diversions for these systems:
    - demsrc(1) set to 7 – carrier structure.

Off-Channel Reservoir (Location 3)

- Values in the end-of-month (*.eom) file are based on historical end-of-month reservoir content.

Off-Channel Demand (Location 4)

- Historical diversions are equal to water delivered from the river diversion (Location 1) minus conveyance losses plus releases from the off-channel reservoir (Location 3), if applicable. Note that reservoir releases are calculated based on change in reservoir end-of-month content from one month to the next and accounting for evaporation.
- For this example, Location 4 is 0100503_I. The demand was calculated as described above and set in SP2016.ddh file.
- Return flow location(s), percentage(s), and delay pattern(s) in the direct diversion station (SP2016_N.dds) file for this structure are based on locations of returns from irrigation. *This is represented by Location 5.*
- For this example, Location 5 is three different structures along the South Platte River, because the irrigated acreage covers a large geographical area.

4.10.3 Off-Channel Reservoir Simulation Scenarios

The Simulation scenario uses the simulation version of the direct diversion station file: SP2016.dds. Simulation scenarios operate the system correctly because all demands (reservoir, irrigation, etc.) in the off-channel system will be satisfied by carried water from the river diversion via operating rules. This ensures that water is delivered only in amounts up to what is needed for the off-channel system. There is no excess water returning from the off-channel system via the physical network connection (via the river). The following approach was implemented at off-channel reservoir system in simulation scenarios.

River Diversion (Location 1)

- Historical demands are set to zero in the diversion demand (SP2016_H.ddm) file.
- The structure is 0% efficient, as set in the direct diversion station (SP2016.dds) file, which results in 100% of the water diverted at this structure to be returned as follows:

    - Use the return flow location(s), percentage(s), and delay pattern(s) in the direct diversion station (SP0216.dds) file to route the conveyance loss back to the correct location. *This is represented by Location 2 in the figure above*.
    - Operating rules simulate the diversions from this structure carrying water to Location 3 and Location 4. Therefore, the return flows at this structure reflect only the conveyance loss routing.
    - Continuing with the example, SP2016.dds for 0100503_D only contains return flow locations 0100507_D and 0100513. These are the Location 2 structures. 70 percent of the return flows arrive at location 0100507_D following delay pattern 1100 and 30 percent of the return flows arrive at location 0100513 following delay pattern 1100.
    - Note that the same relative split of water returning to structures 0100507_D and 0100513 is maintained in both the natural flow mode and simulation mode *.dds files.
    - Also note that the same delay pattern is used in both *.dds files. This is done to maintain consistency between the natural flow mode and simulation mode.
- Operating rules in the operating rule (SP2016.opr) file divert water to storage *(Location 3)* and/or to the off-channel demand (*Location 4)* via the river diversion structure (*Location 1*).
    - Reservoir water rights are located at the reservoir and operating rules carry water to the reservoir via the river diversion structure using the reservoir right as the source water right.
    - Diversion rights are located at the river headgate and operating rules will carry water to the off-channel demand via the river diversion structure using the diversion right as the source water right.

Off-Channel Reservoir (Location 3)

- The demand in the historical reservoir target (*.tar) file is to the historical end-of-month reservoir content.
- Operating rules in the operating rule (*.opr) file release water from storage to the off-channel demand (*Location 4)*.

Off-Channel Demand (Location 4)

- Historical demands in the historical diversion demand (*.ddm) file are set to the historical diversions calculated for natural flow calculations; i.e. water delivered from the river diversion (*Location 1*) minus conveyance losses plus releases from the off-channel reservoir (*Location 3*), if applicable.

4.11 Well Use

This South Platte Model is the first CDSS model to incorporate significant well usage, primarily for irrigation use and, to a lesser extent, for municipal and industrial uses throughout the basin. There are limited records available in HydroBase for historical pumping in the basin; therefore well pumping is estimated based on crop irrigation requirements or municipal and industrial demands.

Well use in the South Platte Model can be divided into two categories, supplemental supply for co-mingled structures and ground water only structures. Although co-mingled structures receive both surface and ground water supplies, they are input into the model as separate demands (*.ddm and *.weh). Well pumping can only be used to meet a well demand; likewise, surface water supplies can only be used to meet a diversion demand. Due to this approach, it is necessary to pre-determine the separate demands. For irrigation structures, this determination is made in StateCU whereby co-mingled structures first receive available surface water supplies and then pumping is estimated to meet remaining crop demands. For ground water only aggregate structures, the well demand is estimated based on the full crop irrigation water requirement. This estimated pumping becomes the basis for the irrigation well demand.

Non-irrigation well demands are developed based on either historical pumping records, when available, or more often, on estimated municipal and industrial demands. StateMod then simulates pumping, and associated depletions, to meet these demands limited by well capacity and well rights available to the structure.

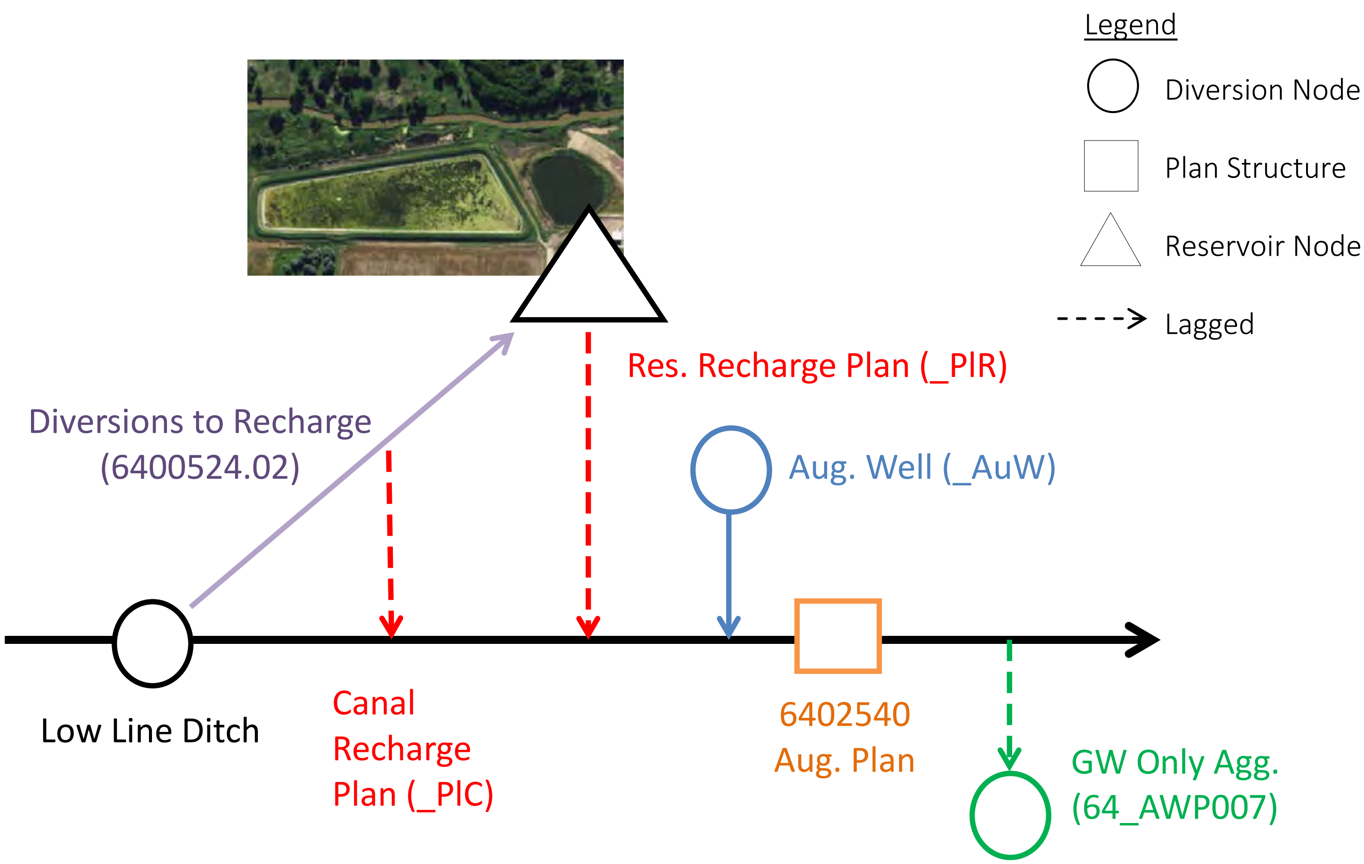
4.11.1 Augmentation Plans and Recharge

Pumping generally occurs under very junior water rights; therefore, to ensure senior water rights are not injured, the wells must be included in augmentation plans which augment the lagged well depletions. There are many augmentation plans in the South Platte River Basin; the largest 25 augmentation plans were selected to be explicitly modeled based on the amount of depletions associated with the plans and input from DWR staff. Once wells are associated with an augmentation plan, StateMod internally accounts for the lagged well depletions as they accrue to the river (see Section 5.10.10). Augmentation supplies, generally in the form of recharge areas, in-ditch recharge, changed water rights, and reservoir releases, are then applied to augment these depletions. Note that StateMod will not limit well pumping if augmentation supplies are not sufficient to meet the depletions; it is the user's responsibility to provide sufficient supplies.

Well pumping in some areas is not required to be augmented because it has been determinted to be hydraulically disconnected from the river system; this includes pumping in Designated Basins and from the Denver Basin aquifers. Depletion patterns for these wells have been adjusted so they do not deplete the river system.

Figure 4-4 provides a schematic of the Low Line Augmentation Plan operations, focusing on the recharge plan supplies associated with the plan. Refer to Section 5.10.10.18 for more information on these operations.

Example Representation of Augmentation Plan and Recharge Operations at Low Line Ditch



1. Co-mingled pumping under Low Line Ditch and ground water pumping at 64_AWP007 for irrigation generates depletions, which are tracked in Low Line Augmentation Plan (6402540).
2. A Type 43 rule establishes the volume of depletions in the current time step occur in-priority; the remaining out-of-priority depletions are tracked in the Low Line Augmentation Plan (6402540).
3. Water is diverted at Low Line Ditch (6400524) under a junior recharge water right (6400524.02) and carried to an aggregated recharge area (_RL) using a Type 45 rule.
4. Canal seepage is tracked by the canal recharge plan (_PlC) and reservoir seepage is tracked by the reservoir recharge plan (_PlR). Water from the recharge plans are applied to the augmentation demand at 6402540 using Type 48 rules.
5. Any remaining unmet augmentation demand is satisfied by pumping the augmentation well (_AuW) using a Type 37 rule.

Figure 4-4: Illustration of augmentation and recharge operations at Low Line Ditch

4.12 Calibration Approach

Calibration is the process of simulating the river basin under historical conditions, and adjusting parameters to achieve agreement between observed and simulated values of stream gages, reservoir levels, and diversions. The South Platte Model was developed first at the sub-basin level, and then integrated into an overall model, separate calibration efforts were made at each of these points during the model development.

- Calibration of the sub-basin models focused on baseflows, particularly to ensure imports were removed from baseflow estimates; to ensure the baseflow in the river was gaining as it moved downstream; to limit excessive baseflow issues from off-channel systems; and determine amount of baseflow distributed to ungaged locations was correct. To facilitate this effort, calibration gages were added to off-channel reservoir systems to review data inconsistencies that may impact baseflow. After calibration of baseflows through adjustment of return flows, diversions, and reservoir contents, the model was simulated and the results were compared to historical values. Remaining calibration issues were generally caused by individual users' order of operations. These were adjusted to better reflect current operations.

- Once the sub-basin models were calibrated, they were integrated into the overall model and a similar calibration effort was performed. Baseflows were reviewed and simulated model results were compared to historical values. Additional adjustments to operating rules, return flow locations, and efficiencies were made to address remaining calibration issues.

Refer to Section 6 for more details on calibration efforts and results, summarized by each sub-basin.

5. Historical Dataset

This section describes each StateMod input file in the Historical Dataset. The approach to creating the dataset is described in more general terms in Section 4. The Historical Dataset represents the historical diversions and demands as they have come on-line through time, imposed with current administration and operations. As such, the surface water demands are set equal historical diversions, reservoirs demands are set equal to historical contents, transmountain supplies are set equal to historical imports, and well demands are set equal historical pumping. Current operations, such as current share ownership in a ditch or operation of reusable supplies, are generally used for the entire study period. This provides a dataset with a complete historical demand for the South Platte River Basin while allowing for the analysis of current operations over a longer hydrologic period.

This section is organized by input file type (e.g. diversion files, well files); the following detailed, file-by-file descriptions are intended to provide enough detail for the user to understand what historical and current operations have been captured in the model.

In order to maintain consistency in the dataset that was produced, the following versions were used:

- HydroBase 2016.04.07
- StateMod 15.0001

Where to find more information

- For generic information on every input file listed below, see the **StateMod** documentation. It describes how input parameters are used as well as format of the files.

5.1 Response File (*.rsp)

The response file lists names of the rest of the data files. StateMod reads the response file first, and then "knows" what files to open to retrieve the remainder of the input data. The list of input files was slightly different depending on whether StateMod was being run to generate baseflows or to simulate the historical scenario. The response file was created by hand using a text editor.

5.1.1 For Historical Simulation

The listing below shows the file names in *SP2016_H.rsp*, describes contents of each file, and shows the subsection of this chapter where the file is described in more detail.

File Name	Description	Reference
SP2016.ctl	Control file – specifies execution parameters, such as run title, modeling period, options switches	Section 5.2
SP2016.rin	River Network file – lists every model node and specifies connectivity of network	Section 5.3.1
SP2016.ris	River Station file – lists model nodes, both gaged and ungaged, where hydrologic inflow enters the system	Section 5.3.1
SP2016.rib	Baseflow Parameter file – gives coefficients and related gage ID's for each baseflow node, with which StateMod computes baseflow gain at the node	Section 5.3.3
SP2016.rih	Historical Streamflow file – Monthly time series of streamflows at modeled gages	Section 5.3.4
SP2016_BFx.xbm	Baseflow Data file – time series of undepleted flows at nodes listed in SP2016.ris	Section 5.3.5
SP2016.dds	Direct Diversion Station file – contains parameters for each diversion structure in the model, such as diversion capacity, return flow characteristics, and irrigated acreage served	Section 5.4.1
SP2016.dly	Delay Table file – contains several return flow patterns that express how much of the return flow accruing from diversions in one month reach the stream in each of the subsequent months, until the return is extinguished	Section 5.4.2
SP2016.ddh	Historical Diversions file – Monthly time series of historical diversions	Section 5.4.3
SP2015_H.ddm	Monthly Demand file – monthly time series of headgate demands for each direct diversion structure	Section 5.4.4
SP2016.ddr	Direct Diversion Rights file – lists water rights for direct diversion	Section 5.4.5
SP2016_crop.str	StateCU Structure file – soil moisture capacity by structure, for variable efficiency structures	Section 5.5.1
SP2016.ipy	CU Irrigation Parameter Yearly file – maximum efficiency and irrigated acreage by year and by structure, for variable efficiency structures	Section 5.5.2
SP2016_ Restricted.ddc	Consumptive Water Requirement file – monthly time series of consumptive water requirement for direct diversion and well only structures	Section 5.5.3
SP2016.res	Reservoir Station file – lists physical reservoir characteristics such as volume, area-capacity table, and some administration parameters	Section 5.6.1
SP2016.eva	Evaporation file – gives monthly rates for net evaporation from free water surface	Section 5.6.2
SP2016.eom	Reservoir End-of-Month Contents file – Monthly time series of historical reservoir contents	Section 5.6.3

File Name	Description	Reference
SP2015_H.tar	Reservoir Target file – monthly time series of maximum and minimum targets for each reservoir. A reservoir may not store above its maximum target, and may not release below the minimum target	Section 5.6.4
SP2016.rer	Reservoir Rights file – lists storage rights for reservoirs	Section 5.6.5
SP2016.ifs	Instream Flow Station file – lists instream flow reaches	Section 5.7.1
SP2016.ifa	Instream Flow Annual Demand file – gives the decreed monthly instream flow demand rates	Section 5.7.2
SP2016.ifr	Instream Flow Right file – gives decreed amount and administration number of instream flow rights associated with instream flow reaches	Section 5.7.3
SP2016.pln	Plan Data file – contains parameters for plan structures	Section 5.8
SP2016.plw	Well Augmentation Plan Data file – ties an augmentation plan to a well water right ID and the structures served by the well	Section 5.8.2
SP2016.plr	Plan to Reservoir Recharge Data file – links a recharge area (modeled as reservoirs) to an augmentation plan.	Section 5.8.3
SP2016.rrf	Reservoir Return Flow file – routes reservoir seepage back to the river over time	Section 5.8.4
SP2016.prf	Plan Return Flow file – contains plan return flow data. For recharge plans, it is used to route canal seepage back to the river over time. For terms and conditions plans, it provides plan efficiency information	Section 5.8.5
SP016.wes	Well Station file – describes the physical properties of each well structure, such as depletion characteristics, return flow characteristics, and irrigated acreage	Section 5.9.1
SP2016.weh	Historical Well Pumping – time series of well pumping through time	Section 5.9.2
SP2016_ NoDuplicates.wer	Well Right file – lists the unique well rights associated with well structures.	Section 5.9.3
SP2015.opr	Operational Rights file – specifies many different kinds of operations that were more complex than a direct diversion or an on-stream storage right.	Section 5.10

5.1.2 For Generating Baseflow

The baseflow file (*.xbm) that was part of the Baseline dataset was created by StateMod and TSTool in three steps described in Section 4.7. In the first step, StateMod estimated baseflows at gaged locations, using the files listed in the SP2016_BF.rsp response file. The table below lists the differences between the simulation SP2016_H.rsp and the baseflow SP2016_BF.rsp.

The baseflow time series created in the first run were partial series, because gage data was missing from three gages in Water District 6. TSTool was used to fill the baseflow time series, creating a complete series of baseflows at gages in a file named SP2016_BF.xbf. The response file for the second step, in which StateMod distributed baseflow to ungaged points, was named SP2016_BFx.rsp. The difference between the first-step response file (SP2016_BF.rsp) and second-step response file (SP2016_BFx.rsp) was that the SP2016.xbf file replaced the historical gage file SP2016.rih.

File Name	Description
SP2016_N.dds	Baseflow Direct Diversion Station file. Contains return flow pattern and locations for off-channel demands specific for Baseflow generation.
SP2016.dre	Diversion to Recharge file. Time series of historical diversions for recharge diverted at each ditch.
SP2016.rre	Reservoir to Recharge file. Time series of historical diversions for recharge at each recharge area.

5.2 Control File (*.ctl)

The control file was hand-created using a text editor. It contains execution parameters for the model run, including the starting and ending year for the simulation, the number of entries in certain files, conversion factors, and operational switches. Many of the switches relate to either debugging output, or to integrated simulation of ground water and surface water supply sources. The latter was developed for the Rio Grande Basin and is not yet a feature of the South Platte Model. Control file switches are specifically described in the StateMod documentation. The simulation period parameters (starting and ending year) are the ones that users most typically adjust.

5.3 River System Files

This section includes files that together specify the river system. These files express the model network and baseflow hydrology.

5.3.1 River Network File (*.rin)

The river network file was created by StateDMI from the graphical network representation file created within StateDMI – StateMod Network interface (SP2016.net). The river network file describes the location and connectivity of each node in the model. Specifically, it is a list of each structure ID and name, along with the ID of the next structure downstream. It is an inherent characteristic of the network that, with the exception of the downstream terminal node, each node had exactly one downstream node.

River gage nodes are labeled with United States Geological Survey (USGS) stream gaging station numbers (i.e., 06744000). In general, diversion and reservoir structure identification numbers are composed of Water District number followed by the State Engineer's four-digit structure ID. Instream flow water rights are also identified by the Water District number followed by the assigned State Engineer's four-digit identifier. Table 5.1 shows how many nodes of each type are in the South Platte Model.

Table 5-1: River Network Elements

Type	Number
Diversion and Well	123
Diversion	452
Stream Gages	49
Instream Flow	31
Other	71
Plan Structures[2]	458
Reservoirs	143
Well	117
Total	**1444**

5.3.2 River Station File (*.ris)

The river station file was created by StateDMI. It lists the model's baseflow nodes, both gaged and ungaged. These are the discrete locations where streamflow is added to the modeled system.

There are 49 gages in the model and 46 ungaged baseflow locations, for a total of 95 hydrologic inflows to the South Platte Model. Ungaged baseflow nodes include ungaged headwater nodes and other nodes where calibration revealed a need for additional baseflows. In the last case, a portion of the water that is simulated as entering the system further down (e.g., at the next gage) is moved up the system to the ungaged baseflow location. For more details on baseflow development, refer to Section 4.7.

5.3.3 Baseflow Parameter File (*.rib)

The baseflow parameter file contains an entry for each ungaged baseflow node in the model, specifying coefficients, or "proration factors," used to calculate the baseflow gain at that point. StateDMI computed proration factors based on the network structure and area multiplied by precipitation values supplied for both gages and ungaged baseflow nodes. This information is in the network file, which was input to StateDMI. Under the default "gain approach," described in Section 4.7.3, the factors reflect the ratio of the product of incremental area and local average precipitation

[2] Due to the extensive number of plan structures in the model, only those plan structures required to be in the network diagram are included. Refer to Section 5.8.1 for more information on Plan Structures.

above the ungaged point to the product of incremental area and local average precipitation for the entire gage-to-gage reach.

If a structures' drainage basin has unique characteristics, a straight proration was used and a percent of a downstream gage's baseflow was set in StateDMI to the specific structure. This approach was used for the following structures:

Table 5-2: Baseflow Nodes with Set Proration Factors

Tributary Name	Baseflow WDID	Baseflow Percent	Downstream Gage
South Platte River	8003550	100 %	06701500
Boulder Creek	0600527	90 %	06730500
North Boulder Creek	06_WSHED	32 %	06727000
North Boulder Creek	0600599	35 %	06727000

Where to find more information

- Section 4.7.3 describes how baseflows were distributed spatially

5.3.4 Historical Streamflow File (*.rih)

Created by TSTool, the historical streamflow file contains historical gage records from 1950 through 2012, for modeled gages. This file is used in the stream baseflow generation and to create comparison output that is useful during model calibration. Records were taken primarily from HydroBase. Missing values were filled with user provided data, regression, combining gages, or with special handling. A description of the filling techniques used is described in Section 4.4.1. The application of filling techniques is detailed below. Table 5-3 lists the key gages, their periods of record, and their average annual flows over the period of record.

Table 5-3: Historical Average Annual Flows for Key South Platte River Stream Gages

Gage ID	Gage Name	Period of Record	Historical Flow (af/year)
06695000	S PLATTE RIV AB 11-MILE CANYON RES, NR HARTSEL, CO	1939-2015	69,118
06696000	SOUTH PLATTE RIVER NEAR LAKE GEORGE, CO.	1929-2015	64,204
06701500	SOUTH PLATTE RIVER BELOW CHEESMAN RESERVOIR	1924-2015	129,502
06707500	SOUTH PLATTE RIVER AT SOUTH PLATTE	1896-2015	291,001
06708000	SOUTH PLATTE RIVER AT WATERTON, CO.	1926-2015	119,478
06709530	PLUM CREEK AT TITAN ROAD NEAR LOUVIERS, CO	1984-2016	22,208
06710500	BEAR CREEK AT MORRISON	1900-2015	36,857
06711500	BEAR CREEK AT SHERIDAN	1927-2015	32,725
06711565	SOUTH PLATTE RIVER AT ENGLEWOOD, CO.	1983-2016	191,935
06713500	CHERRY CREEK AT DENVER, CO.	1942-2016	19,340
06714000	SOUTH PLATTE RIVER AT DENVER	1895-2015	249,401

Gage ID	Gage Name	Period of Record	Historical Flow (af/year)
06716500	CLEAR CREEK NEAR LAWSON, CO	1946-2016	103,001
06719505	CLEAR CREEK AT GOLDEN, CO	1909-2016	139,253
06720000	CLEAR CREEK AT DERBY	1914-2015	70,634
06720500	SOUTH PLATTE RIVER AT HENDERSON, CO	1926-2015	318,289
06720820	BIG DRY CREEK AT WESTMINSTER, CO	1987-2016	10,832
06721000	SOUTH PLATTE RIVER AT FORT LUPTON, CO.	1929-2016	341,136
06722500	SOUTH ST. VRAIN CREEK NEAR WARD, CO.	1925-2015	19,051
06724000	ST. VRAIN CREEK AT LYONS, CO.	1895-2015	90,963
06724500	LEFT HAND CREEK NEAR BOULDER, CO.	1929-1980	25,185
06725500	MIDDLE BOULDER CREEK AT NEDERLAND, CO.	1907-2010	39,568
06727000	BOULDER CREEK NEAR ORODELL, CO.	1906-2015	60,432
06727500	FOURMILE CREEK AT ORODELL, CO	1947-2016	4,517
06729500	SOUTH BOULDER CREEK NEAR ELDORADO SPRINGS, CO.	1896-2015	48,276
06730200	BOULDER CREEK AT NORTH 75TH ST. NEAR BOULDER, CO	1986-2016	70,950
06730300	COAL CREEK NEAR PLAINVIEW, CO.	1959-2015	3,056
06730500	BOULDER CREEK AT MOUTH NEAR LONGMONT, CO	1927-2016	53,985
06731000	ST. VRAIN CREEK AT MOUTH, NEAR PLATTEVILLE, CO.	1927-2015	158,270
06733000	BIG THOMPSON RIVER AT ESTES PARK, CO.	1946-2015	91,241
06734500	FISH CREEK NEAR ESTES PARK, CO.	1947-2012	1,513
06735500	BIG THOMPSON RIVER NEAR ESTES PARK, CO.	1930-2015	74,315
06736000	NORTH FORK BIG THOMPSON RIVER AT DRAKE, CO.	1947-2015	23,665
06738000	BIG THOMPSON RIVER AT MOUTH OF CANYON NR DRAKE, CO	1927-2013	77,476
06739500	BUCKHORN CREEK NEAR MASONVILLE, CO	1947-2012	10,768
06741510	BIG THOMPSON RIVER AT LOVELAND, CO.	1979-2016	53,065
06744000	BIG THOMPSON RIVER AT MOUTH, NEAR LA SALLE, CO.	1914-2015	62,059
06752500	CACHE LA POUDRE RIVER NEAR GREELEY, CO.	1903-2015	102,871
06754000	SOUTH PLATTE RIVER NEAR KERSEY, CO	1901-2015	649,139
06758500	SOUTH PLATTE RIVER NEAR WELDONA, CO	1952-2015	512,027
06759910	SOUTH PLATTE RIVER AT COOPER BRIDGE, NR BALZAC, CO	1980-2015	478,832
06764000	SOUTH PLATTE RIVER AT JULESBURG, CO	1902-2015	388,991
06_BC_N[2]	BEAR CREEK NATURAL FLOW	1950-2012	426
CLPRF[1, 4]	POUDRE RIVER RF BLW GAGE	1950-2012	45,142
LTCANYCO	LITTLE THOMPSON RIVER AT CANYON MOUTH NEAR BERTHOUD	1961-2012	3,491
MIDSTECO	MIDDLE SAINT VRAIN AT PEACEFUL VALLEY	1997-2015	14,819
PLAANTCO	SOUTH PLATTE RIVER BELOW ANTERO RESERVOIR	1975-2012	18,838
PLAGRACO	NORTH FORK SOUTH PLATTE RIVER AT GRANT	1990-2015	116,849
RalstonIN[1, 3]	RALSTON CREEK INFLOW	1950-2012	3,777

1) Structure was modeled as a streamflow gage in order to represent a sub-basin import
2) Bear Creek Natural Flow was treated as a gaged location
3) Historic average annual flows obtained from RIH, reflects natural flow estimate on Ralston Creek
4) Ungaged return flows entering the Cache la Poudre River below stream gage 06752500

While most of the streamflow gages selected as key gages have nearly complete periods of record, some missing data is unavoidable. The table below lists the gages that were filled in TSTool using regression. The table shows the filled gage, the gage used in the regression, and the type of regression used. For details on TSTool regression techniques, please refer to the TSTool User's Manual.

Table 5-4: Stream gages filled with regression

Filled Gage ID	Filled Gage Name	Gage Used in Regression ID	Gage Used in Regression Name	Type of Regression
06725500	MIDDLE BOULDER CREEK AT NEDERLAND	06729500	SOUTH BOULDER CREEK NEAR ELDORADO SPRINGS	Monthly
06730300	COAL CREEK NEAR PLAINVIEW	06_BC_N	BEAR CREEK NATURAL FLOW	Monthly
06736000	NORTH FORK BIG THOMPSON RIVER AT DRAKE	06733000	BIG THOMPSON RIVER AT ESTES PARK	Monthly
06738000	BIG THOMPSON RIVER AT MOUTH OF CANYON NR DRAKE	06735500	BIG THOMPSON RIVER NEAR ESTES PARK	Monthly
06734500	FISH CREEK NEAR ESTES PARK	06736000	NORTH FORK BIG THOMPSON RIVER AT DRAKE	Monthly
06739500	BUCKHORN CREEK NEAR MASONVILLE	06736000	NORTH FORK BIG THOMPSON RIVER AT DRAKE	Monthly
06741510	BIG THOMPSON RIVER AT LOVELAND	06744000	BIG THOMPSON RIVER AT MOUTH, NEAR LA SALLE	Monthly
LTCANYCO	LITTLE THOMPSON RIVER AT CANYON MOUTH NEAR BERTHOUD	06739500	BUCKHORN CREEK NEAR MASONVILLE	Monthly
06722500	SOUTH ST. VRAIN CREEK NEAR WARD	06733000	BIG THOMPSON RIVER AT ESTES PARK	Linear
MIDSTECO	MIDDLE SAINT VRAIN AT PEACEFUL VALLEY	06733000	BIG THOMPSON RIVER AT ESTES PARK	Linear
06724500	LEFT HAND CREEK NEAR BOULDER	06733000	BIG THOMPSON RIVER AT ESTES PARK	Linear
06713500	CHERRY CREEK AT DENVER	06713000	CHERRY CREEK BELOW CHERRY CREEK LAKE	Monthly
06716500	CLEAR CREEK NEAR LAWSON	06719505	CLEAR CREEK AT GOLDEN	Monthly
06721000	SOUTH PLATTE RIVER AT FORT LUPTON	06720500	SOUTH PLATTE RIVER AT HENDERSON	Monthly
06758500	SOUTH PLATTTE RIVER NEAR WELDONA	06760000	SOUTH PLATTE RIVER AT BALZAC	Monthly

Some streamflow gages have been relocated, creating two streamflow records at almost the same location. The following gages were combined:

- PLAGRACO – North Fork South Platte River at Grant was combined with USGS gage 06706000 - North Fork South Platte River below Geneva Creek, At Grant.

- 06709530 – Plum Creek at Titan Road near Louviers was combined with USGS gage 06709500 – Plum Creek near Louviers.

The following streamflow gages had poor periods of records, but were considered important in the South Platte modeling effort. Therefore, they were filled using a combination of methods described below, based on the individual gage situation.

- PLAANTCO – South Platte River below Antero Reservoir. Record begins in 1975. To extend record back to 1950. Individual monthly values were set based on change in reservoir content and remaining months were filled with historical month average.

- 06711565 – South Platte at Englewood. Record begins in 1983. The next nearest gage was 06710000 – South Platte at Littleton, which has records from 1942 through 1986. In order to combine the gages, the Englewood Pipeline diversions are subtracted from 06710000 and inflow from Bear Creek as measured by 06711500 – Bear Creek at Sheridan is added.

- 06719505 – Clear Creek at Golden. Record begins in 1974. Streamflow was originally measured by 06719500 – Clear Creek near Golden, but the gage was moved. To combine the gages, diversions at WDID 0700540 – Church Ditch were subtracted from 06719500.

- RalstonIN - Ralston Creek above Ralston Creek Reservoir. Daily inflow records from 1938 to 2012 were provided by Denver Water. To fill daily missing data during the winter, the last valid streamflow reading was repeated. To fill monthly data throughout the year, the historical month average was used.

- 06720820 - Big Dry Creek at Westminster. Missing monthly values were filled using a Wet/Dry/Average pattern, or historical month average.

- CLPRF – Cache la Poudre Return Flows that accrue to the river below 06752500 - Cache la Poudre near Greeley. This time series was developed externally to the model.

- 06759910 – South Platte River at Cooper Bridge, near Balzac. This gage was moved from its original position at 06760000 – South Platte River at Balzac. To combine the records, the diversions at Prewitt Reservoir Inlet, 0100525- Tetsel Ditch, and 0100526 - Johnson & Edwards Ditch were added to 06760000.

5.3.5 Baseflow File (*.xbm)

The baseflow file contains estimates of naturalized streamflows throughout the modeling period, at the locations listed in the river station file. Baseflows represent the conditions the river would have experienced without the influence of man. Baseflows are the starting point of the historical dataset. Simulated transmountain imports, diversion demands, reservoir operations, well pumping and augmentation, and minimum streamflow demands are superimposed onto baseflows. StateMod estimates baseflows at stream gages during the gage's period of record from historical streamflows, transmountain imports, diversions, end-of-month contents of modeled reservoirs, and estimated consumption and return flow patterns. It then distributes baseflow at gage sites to ungaged locations using proration factors representing the fraction of the reach gain estimated to be tributary to a baseflow point. For details on baseflow generation, refer to Section 4.7.

Table 5.5 compares historical gage flows with simulated baseflows for the stream gages that are not located at the top of the network, meaning that they show impacts from human operations. When the historical gaged flow is larger than the baseflow, this represents stream reaches that are enlarged due to imports. When the historical gaged flow is smaller than the baseflow, the stream reach is more impacted by consumptive use.

Note that modeling the full Cache la Poudre River Basin was not included in this phase of the modeling effort. The Cache la Poudre River inflow is currently reflected in the model by the historical streamflow from the Cache la Poudre River near Greeley gage (06752500), and an estimate of historical return flows that accrue to the South Platte River downstream of the Greeley gage. As such, these gages do not represent baseflow at these locations and have been excluded from the table below.

Table 5-5: Average Baseflow Comparison from 1993-2012 (Af/Year)

Gage ID	Gage Name	Baseflow	Historical
06695000	S PLATTE RIV AB 11-MILE CANYON RES, NR HARTSEL, CO	67,240	89,320
06696000	SOUTH PLATTE RIVER NEAR LAKE GEORGE, CO.	73,240	84,960
06701500	SOUTH PLATTE RIVER BELOW CHEESMAN RESERVOIR	146,090	152,215
06707500	SOUTH PLATTE RIVER AT SOUTH PLATTE	259,460	340,285
06708000	SOUTH PLATTE RIVER AT WATERTON, CO.	269,475	92,245
06709530	PLUM CREEK AT TITAN ROAD NEAR LOUVIERS, CO	23,640	22,000
06710500	BEAR CREEK AT MORRISON	30,320	30,165
06711500	BEAR CREEK AT SHERIDAN	41,230	35,000
06711565	SOUTH PLATTE RIVER AT ENGLEWOOD, CO.	349,640	162,875
06713500	CHERRY CREEK AT DENVER, CO.	19,140	27,220
06714000	SOUTH PLATTE RIVER AT DENVER	407,900	232,070
06716500	CLEAR CREEK NEAR LAWSON, CO	101,010	102,680
06719505	CLEAR CREEK AT GOLDEN, CO	154,130	137,875

Gage ID	Gage Name	Baseflow	Historical
06720000	CLEAR CREEK AT DERBY	179,100	73,930
06720500	SOUTH PLATTE RIVER AT HENDERSON, CO	620,490	363,285
06720820	BIG DRY CREEK AT WESTMINSTER, CO	7,760	11,155
06721000	SOUTH PLATTE RIVER AT FORT LUPTON, CO.	644,650	374,875
06724000	ST. VRAIN CREEK AT LYONS, CO.	116,690	86,250
06724500	LEFT HAND CREEK NEAR BOULDER, CO.	8,600	23,770
06727000	BOULDER CREEK NEAR ORODELL, CO.	69,560	52,990
06729500	SOUTH BOULDER CREEK NEAR ELDORADO SPRINGS, CO.	46,030	40,120
06730200	BOULDER CREEK AT NORTH 75TH ST. NEAR BOULDER, CO	128,790	66,960
06730500	BOULDER CREEK AT MOUTH NEAR LONGMONT, CO	121,375	53,310
06731000	ST. VRAIN CREEK AT MOUTH, NEAR PLATTEVILLE, CO.	264,750	162,835
06733000	BIG THOMPSON RIVER AT ESTES PARK, CO.	88,400	88,400
06735500	BIG THOMPSON RIVER NEAR ESTES PARK, CO.	98,150	74,610
06738000	BIG THOMPSON RIVER AT MOUTH OF CANYON NR DRAKE, CO	121,175	63,890
06739500	BUCKHORN CREEK NEAR MASONVILLE, CO	9,490	9,200
06741510	BIG THOMPSON RIVER AT LOVELAND, CO.	108,820	40,175
06744000	BIG THOMPSON RIVER AT MOUTH, NEAR LA SALLE, CO.	122,630	58,650
06754000	SOUTH PLATTE RIVER NEAR KERSEY, CO	1,216,620	709,810
06758500	SOUTH PLATTE RIVER NEAR WELDONA, CO	1,264,550	485,220
06759910	SOUTH PLATTE RIVER AT COOPER BRIDGE, NR BALZAC, CO	1,282,820	388,810
06764000	SOUTH PLATTE RIVER AT JULESBURG, CO	1,366,570	371,110
PLAANTCO	SOUTH PLATTE RIVER BELOW ANTERO RESERVOIR	18,505	17,976
PLAGRACO	NORTH FORK SOUTH PLATTE RIVER AT GRANT	43,515	118,950

5.4 Diversion Files

This section includes files that define characteristics of the diversion structures in the model: physical characteristics, irrigation parameters, historical diversions, demand, and water rights.

5.4.1 Direct Diversion Station File (*.dds)

The direct diversion station file describes the physical properties of each diversion simulated in the South Platte Model. This file is created using StateDMI. Structures included in the direct diversion station file are nodes that are designated as “Diversion” or as “Diversion and Well”. In the network, these are displayed as “D” or “D&W” node types. Structures that are supplied with only surface water (“D”) and structures that are supplied by co-mingled surface water and ground water

(“D&W”) are included. Structures with ground water only supplies (“W”) are found in the Well files (see Section 5.9).

Table 7-1 is a summary of the South Platte Model’s diversion station file contents, including each structure’s diversion capacity, 2010 irrigated acreage served, average annual system efficiency, and average annual surface water demand. The average annual headgate demand parameter was summarized from data in the diversion demand file rather than the diversion station file, but it was included here as an important characteristic of each diversion station. In addition to the tabulated parameters, the *.dds file also specifies return flow nodes and average monthly efficiencies.

Generally, the diversion station ID, name, and diversion capacity were gathered from HydroBase, by StateDMI. Irrigates acreage in the *.dds is from the 2010 irrigated acreage assessment. It is read into StateDMI from a *.csv file. Return flow locations were specified to StateDMI in a hand-edited file SP2016_SW.rtn. The return flow locations and distribution were based on physical location of irrigated lands, discussions with Division 1 personnel, as well as calibration efforts. For more information on the development of return flow delay patterns and locations, refer to Section 4.6. StateCU computes monthly system efficiency for irrigation structures from historical diversions and historical crop irrigation requirements, and StateDMI writes the average monthly efficiencies into the *.dds file. While the average monthly efficiencies appear for all structures in the *.dds file, StateMod operates in the “variable efficiency” mode for the irrigation structures that appear in the *.ddc file. Therefore, the average monthly efficiency values from the *.dds are not used during simulation. Efficiency in a given month of the simulation is a function of the amount diverted that month, and the consumptive use, as limited by the water supply. For more details on variable efficiency in StateMod, refer to Section 4.5.1. For non-irrigation structures, monthly efficiency is specified by the user as input to StateDMI.

Diversion capacity is stored in HydroBase for most structures and was generally taken directly from the database. Capacities and irrigated acreage were accumulated by StateDMI for defined diversion systems and aggregates. In preparing the direct diversion station file, however, StateDMI determined whether historical diversion records indicated diversions greater than the database capacity. If so, the diversion capacity was modified to reflect the recorded maximum diversion. Unknown capacities were set to 999. This number is intentionally large so diversions are not limited.

The majority of the diversion structures in the South Platte River Basin are used for irrigation. Structures diverting for non-irrigation use were noted in Table 7-1 and include structures that carry water to reservoirs or other structure’s irrigation demands, municipal and industrial structures, and transmountain export structures.

For additional details on the development and approach to the *.dds file, see the following sections in the report:

- Key structure selection - refer to Section 4.2.1.1.
- Diversion system creation - refer to Section 4.2.1.1 and Appendix 7.1.

- Aggregate node development - refer to section 4.2.1.2 and Appendix 7.3.
- Municipal and industrial demand - refer to Section 4.2.1.3.
- Operations of complex structures - refer to Section 5.10.

5.4.1.1 Baseflow DDS

In order to generate baseflows (*.xbm), StateMod is run in "Natural Flow" mode. For more details on baseflow generation, refer to Section 4.7. The most significant different between the simulation SP2016.dds file and the baseflow SP2016_N.dds file is the treatment of off-channel reservoir systems. In natural flow mode, carriers are not operated. Therefore, water that is delivered to off-channel reservoir systems must be routed there using the return flow options in the *.dds file. In SP2016_N.dds, carriers have return flow locations and timing that represent ditch seepage returning to the river and the delivery of water to the off-channel reservoir structure. In contrast, the SP2016.dds file used in simulation mode only contains return flow locations and timing that represent ditch seepage. For more details on the approach to off-channel reservoir systems (or any headgate that carries water to multiple uses), refer to Section 4.10.

Where to find more information

- SPDSS Task Memorandum 3, "Key Diversion Structure," available on the CDSS website.
- When StateMod is executed in the "data check" mode, it generates an *.xtb file which contains summary tables of input. One of these tables provides the return flow locations and percent of return flow to each location, for every diversion structure in the model. Another table provides the information shown in Table 7-1.

5.4.2 Return Flow Delay Tables (*.dly)

The SP2016.dly file, which was hand-built with a text editor, is used in the model to determine the timing of return flows accruing to the river and the timing of lagged depletions as they deplete the river. Each entry reflects the monthly percent of the return flow or depletion that occurs each month. The patterns are used in the diversion station file (*.dds), well station file (*.wes), and plan and reservoir return flow files (*.prf and *.rrf) to inform the model the timing associated with canal seepage, irrigation return flows, reservoir and recharge area seepage, and well pumping. Patterns range from 100 percent occurring in the first time step (i.e. "immediate") to lagging patterns of up to 120 months. The return flow patterns reflect 100 percent of the return flow; no losses to phreatophytes (i.e. incidental losses) are included. For more information on how the patterns were developed and implemented in the model, refer to Section 4.6.

A portion of the patterns included in the delay file are not used to route irrigation and canal recharge or pumping, rather they are used to estimate the lagged return flow obligations for terms and conditions plans. These 12-month patterns reflect the return flow obligations required by some changed water rights operations. See Section 5.8.6 for more information on terms and conditions plans.

As part of the integration effort, the delay tables developed by the sub-basin modelers were combined; overlapping delay table IDs were made unique by assigning the Water District number to them. There are a total of 98 delay patterns available in the *.dly file.

5.4.3 Historical Diversion File (*.ddh)

The historical diversion file contains time series of diversions for each structure. The file is created in a two-step process. In Step 1, StateDMI reads historical diversions from HydroBase, fills missing records as described in Section 4.4, and sets structures with externally created time series. In Step 2, TSTool reads in the Step 1 output and individual diversion classes for specified structures. TSTool generates new total diversion time series and over-writes the Step 1 output. Details are provided below. The final SP2016.ddh file is used for baseflow estimations at stream gage locations; developing headgate demand time series for the diversion demand file; developing average efficiency values for the diversion station file, and for comparison output that is useful during calibration.

As introduced above, the SP2016.ddh is created in a two-step process. In the first step, StateDMI is accessing the diversion total time series stored in HydroBase for diversion structures in the network. Missing data is filled. Diversion systems and aggregate structures are assigned the sum of the constituent structures total diversions. Augmentation station diversions are set to zero. Of critical importance in the South Platte Model is the setting of external time series. A large number of time series were created outside of StateDMI in order to correctly represent the complex systems in the South Platte. The following is a list of the type of structures that have external time series:

- Total diversions at the headgate of an off-channel reservoir systems or any system where the headgate carries to multiple demands,
- Diversions at off-channel irrigation structures
- Transmountain import structures, for example, Adams Tunnel and Moffat Tunnel. Imports are set as negative diversions.
- Transmountain import structures, for example, the St. Vrain Supply Canal and the Boulder Creek Supply Canal. Imports are set as negative diversions.
- Municipal diversion structures. Generally, a large amount of user provided data is processed and multiple water sources were considered in order to create the total demand. Total demand is split to represent indoor and outdoor demands.

- Industrial diversion structures. Several large, self-supplied industrial demands are located in the South Platte Basin and required special handling.

- Diversion structures that only have infrequently recorded diversion data in HydroBase. External time series were created from the infrequent data.

- Correct automated filling process for structures that either started at a set point in time, or stopped diverting surface water at a set point in time.

Step 2 of generating the *.ddh was necessary because of a diversion coding problem in HydroBase for Water District 2 in 2011 and 2012. The State is aware of the issue and is working to correct it. Structures in Water District 2 have specific diversion classes stored in HydroBase, but total diversion is not being correctly calculated. In TSTool, the individual diversion classes are pulled from HydroBase, combined to create the total diversion time series, and used to fill the missing 2011 and 2012 data. It is anticipated that Step 2 will not be required in future modeling efforts.

5.4.4 Direct Diversion Demand File (*.ddm)

This file contains time series of surface water demand for each diversion structure in the model. Demand is the amount of water the structure “wants” to divert during simulation. In the South Platte Model, it is generally set to the historical diversions (SP2016.ddh). Special cases are discussed below. Table 7-1 lists average annual demand for each diversion structure.

The file is created in TSTool. The *.ddh file is read in, modifications are made, as described in the Special Structures section below, and the *.ddm is written out.

5.4.4.1 Special Structures

In Lower South Platte (Water Districts 1 and 64), the *.ddh time series for off-channel irrigation structures includes water that was diverted for recharge. This water is not used for irrigation, but was sent to the off-channel irrigation structure to develop the correct baseflows. The *.dre file contains time series of diversions to recharge and is also an input to baseflow generation. The *.dre file is read in and subtracted from the relevant irrigation demand structures.

Carrier structures are set to zero. In simulation mode, carrier structures do not have demand at the headgate. Water is moved through carrier structures to meet other demands, as specified in the operating rule file.

5.4.5 Direct Diversion Right File (*.ddr)

The direct diversion right file contains water rights information for each diversion structure in the model. StateDMI creates the diversion right file, based on the structure list in the diversion station file. The information in this file is used during simulation to allocate water in the right sequence or priority and to limit the allocation by decreed amount.

Water rights for explicitly modeled structures were taken from the HydroBase and match the State Engineer's official water rights tabulation, except for special cases discussed below. Aggregated irrigation structures and diversion systems were assigned all the water rights belonging to their constituent structures. Aggregated M&I water rights were assigned an amount equal to their depletion and assigned an administration number of 1.00000.

5.4.5.1 Special Diversion Rights

For structures that divert water to off-channel reservoir systems, water rights in HydroBase may reflect flow rate limitations for diversions to storage, or may reflect water rights that can only be used for storage. Both of these types of rights are turned off in the *.ddr. For flow rate limitations, these are not real water rights and cannot be used to meet demands. For storage rights, these are already reflected in the Reservoir Rights (*.rer) file and should not be double counted.

As part of calibration, additional rights may be added to structures. StateDMI only retrieves absolute water rights, so conditional water rights that are actively being made absolute are not accounted for. These have been assigned to the relevant structures. Although free river is not a very common occurrence on the South Platte, there are structures that historically have taken more than their absolute water rights under free river conditions. To represent this, water rights with administration number 99999.99999 are assigned to select structures.

The approach taken in the South Platte Model to capture changed water rights involves diverting the original amount of the changed water right into a plan located just upstream of the original ditch. Frequently, HydroBase water rights tabulation reflects only the remaining, unchanged portion of the water right. The full amount of the water right must be set at the ditch in the SP2016.ddr. Operating rules are used to move the water right to a plan and divide the water right into the changed and unchanged portions. For more details on the approach to changed water rights, refer to Section 0. For details on a specific changed water right, refer to Section 5.10.

The general approach taken in the South Platte Model to capture transmountain and transbasin imports requires that the diversion structure receiving the import be assigned the most senior water right of administration number 1.00000. For more details on the approach to imports, refer to Section 4.8.

District 23 had a large amount of water rights changed to the City of Aurora. To administer the water rights, gage locations were established by decree. In the *.ddr file, the water rights of the various ditches are assigned to the decreed administration point. Until 1989, the full amounts of the original water rights are assigned to the administration gages. That allows the historical irrigation demand to be met. Under a separate water right ID, the administration gages are also assigned the changed portion of the water rights. Starting in 1989, rules in the *.opr file move the changed water to meet Aurora's demands.

COSMIC operations on Clear Creek involve the City of Golden, Coors Industrial Demand, and Croke Canal. The City of Golden is assigned a very slightly senior administration number to Coors, which is assigned a very slightly senior administration number to Croke Canal.

5.5 Irrigation Files

This section includes files that further define irrigation parameters for diversion structures. The parameters are used during simulation to compute on-farm consumptive use, and return flow volumes related to a given month's diversion.

5.5.1 StateCU Structure File (*.str)

This file contains the soil moisture capacity of each irrigation structure in inches per inch of soil depth. It is required for StateMod's soil moisture accounting in both baseflow and simulation modes. Soil moisture capacity values were gathered from Natural Resources Conservation Service (NRCS) mapping. The file is assembled by StateDMI from hand-built list files.

5.5.2 Irrigation Parameter Yearly (*.ipy)

This file is created by StateDMI, and contains maximum efficiency parameters and irrigated acreage for each irrigation structure and each year of the study period.

In the South Platte Model, maximum application efficiency has been assumed to be constant over the study period, at 60 percent for flood irrigated acreage and 80 percent for sprinkler irrigated acreage. Maximum delivery efficiency is the conveyance efficiency of the ditch. Consistency between the conveyance efficiency assigned in the *.ipy file, the *.dds file, and the *.opr file is essential. Carrier structures do not appear in the *.ipy file, as all of the irrigated acreage is assigned to the off-channel irrigation demand structure. In the *.ipy conveyance efficiency of off-channel irrigation demand structures (*_I) must be set to zero, because the conveyance efficiency is already accounted for at the carrier structure. The carrier structure must have consistency conveyance efficiency in the *.dds file and *.opr file. The value in the SP2016_N.dds file is used to generate natural flows, but the value assigned in the *.opr file will be used in simulation.

The irrigated acreage is categorized by deliver method (flood or sprinkler) and by water source (surface or ground water). Irrigated acreage is based on 1956, 1976, 1987, 1997, 2001, 2005, and 2010 irrigated acreage assessments. Acreage is linearly interpolated between the years with acreage assessments.

5.5.3 Consumptive Use Water Requirement File (*.ddc)

This file contains the time series of monthly irrigation water requirements for structures whose efficiency varies through the simulation. Irrigation water requirements are generated by StateCU.

In the South Platte Model, the some irrigation structures were included in the StateCU analysis, but removed from the *.ddc for the StateMod analysis. These structures do not have representative acreage assigned to them, therefore, do not have representative efficiency. By removing them from the *.ddc file, the efficiency values set in the *.dds will be used in StateMod. Generally, this occurs for structures that are located in municipal areas and supply golf course, parks, cemeteries, etc. For a list of structures and further explanation, refer to Section 4.5.2.1.

5.6 Reservoir Files

This section includes files that define characteristics of the reservoir structures in the model: physical characteristics, evaporation parameters, historical contents, operational targets, and water rights.

5.6.1 Reservoir Station File (*.res)

This file describes physical properties and some administrative characteristics of each reservoir simulated in the South Platte River Basin. It was assembled by StateDMI, using considerable amount of information provided in the commands file. Sixty-seven reservoirs are modeled explicitly, in addition to forty-nine aggregate recharge areas, sixteen aggregate stock ponds, and eleven aggregate reservoirs.

The modeled reservoirs are listed below in Table 5-6 with their capacity, their number of accounts or pools, and the evaporation station used to calculate evaporation (See Section 5.6.2).

Details on reservoirs that have more than two active accounts are provided in the subsections below. Details on water rights that are used to fill specific accounts, or are being set are described in Section 5.6.5.

Table 5-6
Modeled Reservoirs

WDID	Reservoir Name	Capacity (AF)	# of Accounts	Evaporation Station
0203351	Bull Reservoir	4,500	1	2
0203379	Aurora Reservoir	32,247	1	8-Lower
0203699	West Gravel Lakes	3,400	4	7-Lower
0203700	Thornton East Gravel Lakes	17,500	2	2
0203837	Barr Lake	32,000	2	2
0203858	Lower Latham Reservoir	6,212	1	2
0203876	Milton Reservoir	23,295	1	2
0203903	Standley Lake	42,734	6	7-Lower
02_ARP002	WD 2 Aggregate Reservoir	71,259	1	2

WDID	Reservoir Name	Capacity (AF)	# of Accounts	Evaporation Station
02_ASP002	WD 2 Aggregate Stock Pond	1,251	1	2
0200808_RB	Fulton WR Recharge Area	4,164	1	2
0200808_RC	Fulton Central WR Recharge Area	531	1	2
0200808_RS	Fulton WR Recharge Area	1,630	1	2
0200810_RC	Brighton Central WR Recharge Area	43	1	2
0200810_RS	Brighton WR Recharge Area	491	1	2
0200812_RC	Lupton Bottom Central WR Recharge Area	1,501	1	2
0200812_RS	Lupton Bottom WR Recharge Area	1,672	1	2
0200813_RC	Platteville Central WR Recharge Area	242	1	2
0200821_RS	Meadow Island No. 1 WR Recharge Area	340	1	2
0200824_R	Farmers Independent Recharge Area	1,000	1	2
0200824_RC	Farmers Independent Central Recharge Area	587	1	2
0200825_R	Hewes Cook Recharge Area	1,000	1	2
0200830_RC	Section No. 3 WR RA	199	1	2
0200837_RC	Highland WR RA	1,846	1	2
0202003_R	Ford Recharge Pit	1,000	1	2
Phantom Standley Lake	Phantom Standley Lake	427,34	5	7-Lower
0703010	Coors South Lakes	9,911	1	7-Lower
0703308	Arvada Reservoir	6,373	2	7-Lower
0703324	Ralston Reservoir	11,820	1	7-Lower
0703336	Jim Baker Reservoir	955	2	7-Lower
0703389	Coors North Lakes	1,322	1	7-Lower
0704030	Guanella Reservoir	2,325	1	8-Upper
0704354	Copeland Reservoir	70	1	7-Lower
ConMutualAGG[A)]	Consolidated Mutual Aggregate Reservoir	12,475	1	7-Lower
07_ARP011	Upper WD 7 Aggregate Reservoir	8,143	1	7-Upper
07_ARP012	Lower WD 7 Aggregate Reservoir	35,768	1	7-Lower
07_ASP007	WD 7 Aggregate Stock Pond	450	1	7-Lower
0803514	Chatfield Reservoir	53,697	3	8-Lower
0803532	Cherry Creek Reservoir	265,770	1	8-Lower
0803832	McLellan Reservoir	5,959	2	8-Lower

WDID	Reservoir Name	Capacity (AF)	# of Accounts	Evaporation Station
0803983	Strontia Springs Reservoir	8,074	2	8-Lower
0804097	South Platte Lake	6,389	1	8-Lower
08_ARP013	WD 8 Aggregate Reservoir	32,402	1	8-Upper
08_ASP008	WD 8 Aggregate Stock Pond	22,537	1	8-Lower
0903501	Marston Reservoir	20,103	2	8-Lower
0903999	Bear Lake	8,992	1	9-Lower
2303904	Antero Reservoir	23,746	3	23
2303965	Eleven Mile Reservoir	106,558	1	23
2303981	Jefferson Lake Reservoir	2,200	1	23
2304013	Spinney Mountain Reservoir	53,900	3	23
23_ARP016	WD 23 Aggregate Reservoir	16,898	1	23
23_ASP010	WD 23 Aggregate Stock Pond	3,258	1	23
8003550	Cheesman Reservoir	79,064	1	80
80_ARP019	WD 80 Aggregate Reservoir	6,749	1	80
80_ASP012	WD 80 Aggregate Stock Pond	133	1	80
0604172	Barker Reservoir	12,125	2	6-Upper
0604173	Baseline Reservoir	5,380	2	6-Lower
0604185	Panama Reservoir	4,989	1	6-Lower
0604187	Six Mile Reservoir	1,550	1	6-Lower
0604199	Gross Reservoir	43,591	1	6-Upper
0604212	Marshall Lake	9,952	2	6-Lower
0604214	McKay Lake	1,245	1	6-Lower
06_VALMT[B)]	Valmont Reservoir System	11,234	1	-
06_WSHED[C)]	Combined Watershed Reservoir	7,259	2	6-Upper
06_ARP009	WD 6 Upper Aggregate Reservoir	1,245	1	6-Upper
06_ARP010	WD 6 Lower Aggregate Reservoir	7,327	1	6-Lower
06_ASP006	WD 6 Aggregate Stock Pond	1,548	1	6-Lower
0503905	Union Reservoir	13,089	2	5-Lower
0504010	Button Rock Reservoir	16,400	1	5-Lower
0504015	Gold Lake	454	1	5-Upper
0504020	Beaver Park Reservoir	2,400	2	5-Upper
0504032	Highland Reservoir No. 2	3,713	1	5-Lower
0504037	Highland Reservoir No. 1	1,033	2	5-Lower

WDID	Reservoir Name	Capacity (AF)	# of Accounts	Evaporation Station
0504038	Highland Reservoir No. 3	1,430	2	5-Lower
0504071	Foothills Reservoir	4,350	2	5-Lower
0504073	McIntosh Reservoir	2,550	2	5-Lower
0504077	Allen Lake Reservoir	704	1	5-Lower
0504488	Left Hand Valley Reservoir	1,626	1	5-Lower
0504515	Boulder Reservoir	13,100	2	5-Lower
05_ARP007	Upper WD 5 Aggregate Reservoir	4,947	1	5-Upper
05_ARP008	Lower WD 5 Aggregate Reservoir	65,790	1	5-Lower
05_ASP005	WD 5 Aggregate Stock Pond	730	1	5-Lower
0403659	Loveland Municipal Reservoir	8,696	3	4-Lower
0404110RS[D)]	Greeley Loveland Reservoir System	70,496	2	4-Lower
0404128	Lake Estes	3,007	2	4-Upper
0404137RS[E)]	Home Supply Ditch Reservoir System	2,0427	4	4-Lower
0404138RS[F)]	Rist Benson Reservoir System	3,033	1	4-Lower
0404146RS[G)]	Handy Ditch Reservoir System	15,014	1	4-Lower
0404156	Ish Reservoir	7,319	1	4-Lower
0404171RS[H)]	South Side Reservoir System	1,656	1	4-Lower
0404513	Carter Lake	112,356	2	4-Lower
04_ARP005	Upper WD 4 Aggregate Reservoir	11,169	2	4-Upper
04_ARP006	Lower WD 4 Aggregate Reservoir	73,083	1	4-Lower
04_ASP004	WD 4 Aggregate Stock Pond	11,71	1	4-Lower
0103570	Bijou Reservoir No. 2	7,600	1	1-Lower
0103592	Horse Creek Reservoir	22,555	1	2
0103651[I)]	Riverside Reservoir	74,000	2	1-Lower
0103816	Empire Reservoir	37,800	1	1-Lower
0103817	Jackson Lake Reservoir	36,195	8	1-Lower
01_ARP001	WD 1 Aggregate Reservoir	89,743	1	1-Lower
01_ASP001	WD 1 Aggregate Stock Pond	52,514	1	1-Lower
0102513_Rn	N Rothe Recharge Res	93	1	1-Lower
0102513_Rs	S Rothe Recharge Res	272	1	1-Lower
0102518_R	Pioneer Recharge Res	684	1	1-Lower
0102522_R	Riverside Recharge Res	31,409	1	1-Lower
0102528_R	Ft Morgan Canal Recharge Res	16,500	1	1-Lower

WDID	Reservoir Name	Capacity (AF)	# of Accounts	Evaporation Station
0102529_R	Upper PB Recharge Res	14,400	1	1-Lower
0102535_R	Lower PB Recharge Res	19,800	1	1-Lower
0103339_R	Bijou Aug Recharge Res	50,700	1	1-Lower
6403551	North Sterling Reservoir	74,590	3	64
6403552	Prewitt Reservoir	32,164	20	64
6403906	Julesburg Reservoir	28,200	1	64
64_ARP001	WD 64 Aggregate Reservoir	17,952	1	64
64_ASP001	WD 64 Aggregate Stock Pond	6,195	1	64
6402515	Sterling Recharge Area	1,434	1	64
6402517_R	Sedgwick JID Seep Recharge Area	240	1	64
6402517_RP	Sedgwick Peterson Recharge Area	136	1	64
6402517_RS	Sedgwick S Res Recharge Area	18	1	64
6402518_R	Harmony Recharge Res	3,100	1	64
6402519_R	Dinsdale Recharge Res	2,000	1	64
6402525_R	Condon Recharge Res	7,800	1	64
6402526_R	Sterling Recharge Res	15,500	1	64
6402536_R	LLWUA Recharge Res	860	1	64
6402536_RB	LL Bravo Recharge Res	2,850	1	64
6402536_RH	LL UHD Recharge Res	610	1	64
6402536_RI	LL IPV Recharge Res	3,000	1	64
6402539_R	LWU Recharge Res	550	1	64
6402539_RC	LWU Schneider Recharge	880	1	64
6402539_RF	LWU Farmers Recharge Res	6,150	1	64
6402539_RP	LWU South Platte Recharge Res	5,000	1	64
6402539_RS	LWU Springdale Recharge Res	3,450	1	64
6402539_RT	LWU Sterling Recharge Res	1,350	1	64
6402540_R	Lowline Recharge Res	2,450	1	64
6402542_R	LSP Recharge Res	300	1	64
6402542_RH	LSP Heyborne Recharge Res	430	1	64
6402542_RL	LSP Liddle Recharge Res	420	1	64
6402542_RP	LSP Peterson Recharge Res	2,100	1	64
6403392_R	N. Sterling Recharge Res	7,800	1	64
6400525_A	Henderson Smith WR Recharge Area	3,381	1	64

WDID	Reservoir Name	Capacity (AF)	# of Accounts	Evaporation Station
6400528_A	Sterling No1 WR Recharge Area	2,990	1	64

A) Includes Maple Grove Reservoir, Fairmount Reservoir, and Welton Reservoir
B) Includes Valmont Lake Reservoir, Legett Reservoir, and Hillcrest Reservoir
C) Includes Green Lake Reservoirs 1 – 3, Albion Lake, Goose Lake, Island Lake, and Silver Lake
D) Includes Lake Loveland, Horseshoe Lake, and Boyd Lake
E) Includes Lone Tree Reservoir, Lone Hagler Reservoir, and Mariano Reservoir
F) Includes Rist Benson Reservoir, Donath Reservoir, and Fairport Reservoir
G) Includes Hertha Reservoir, Coleman Reservoir, Welch Reservoir, and Loveland Reservoir
H) Includes Ryan Gulch Lake and South Side Reservoir
I) Includes Vancil Reservoir

Note Phantom Standley Lake is not a real reservoir; it is included in the model for operational purposes. See Section 5.6.1.4.2 for more information.

5.6.1.1 Key Reservoirs

Parameters related to the physical attributes of key reservoirs include inactive storage, where applicable, total storage, area-capacity data, applicable evaporation/precipitation stations, and initial reservoir contents. For explicitly modeled reservoirs, storage and area-capacity information were obtained from either the Division Engineer or the reservoir owners. Initial contents for all reservoirs were set to the December 1949 end-of-month contents. If the end-of-month content for December 1949 data was filled, the initial content was set to 75 percent of the filled value. If the December 1949 end-of month content was missing, the initial content was set to 75 percent of the January 1950 end-of-month contents. The initial contents were prorated to reservoir accounts based on account size.

Administrative information includes reservoir account ownership, administrative fill date, and evaporation charge specifications. This information was obtained from interviews with the Division Engineer, local water commissioners, and the owner/operator of the individual reservoirs.

5.6.1.2 Aggregate Reservoirs and Stock Ponds

The amount of storage for aggregate reservoirs and stock ponds is based on storage decrees and SPDSS Task 69 Memorandum. For more details on the approach to creating aggregate reservoirs and stock ponds, refer to Section 4.2.2.2 Initial contents were set to capacity.

5.6.1.3 Aggregate Recharge Areas

The amount of storage for the aggregate recharge areas is based on the sum of the individual recharge pit capacities provided for in the decrees. The model ID's contain the associated augmentation structure followed by _R*. All of the modeled recharge areas are located in Water Districts 1, 2, and 64.

5.6.1.4 Reservoir Account Descriptions

Account descriptions are provided below for reservoirs that have two or more active accounts. Reservoirs that have an active account and a dead pool account are not included.

5.6.1.4.1 West Gravel Lakes

West Gravel Lakes is located along the Lower Clear Creek Ditch system and is represented in the SPDSS model in aggregate with the smaller Brannan Lakes (560 af capacity). The City stores water under its storage rights along with supply associated with some its changed water rights in various Clear Creek ditch companies. Additional uses of the reservoir include the storage of Bypass Water attributed to diversions by Coors and Golden for inside uses during the Croke season (see Section 5.10.8.10.79).

The reservoir is modeled with the following four accounts:

Account	Storage Amount (AF)
Coors Bypass	2,758
Golden Bypass	1,113
Thornton One Use	3,400
Thornton Reuse	3,400

5.6.1.4.2 Standley Lake

Standley Lake is an agricultural reservoir filled with water rights from Clear Creek and other smaller tributary creeks. Standley Lake water historically supplied agricultural users in the Big Dry Creek Basin as part of the Farmers Reservoir Irrigation Company (FRICO) Standley Lake division.

Standley Lake is primarily filled from Clear Creek via the Croke Canal, located downstream of the City of Golden. Water from Clear Creek can also be conveyed into the reservoir via the Church Ditch and the Farmers' Highline Canal.

FRICO Standley shares have been purchased and changed by three major municipalities – the Cities of Northglenn, Westminster, and Thornton. The three municipalities (see SPDSS Task 5 memo on the "Standley Lake Cities") and FRICO irrigators use their respective accounts in Standley Lake. Northglenn and Westminster store all their water in Standley Lake and then make releases to municipal pipelines out of the reservoir. Thornton uses water from Standley Lake as its primary supply during the winter but may store its FRICO share water in West Gravel Lakes and Standley Lake.

The reservoir is modeled with the following four accounts based on the user's pro rata share ownership:

Account	Storage Amount

	(AF)
Westminster	21,985
Northglenn	6,532
FRICO	2,288
Thornton	12,929

Clear Creek operations are fairly complex with multiple M&I interests competing for water supply with irrigation users. The feeder canals to Standley Lake are also used by other water users to convey changed share water to their respective facilities. To maximize the use of storage space in Standley Lake, the four account holders have operated under a 4-Way Agreement since the late-1970s. The 4-Way Agreement allows a user to temporarily store water in others' accounts subject to the account owners' need of its account capacity. A dummy reservoir (ID PhantomStand) is modeled with the follow five accounts to represent the shared use of Standley Lake storage:

Account	Storage Amount (AF)
WestyNgln	21,985
WestyFRICO	21,985
ThornWesty	12,929
ThornNglen	12,929
ThornFRICO	12,929

The account names (e.g., WestyNgln) represent the account owner (Westy) and entity (Ngln) temporarily using space in that account. Water is booked into and out of the Standley Lake and Phantom Reservoir accounts during each time step to operate the 4-Way Agreement (see Section 5.10.8.10).

5.6.1.4.3 Chatfield Reservoir

Chatfield Reservoir was completed in 1973 and inundated ditches that diverted from the South Platte River and Plum Creek. The disposition of the water rights in these ditches (City Ditch, Last Chance Ditch, and Nevada Ditch – aka the Manifold Ditches) is a bit confusing since the rights and ditches were moved over time, transferred back and forth, portions changed, portions abandoned, etc. The Manifold Ditch water ditches are owned primarily by Denver Water and the Cities of Aurora and Englewood. Denver Water actively uses its account in Chatfield Reservoir for storage of changed rights and reusable effluent and as a native source of Denver Water's South Platte River in its integrated Front Range / western slope water supply.

The reservoir is modeled with the following three accounts:

Account	Storage Amount (AF)
Fish Pool	16,294

Denver Water	11,134
USCOE	26,269

5.6.1.4.4 Antero Reservoir

Antero Reservoir is the highest elevation storage unit in Denver Water Board's infrastructure. The lake is relatively shallow and is subject to reasonably high evaporation losses from its exposed surface area. Denver Water typically operates Antero Reservoir as a drought supply.

The reservoir is modeled with the following three accounts:

Account	Storage Amount (AF)
Dead Pool	55
Denver Water	19,826
Flood Pool	3,865

5.6.1.4.5 Spinney Mountain Reservoir

Spinney Mountain is an on-channel reservoir on the South Platte River. Spinney Mountain Reservoir (completed in 1981) provides the City of Aurora with high basin storage to manage its transmountain supplies. The reservoir is modeled with the following three accounts:

Account	Storage Amount (AF)
Dead Pool	5,000
One Time Use	48,900
Reuse	48,900

5.6.1.4.6 Barker Reservoir (0604172)

The City of Boulder owns and operates Barker Reservoir. Barker Reservoir provides municipal supply to the City of Boulder as well as water to a downstream hydroelectric power generation facility. The reservoir is modeled with the following two accounts:

Account	Storage Amount (AF)
Municipal	8,125
Hydropower	4,000

5.6.1.4.7 Baseline Reservoir (0604173)

Baseline Reservoir provides water primarily for two municipalities – the City of Boulder and the City of Lafayette. Lafayette owns a large portion of Baseline Reservoir. While some water is leased from Baseline Reservoir to irrigators in District 6, those leases are inconsistent and were not modeled. The reservoir is modeled with the following two accounts:

Account	Storage Amount (AF)
Lafayette Municipal	4,849
Boulder Municipal	531

5.6.1.4.8 Combined Watershed Reservoir (06_WSHED)

The Watershed Reservoirs consist of 7 individual reservoirs: Silver Lake, Island Lake, Lake Albion, Goose Lake and Green Lakes 1, 2 and 3. They are owned by the City of Boulder. These reservoirs are operated together and are treated as one in this model. Some of the storage is dedicated to meeting minimum streamflows with the remainder used for direct municipal use.

Account	Storage Amount (AF)
Municipal	3,917
Min Streamflow	3,342

5.6.1.4.9 Beaver Park Reservoir (0504020)

Beaver Park Reservoir has two owners. Supply Ditch holds 51 percent ownership and Highland Ditch owns the remaining 49 percent. The owners are modeled with separate accounts. Water to each owner is only available from their account.

Account	Storage Amount (AF)
Highland System	1,176
Supply Ditch	1,224

5.6.1.4.10 Union Reservoir (0503905)

Union Reservoir serves multiple users. The Operational Pool is available to the City of Longmont, to meet demands via exchange. The RFO's account is available to Central Well Augmentation Plan, located downstream of the confluence of the St. Vrain and the South Platte River.

Account	Storage Amount (AF)
Operational Pool	6,544

RFO's	6,544

5.6.1.4.11 Loveland Municipal Reservoir (0403659)

Loveland Municipal Reservoir stores municipal supply for the City of Loveland. Currently, the City of Loveland indoor and outdoor municipal demands are the only users of the reservoir. The Loveland and Reuse account is a placeholder for future modeling operations. The reservoir is modeled with the following accounts:

Account	Storage Amount (AF)
Loveland	8,646
Dead Pool	50
Loveland and Reuse	8,646

5.6.1.4.12 Home Supply Ditch Reservoir System (0404173RS)

The Home Supply Ditch Reservoir System combines the storage capacity of three reservoirs: Lon Hagler, Lone Tree, and Mariano. Separate accounts are maintained because different water rights are used to fill different reservoirs and the reservoirs release to some separate demands. The reservoir is modeled with the following accounts:

Account	Storage Amount (AF)
Dead Pool	735
Lon Hagler	5148
Lone Tree	9068
Mariano	5476

5.6.1.4.13 Jackson Lake Reservoir

Jackson Lake Reservoir is an off-channel reservoir which receives water from the Lower South Platte River and stores it for primarily for irrigation. Fort Morgan has majority ownership in the reservoir and utilizes its storage supply to supplement direct flow diversions. The reservoir is modeled with the following accounts:

Account	Storage Amount (AF)
Ft. Morgan	22,912
Lower Platte and Beaver	5,829
Upper Platte and Beaver	2,123
Misc.	1,820

Riverside	640
Deuel Snyder	236
Bijou	135
Dead Pool	2,500

5.6.1.4.14 North Sterling Reservoir

North Sterling Reservoir is an off-channel reservoir in Water District 64 that diverts water from the South Platte River by the North Sterling Canal, which originates in Water District 1. Storage water is either released to the North Sterling Outlet Canal for irrigation of lands within the district or for recharge/augmentation. The reservoir is modeled with the following accounts:

Account	Storage Amount (AF)
Irrigation	55,590
Recharge, Aug, Irrigation	15,000
Dead Pool	4,000

5.6.1.4.15 Prewitt Reservoir

Prewitt Reservoir is an off-channel reservoir located on the south side of the lower South Platte River. Water is conveyed to the reservoir for storage through the Prewitt Inlet Canal, which originates in Water District 1. Water from the reservoir is released into the Prewitt Outlet Canal for delivery to multiple downstream ditch accounts. The reservoir is modeled with the following accounts:

Account	Storage Amount (AF)
South Platte Ditch	1,133
Pawnee Canal	7,859
Davis Bros. Ditch	1,380
Springdale Ditch	3,869
Schneider Ditch	290
Unattached W	50
Bravo Farmer	1,399
Iliff Platte	3,977
Lone Tree Ditch	524
Powell Ditch	1,682
Harmony No. 1	4,077
Ramsey Ditch	119
Sterling No. 2	411
Bijou Canal	150
Upper Platte Beaver	1,761
Lower Platte Beaver	1,826
Johnson Edwards	249

Deuel Snyder	100
Augmentation	666
Unknown WD1	642

5.6.2 Net Evaporation File (*.eva)

The evaporation file contains monthly average evaporation data (12 values that are applied in every year). The annual net reservoir evaporation was estimated by subtracting the weighted average effective monthly precipitation from the estimated gross monthly free water surface evaporation. Annual estimates of gross free water surface evaporation were taken from the National Oceanic and Atmospheric Administration (NOAA) Technical Report NWS 33. The annual estimates of evaporation were distributed to monthly values based on elevation through the distributions listed in Table 5-7. These monthly distributions are used by the State Engineer's Office.

Table 5-7
Monthly Distribution of Evaporation as a Function of Elevation (percent)

Month	Greater than 6,500 feet	Less than 6,500 feet
Jan	3.0	1.0
Feb	3.5	3.0
Mar	5.5	6.0
Apr	9.0	9.0
May	12.0	12.5
Jun	14.5	15.5
Jul	15.0	16.0
Aug	13.5	13.0
Sep	10.0	11.0
Oct	7.0	7.5
Nov	4.0	4.0
Dec	3.0	1.5

The less than 6,500 feet distribution was used for Water Districts 2, 64, and the lower portions of Water Districts 1, 3, 4, 5, 6, 7, 8, and 9. The greater than 6,500 feet distribution was used for the upper portions of Water Districts 1, 3, 4, 5, 6, 7, 8, 9 and all of Water Districts 23, 47, 76, and 80. The resulting average monthly gross reservoir evaporation estimates, in inches, are shown in Table 2.

Table 5-8. Average Monthly Gross Evaporation Distribution (inches)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1-Upper	0.07	0.93	1.52	2.25	3.17	4.81	4.46	3.11	3.59	2.40	1.09	0.26	27.67
1-Lower	1.18	1.47	1.86	3.12	3.56	4.73	4.75	4.54	3.48	2.61	1.50	1.17	33.96
2	0.90	1.19	1.44	2.37	2.81	4.57	5.12	4.73	3.23	2.19	1.07	0.94	30.55
3-Upper	-0.31	0.30	0.44	1.00	1.95	3.68	3.35	2.69	2.44	1.65	0.36	-0.10	17.46
3-Lower	0.75	1.04	1.16	1.92	2.18	3.89	4.44	4.12	2.76	1.86	0.87	0.79	25.78

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
4-Upper	-0.19	0.33	0.64	1.09	1.30	3.01	2.38	1.66	2.03	1.46	0.46	-0.15	14.02
4-Lower	0.73	0.93	0.90	1.62	2.00	3.83	4.61	3.85	2.50	1.80	0.79	0.66	24.22
5-Upper	-0.96	-0.18	-0.25	0.34	1.25	3.28	2.97	1.99	1.95	1.31	-0.18	-0.70	10.79
5-Lower	0.72	0.92	0.87	1.58	1.94	3.79	4.58	3.82	2.47	1.78	0.77	0.65	23.89
6-Upper	-0.54	0.11	0.16	0.65	1.71	3.39	2.54	1.12	1.89	1.25	0.16	-0.59	11.85
6-Lower	0.60	0.68	0.59	1.39	1.94	3.385	4.22	3.77	2.44	1.63	0.50	0.56	22.17
7-Upper	-0.48	0.18	0.31	0.85	1.92	3.57	2.79	1.39	2.06	1.37	0.25	-0.50	13.72
7-Lower	0.70	0.84	0.86	1.71	2.20	3.88	4.25	3.78	2.66	1.83	0.67	0.68	24.06
8-Upper	-0.02	0.57	1.03	1.90	2.87	4.35	3.71	2.49	3.06	1.88	0.78	0.03	22.63
8-Lower	0.75	0.86	0.93	2.14	2.75	4.28	4.15	3.73	3.02	1.96	0.87	0.69	26.13
9-Upper	-0.23	0.19	0.35	0.89	1.52	3.35	3.33	2.19	2.40	1.40	0.39	-0.20	15.57
9-Lower	0.71	0.85	0.86	1.72	2.21	3.91	4.29	3.82	2.68	1.85	0.68	0.69	24.27
23	0.11	0.77	1.55	2.46	3.32	4.33	3.22	1.67	2.80	1.90	1.04	0.16	23.33
47	-0.64	0.17	1.06	1.80	2.41	3.95	3.69	2.67	2.13	1.37	0.21	-0.47	18.35
48	-0.41	0.18	0.17	0.65	1.54	3.38	2.97	2.37	2.19	1.49	0.19	-0.20	14.51
64	1.16	1.43	1.88	3.17	3.14	4.50	4.82	4.87	3.79	2.54	1.47	1.17	33.93
76	-0.24	0.43	0.70	1.37	2.42	4.19	3.91	3.14	2.81	1.91	0.53	-0.02	21.15
80	-0.09	0.42	0.68	1.11	1.99	3.61	2.66	1.63	2.35	1.37	0.55	-0.09	16.19

Note, Water Districts 3, 47, 48, and 76 are not included in the South Platte Model.

Where to find more information

- SPDSS Task Memorandum 53.3, "Assign Key Climate Information to Irrigated Acreage and Reservoirs," available on the CDSS website.

5.6.3 End-Of-Month Content File (*.eom)

The end-of-month content file contains historical end-of-month storage contents for reservoirs in the reservoir station file. The historical EOM reservoir contents in this file are used by StateMod when estimating baseflow to reverse the effects of reservoir storage and evaporation on gaged streamflows, and to produce comparison output useful for calibration. The file was created by TSTool, which reads data from HydroBase and filled missing data with a variety of user-specified algorithms.

5.6.3.1 Key Reservoirs

Data for the South Platte Model key reservoirs was primarily generated by converting daily observations stored in HydroBase to month-end data, supplemented by user-provided data. Missing end-of-month contents were filled by interpolation, the average of available values for months with the same hydrologic condition, and remaining missing values were filled with historical average monthly values. For reservoirs with little or no historical data, available end-of-month contents were set to reservoir capacity. Table 5-9 presents the on-line date for each reservoir and the primary data source for end-of-month contents. Historical contents in the *.eom file were set to zero prior to the on-line date.

Table 5-9. Reservoir On-line Dates and EOM Contents Data Source

WDID	Reservoir Name	On-Line Date	Primary Data Source
0203351	Bull Reservoir	1984	HydroBase Daily
0203379	Aurora Reservoir	1990	Aurora Water
0203699	West Gravel Lakes	1982	HydroBase Daily
0203700	Thornton East Gravel Lakes	1994	HydroBase Daily
0203837	Barr Lake	Pre-1950	FRICO
0203858	Lower Latham Reservoir	Pre-1950	Lower Latham Reservoir Company
0203876	Milton Reservoir	Pre-1950	FRICO
0203903	Standley Lake	Pre-1950	HydroBase Daily
0703010	Coors South Lakes	1978	HydroBase Daily
0703308	Arvada Reservoir	1982	HydroBase Daily
0703324	Ralston Reservoir	Pre-1950	HydroBase Daily
0703336	Jim Baker Reservoir	1994	HydroBase Daily
0703389	Coors North Lakes	1978	HydroBase Daily
0704030	Guanella Reservoir	2003	HydroBase Daily
0704354	Copeland Reservoir	Pre-1950	Set to capacity
ConMutualAGG[A)]	Consolidated Mutual Aggregate Reservoir	1953	HydroBase Daily
0803514	Chatfield Reservoir	1975	Army Corps of Engineers
0803532	Cherry Creek Reservoir	1957	HydroBase Daily
0803832	McLellan Reservoir	1964	HydroBase Daily
0803983	Strontia Springs Reservoir	1982	HydroBase Daily
0804097	South Platte Lake	2008	HydroBase Daily
0903501	Marston Reservoir	Pre-1950	Denver Water
0903999	Bear Lake	1977	Army Corps of Engineers
2303904	Antero Reservoir	Pre-1950	Denver Water
2303965	Eleven Mile Reservoir	Pre-1950	Denver Water
2303981	Jefferson Lake Reservoir	Pre-1950	HydroBase Daily
2304013	Spinney Mountain Reservoir	1981	HydroBase Daily

WDID	Reservoir Name	On-Line Date	Primary Data Source
8003550	Cheesman Reservoir	Pre-1950	Denver Water
0604172	Barker Reservoir	Pre-1950	HydroBase Daily
0604173	Baseline Reservoir	Pre-1950	HydroBase Daily
0604185	Panama Reservoir	Pre-1950	HydroBase Daily
0604187	Six Mile Reservoir	Pre-1950	HydroBase Daily
0604199	Gross Reservoir	1957	HydroBase Daily
0604212	Marshall Lake	Pre-1950	HydroBase Daily
0604214	McKay Lake	Pre-1950	HydroBase Daily
06_VALMT[B)]	Valmont Reservoir System	Pre-1950	HydroBase Daily
06_WSHED[C)]	Combined Watershed Reservoir	Pre-1950	HydroBase Daily
0503905	Union Reservoir	Pre-1950	HydroBase Daily
0504010	Button Rock Reservoir	1969	HydroBase Daily
0504015	Gold Lake	Pre-1950	HydroBase Daily
0504020	Beaver Park Reservoir	Pre-1950	HydroBase Daily
0504032	Highland Reservoir No. 2	Pre-1950	HydroBase Daily
0504037	Highland Reservoir No. 1	Pre-1950	HydroBase Daily
0504038	Highland Reservoir No. 3	Pre-1950	HydroBase Daily
0504071	Foothills Reservoir	1950	HydroBase Daily
0504073	McIntosh Reservoir	Pre-1950	HydroBase Daily
0504077	Allen Lake Reservoir	Pre-1950	HydroBase Daily
0504488	Left Hand Valley Reservoir	Pre-1950	HydroBase Daily
0504515	Boulder Reservoir	1955	Northern Water Conservancy District
0403659	Loveland Municipal Reservoir	1978 (check)	HydroBase Daily
0404110RS[D)]	Greeley Loveland Reservoir System	Pre-1950	HydroBase Daily
0404128	Lake Esters	Pre-1950	Northern Water Conservancy District
0404137RS[E)]	Home Supply Ditch Reservoir System	Pre-1950	HydroBase Daily
0404138RS[F)]	Rist Benson Reservoir System	Pre-1950	HydroBase Daily
0404146RS[G)]	Handy Ditch Reservoir System	Pre-1950	HydroBase Daily

WDID	Reservoir Name	On-Line Date	Primary Data Source
0404156	Ish Reservoir	Pre-1950	HydroBase Daily
0404171RS[H)]	South Side Reservoir System	Pre-1950	HydroBase Daily
0404513	Carter Lake	1952	Northern Water Conservancy District
0103570	Bijou Reservoir No. 2	Pre-1950	HydroBase Daily
0103592	Horse Creek Reservoir	Pre-1950	HydroBase Daily
0103651[I)]	Riverside Reservoir	Pre-1950	HydroBase Daily
0103816	Empire Reservoir	Pre-1950	HydroBase Daily
0103817	Jackson Lake Reservoir	Pre-1950	HydroBase Daily
6403551	North Sterling Reservoir	Pre-1950	HydroBase Daily
6403552	Prewitt Reservoir	Pre-1950	HydroBase Daily
6403906	Julesburg Reservoir	Pre-1950	HydroBase Daily

A) Includes Maple Grove Reservoir, Fairmount Reservoir, and Welton Reservoir
B) Includes Valmont Lake Reservoir, Legett Reservoir, and Hillcrest Reservoir
C) Includes Green Lake Reservoirs 1 – 3, Albion Lake, Goose Lake, Island Lake, and Silver Lake
D) Includes Lake Loveland, Horseshoe Lake, and Boyd Lake
E) Includes Lone Tree Reservoir, Lone Hagler Reservoir, and Mariano Reservoir
F) Includes Rist Benson Reservoir, Donath Reservoir, and Fairport Reservoir
G) Includes Hertha Reservoir, Coleman Reservoir, Welch Reservoir, and Loveland Reservoir
H) Includes Ryan Gulch Lake and South Side Reservoir
I) Includes Vancil Reservoir

5.6.3.2 Aggregate Reservoirs, Stock Ponds, and Recharge Areas

Aggregate reservoirs and stock ponds were assigned contents equal to their capacity, because actual data was not available. Aggregate reservoirs are modeled as though in operation throughout the study period.

The aggregate recharge areas were assigned contents equal to zero, and fill based on operating rules.

5.6.4 Reservoir Target File (*.tar)

The reservoir target file contains minimum and maximum target storage limits for reservoirs in the reservoir station file. The reservoir may not store more than the maximum target, or release to the extent that storage falls below the minimum target. For the SP2016.tar, the minimum targets were set to zero and the maximum targets were set to the end-of-month contents. This represents an initial step of calibration. It is recommended that future modeling efforts set the maximum targets to capacity for water supply reservoirs. Flood control reservoirs will need special treatment in the future. This file was created by TSTool.

5.6.5 Reservoir Right File (*.rer)

The reservoir right file contains water rights associated with each reservoir in the reservoir station file. Specifically, the parameters for each storage right include the reservoir, administration number, decreed amount, the account(s) to which exercise of the right accrues, and whether the right was used as a first or second fill. It is recommended for future updates that the StateDMI commands be run initially without the “set” commands. This allows the modeler to view any changes to water rights (transfers, conditional to absolute, abandonment, etc.) reflected in updated versions of HydroBase and modify the “set” commands as necessary.

Note that in order for off-channel reservoirs to be filled with their water rights, the water must be carried to the reservoir using operating rules. In StateMod, the account that the operation rule delivers the water to takes priority over what is set up in the *.rer file. To gain a complete understanding of how reservoir rights are used to fill off-channel reservoirs, refer to the Operating Rule File (*.opr) Section 5.10.

5.6.5.1 Key Reservoirs

In general, water rights for explicitly modeled reservoirs were taken from HydroBase and correspond to the State Engineer’s official water rights tabulation. In addition, a few key reservoirs were assigned a “free water right”, with an extremely junior administration number to allow storage under free river conditions.

5.6.5.2 Aggregate Reservoirs

Aggregate reservoirs and stock ponds were assigned a decreed amount equal to their capacity, and an administration number 1.00000.

5.6.5.3 Special Reservoir Rights

The following section describes reservoirs that have water rights going to specific accounts (as opposed to all of the water rights filling all of the accounts). Details are also provided for water rights that are being set. Note that operating rules that have reservoir storage water rights as the source will take priority over the account settings in the *.rer file. Refer to the Operating Rule File Section 5.10 below for a complete description of how reservoir accounts are filled, especially for off-channel reservoirs.

5.6.5.3.1 Antero Reservoir

The reservoir is modeled with the following three water rights:

Storage Right Name	Storage Amount (AF)	Admin. Number	Account No.
Antero Res (2303904.01)	85,564	21099.00000	Accounts 1-2
Antero Res (2303904.02)	20,046	29219.00000	Accounts 1-2
Antero Res (2303904.03)	3,865	29219.00000	Account 3

According to Attachment A of the recently-completed Colorado River Cooperative Agreement (CRCA), Antero Reservoir has a first fill decree for 85,564 af (1907 priority) and a refill decree for 20,046 af (1929 priority). Denver Water generally does not divert under the 1907 priority, occasionally stores under the 1929 priority and more likely stores under its 1929 exchange right. Therefore, the senior right is turned off.

5.6.5.3.2 Spinney Mountain Reservoir

The reservoir is modeled with the following water right:

Storage Right Name (Acct. No.)		Storage Amount (AF)	Admin. Number
Spinney Mountain	(1 and 2)	86,000	45010.00000

The original right is for 86,000 af and 52,589 af of that is absolute. The maximum end-of-month contents recorded for the reservoir is 53,873 af. Therefore, the conditional portion of the original storage right is included in the model to provide legal right to water during simulation. Note also there is a 4,000 af Fill and Refill junior right that is conditional that is not included in the model.

5.6.5.3.3 Eleven Mile Reservoir

The reservoir is modeled with the following four water rights for the one account represented in Eleven Mile Reservoir:

Storage Right Name	Storage Amount (AF)	Admin. Number
11 Mile Reservoir	81,917	27949.00000
11 Mile Reservoir Refill	81,917	29219.00000
11 Mile Reservoir 1st Enl.	15,862	39361.00000
11 Mile Reservoir 2nd Enl.	17,810	39424.00000

The junior right is a Refill right. The Eleven Mile Reservoir 2nd Enlargement right is conditional. The original and first enlargement rights total 97,779 af but the maximum end-of-month contents recorded for the reservoir is 106,558 af. Therefore, the conditional portion of the original storage right is included in the model to provide legal right to water during simulation.

5.6.5.3.4 East Gravel Lakes

The reservoir is composed of multiple storage units and is modeled with the following three water rights:

Storage Right Name	Storage Amount (AF)	Admin. Number
Tani Lake	3,928	47116.46368
South Dahlia	1,230	51864.50687
EGL Conditional	12,242	51864.50687

The first two rights are the absolute portions of the storage decrees for Tani and South Dahlia (5,158 af, total). There are also conditional storage rights for the interconnected gravel pits that make up the East Gravel Lakes. The following conditional rights total 12,342 af: East Gravel Lakes 4,072 af - 47116.46368; North Dahlia 3,500 af - 51864.00000; South Dahlia 3,270 af - 51864.00000; East Sprat Platte – 1,500 af, 51864.00000.

The maximum end-of-month contents recorded for the reservoir is 14,772 af. Therefore, the conditional storage rights are included in the model, in aggregate, to provide legal right to water during simulation. Note the administration number for the conditional right is set equal to the priority for the South Dahlia absolute storage so the absolute right would trigger first during model simulation.

5.6.5.3.5 Bull Reservoir

The reservoir is modeled with the following two water rights:

Storage Right Name	Storage Amount (AF)	Admin. Number
Bull Reservoir	8,232	46147.00000
Bull Reservoir	761	53482.00000

The senior right (1976 priority) is partially absolute; in the amount of 684 af. The 761 af junior right (1996 priority) is absolute. The maximum end-of-month contents recorded for the reservoir is 4,448 af. Therefore, the conditional portion of the senior storage right is included in the model to provide legal right to water during simulation.

5.6.5.3.6 West Gravel Lakes and Brannan

The reservoir is modeled with the following two water rights:

Storage Right Name	Storage Amount (AF)	Admin. Number	Account No.
WGL and Brannan (0203699.01)	3600	48198.00000	Account 3
WGL and Brannan (0203699.02)	945	50477.00000	Account 3

The storage rights above are assigned to the One Time Use account. Conditional amounts were included (2825A and 62 AF, respectively) so that historical EOM can be simulated.

5.6.5.3.7 Barr Lake

The reservoir is modeled with the following three water rights:

Storage Right Name	Storage Amount (AF)	Admin. Number	Account No.
Barr Lake (0203837.01)	11,081	13108.00000	Account 1
Barr Lake (0203837.02)	19,484	21562.00000	Account 2
Barr Lake (0203837.03)	33,011	21562.00000	Accounts 1-2

The 1909 storage rights equal sum of 19,484 acre-feet (measure of 1909 storage right in Case No. 02CW105A) and 33,011.26 acre-feet (refill right).

5.6.5.3.8 Barker Reservoir

The reservoir is modeled with the following two water rights:

Storage Right Name	Storage Amount (AF)	Admin. Number	Account No.
Barker Meadow Res (0604172.01)	11,687	20805.00000	Account 1
Barker Meadow Res (0604172.02)	3,163	29219.00000	Account 1
Barker Meadow Res (0604172.03)	4,000	40740.38851	Account 2
Barker Meadow Res (0604172.04)	2,000	44559.42480	Account 1

5.7 Instream Flow Files

This section includes files that define characteristics of instream flow structures in the model: location, demand, and water rights.

5.7.1 Instream Station File (*.ifs)

Thirty-one instream flow reaches are defined in this file, which was created in StateDMI. The file specifies an instream flow station and downstream terminus node for each reach, through which instream flow rights can exert a demand in priority. Table 5-10 lists each instream flow station included in the South Platte Model, along with their location and maximum daily demand. These rights represent decrees acquired by CWCB, with the exception of the instream flow stations listed under the following section.

5.7.1.1 Special Instream Flow Stations

Several reservoir bypass agreements and other operations are represented as instream flow reaches as follows:

Reservoir Bypass Agreements:

- Lake Estes Bypass (0404128_M)
- 1982 Strontia Springs Bypass (1982_MinFlow)
- Voluntary Barker Reservoir Bypass (06_BARKMSF)

Legal Compact:

- South Platte River Compact (6499999)

Recreational Instream Channel Diversion:

- Golden White Water Course (0701000)

5.7.2 Instream Flow Annual File (*.ifa)

Instream flow demands were developed from decreed amounts and comments in the State Engineer's water rights tabulation or from agreements as listed in Section 5.7.1. Thirty-one monthly instream flow demands are used and repeated for each year of the simulation. This file, created in StateDMI, contains monthly demands for each instream flow structure included in the South Platte Model.

5.7.3 Instream Right File (*.ifr)

Water rights for each instream flow reach modeled in the South Platte Model are contained in the instream flow right file, and shown in Table 5-10. Note that the decree represents the maximum demand, which may vary throughout the year. These data were obtained from HydroBase with the exception of instream flow reaches listed under Section 5.7.3.1. It is recommended for future updates that the StateDMI commands be run initially without the "set" commands. This allows the modeler to view changes to water rights (transfers, conditional to absolute, abandonment, etc.) reflected in updated versions of HydroBase and modify the "set" commands as necessary. Note that there are instream flow demands that can only be met by operations and therefore do not have decreed rights. These instream flow operations are discussed below.

Table 5-10. Instream Flow Summary

ID	Name	Decree (cfs)
0402110	BIG T OLYMPUS/DRAKE M FLOW	40.00
0402112	LOVELAND PWR-DILLE M FLOW	50.00
0404128_M	MIN BYPASS FOR LAKE ESTES AND OLYMPUS TUNNEL	125.00
0502115	S ST VRAIN CR MIN FLOW	8.0

ID	Name	Decree (cfs)
0502120	MID ST VRAIN CR MIN FLOW	8.00
0502127	S ST VRAIN CR MIN FLOW	20.00
0502128	N ST VRAIN CR MIN FLOW	21.00
0502129	S ST VRAIN CR MIN FLOW	20.00
0602100	BOULDER CR MIN FLOW	15.00
0602107	MIDDLE BOULDER CR MIN FLOW	12.00
0602110_L	SO BOULDER CR MIN FLOW SEG 1 (LOWER)	15.00
0602110_U	SO BOULDER CR MIN FLOW SEG 1 (UPPER)	15.00
0602124_L	BOULDER CR MIN FLOW SEG B (LOWER)	15.00
0602124_U	BOULDER CREEK MIN FLOW SEG B (UPPER)	5.00
06_BARKMSF	BARKER BYPASS	3.00
0701000	GOLDEN WHITE WTR COURSE	1000.00
0702109	CLEAR CREEK MIN FLOW	10.00
0702113	LEAVENWORTH CR MIN FLOW	1.50
0702118	WEST FK CLEAR CR MIN FLOW	11.00
0902115	BEAR CR MIN FLOW	14.90
1982_MinFlow	DWB 1982 STRONTIA BYPASS	60.00
2302103	SO FORK SO PLATTE MIN FLOW	7.00
2302107	TARRYALL CREEK UPPER MIN	14.00
2302116	JEFFERSON CK MIN FLOW	6.00
2302118	MICHIGAN CREEK MIN FLOW	7.00
2302119	TARRYALL CREEK MIN FLOW	7.00
2302123	FOURMILE CREEK MIN FLOW	8.00
2302148	MID FK S PLATTE MIN FLOW	16.00
6499999	SOUTH PLATTE RIVER COMPACT	120.00
8002110	DEER CR MIN FLOW	2.00
8002111	ELK CR MIN FLOW	5.00

5.7.3.1 Special Instream Flow Rights

Several reservoir bypass agreements and other operations are represented as instream flow reaches have water rights set as follows:

Reservoir Bypass Agreements:

- Lake Estes Bypass (0404128_M) was set to 125 cubic feet per second with an administration number of 99999.00000
- 1982 Strontia Springs Bypass (1982_MinFlow) was set to 60 cubic feet per second with an administration number of 30571.99999

- Voluntary Barker Reservoir Bypass (06_BARKMSF) was set to 3 cubic feet per second with an administration number of 99998.99999

Recreational Instream Channel Diversion:

- Golden White Water Course (0701000) was set to 1,000 cubic feet per second with an administration number of 54420.00000

Operational Structures

- Boulder Creek Minimum Flow A (0602125) water rights were turned off as they are associated with changed water rights from multiple ditches. This instream flow demand is satisfied using operating rules that release Boulder's changed water rights to meet the instream flow demands.

Others:

- The administration number for the Big T Olympus/Drake Min Flow (0402110) was set to 30571.99999—making it just senior to the Olympus Tunnel native rights based on actual operations.

- The administration number for the Loveland Pwr-Dille Min Flow (0402112) was set to 30571.99999—making it just senior to the Olympus Tunnel native rights based on actual operations.

5.8 Plan Files

Plan structures are used by in the South Platte Model to represent complex operations, such as reusable supplies, recharge supply and augmentation demands, terms and conditions, changed water rights, and imports. Plan structures work in conjunction with operating rules, and require several types of plan files to represent the operations. This section documents the plan files used in the South Platte Model to simulate the plan structures and their operations. For more information on a specific plan structure, refer to the Operating Rules section.

5.8.1 Plan Data File (*.pln)

The plan data file provides the ID, name, location in the network, and plan type for the plan structures in the model. There are 10 different plan types used in the model, and 783 total plan structures. The file was developed in a text editor and generally grouped by operations. Table 5-11 reflects the count of plan structures by plan type, and Table 7-4 (in the appendix) lists the plan structures included in the model organized by plan type. The plan structures are discussed in more detail in the Operating Rules section, however examples for each plan type are provided below.

Table 5-11: Plan Structure Summary

Plan Type	Plan Type	No. in Model
1	Terms & Conditions Plan	82
2	Well Augmentation Plan	51
3	Reservoir Reuse Plan	21
4	Diversion (Non-Reservoir) Reuse Plan	24
7	Import Plan	17
8	Recharge Plan	49
10	Special Well Augmentation Plan	5
11	Accounting Plan	28
12	Release Limit Plan	157
13	Changed Water Rights Plan	350
Total		**784**

Type 1 – Terms and Conditions (T & C) Plan is used to store a future return flow obligation associated with the transfer of water from one structure to another. They generally represent the amount, timing, and location of non-consumed water returned to the river from the historical use of the changed water right. For example, the City of Longmont's use of changed shares in the Rough and Ready Ditch requires historical return flows be maintained as part of the transfer. In order to track these return flow obligations, operating rules that reflect the use of these shares (e.g. 527_Pln5) include Longmont's terms and conditions plan (Longmont_TC). StateMod calculates the obligation for the time step it occurs and all associated future time steps.

Type 2 - Well Augmentation Plan is used to store a future obligation to return water to the river (augment) when a well depletes the river out-of-priority. When a Well Augmentation Plan is specified, StateMod calculates the current and future obligation for the time step it occurs and all associated future time steps. Well depletions are associated with augmentation plans through the Augmentation Plan to Well Data file (*.plw). For example, the Lowline Augmentation Plan (6402540) tracks the out-of-priority pumping from several wells that irrigate land under Lowline Ditch and surrounding ground-water only parcels. Well augmentation plan obligations are generally augmented by changed ditch shares, canal and recharge area seepage (see Plan Type 8), or reservoir releases.

Type 3 – Reservoir Reuse Plan is used to store a reusable water supply associated with a reservoir. As the reuse plan represents water stored in the reservoir, any unused water can be carried over in the plan to the next time step. For example, the City of Longmont's reusable supplies that are stored in Button Rock Reservoir are tracked through the Longmont reservoir reuse plan (LResReusable).

Type 4 - Diversion (Non-Reservoir) Reuse Plan is used to store a reusable water supply associated with a diversion. As the reuse plan is associated with a diversion, any unused water must be released since it cannot be carried over to the next month. For example, the City of Aurora's reusable effluent is tracked through the Metro WWTP in Aurora's Metro reuse plan (MetroAur).

Type 7 - Import Plan is used to account for imported water which, in many cases, may be used to extinction. Import plans are used in conjunction with accounting plans, and allow StateMod to provide multiple users with import supplies in the priority that is appropriate for their system. For example, Adams Tunnel water is imported into the river system first using an import plan (0404634), then the imported water is transferred to an accounting plan (CBT_AllPln) where it can be divided into other accounting plans (e.g. AdamsTunPln and LoveCBTPln) or released directly to users.

Type 8 - Recharge Plan is used to store a water supply that originated from reservoir, recharge area, or canal seepage. The water supply from this plan is typically used to meet a well augmentation demand generated in a Type 2 plan. The return to the river is controlled by a unit response table therefore it accrues to the river as a supply even if it is not assigned to a demand. Using the Lowline Augmentation Plan example from above, the augmentation plan demands are met through the canal and recharge seepage associated with the operation of a junior recharge right on Lowline Ditch. The canal and recharge seepage is tracked in the Lowline recharge plans (6402540_PlC and 6402540_PlR).

Type 10 - Special Well Augmentation Plan is similar to a Type 2 plan, however is used to store the depletion associated with a well that is *not* required to be augmented. Examples include pumping in a designated basin (e.g. Lost_Creek plan) or pumping by a well which has been decreed to be non-tributary (e.g. Coffin_Well plan). A special augmentation plan is typically used to demonstrate that every well in the model is assigned to an augmentation plan even if some wells are not required to augment their depletions as is the case with "Coffin" wells.

Type 11 - Accounting Plan is used to "temporarily" divert water in priority which may subsequently be used at a later point in the priority system or by a number of other structures. Note this plan type was historically used for changed water rights, however due to the complexity of those operations; Plan Type 13 was developed exclusively for those operations. The Type 11 plan is still used in special operations such as the South Platte Compact (Compact_Pln) and import operations (CBT_AllPln).

Type 12 - Release Limit Plan is used to limit the cumulative supply from multiple sources to monthly and annual values. This plan is typically included in a series of other operating rules to limit the total amount of diversions or reservoir releases to a user-specified monthly or annual amount. For example, the City of Boulder's operations with changed shares from Anderson Ditch are limited by three separate limit plans (060501_CHL1, 060501_CHL2, 060501_CHL3) to account for the volumetric limitations associated with three different decrees.

Type 13 – Changed Water Rights Plan is a specific type of accounting plan that is used to handle changed water right operations, allowing water to be "temporarily diverted" in priority, split to other Type 13 plans if the changed right has more than one owner, then released at a later priority to meet demands. For example, the City of Louisville's change of the senior McGinn Ditch water right is first diverted into the McGinn Louisville Change Plan (060586_CH1), and then delivered to Louisville's indoor and outdoor demands via pipeline. As the changed water rights plan is associated with a diversion, any unused water must be released since it cannot be carried over to the next month.

5.8.2 Augmentation Plan to Well Data File (*.plw)

The augmentation plan to well data file associates well rights and well structures to an augmentation plan, informing the model the amount and pattern of well depletions should be tracked under each augmentation plan. This file contains each unique well right, along with its associated well structure, well ID, and augmentation plan ID. This file is created through TSTool and an external database/spreadsheet; the process for developing the file is documented in Section7.8. In general, the association between augmentation plans and well IDs are based on the Associated Structure Table queried directly from HydroBase.

Key augmentation plans and recharge operations were originally identified under SPDSS Task 7.2; the list of key augmentation plans and operations was refined during model development. Larger augmentation plans are modeled explicitly; well IDs associated with smaller augmentation plans are grouped in aggregate augmentation plans (i.e. AggWell_01 or GwOnly_01). Due to pumping quotas imposed for some augmentation plans, wells are often included in multiple augmentation plans. The augmentation plan to well file reflects this multiple plan association; however StateMod currently only accounts for the depletions under one augmentation plan. Table 5-12 summarizes the number of well rights associated with each augmentation plan in the augmentation plan to well file.

Table 5-12: Augmentation Plan to Well Data Summary

Aug. Plan ID	Aug. Plan Name	No. of Associated Well Rights	Plan Type
0102456	FT MORGAN CITY AUG	116	2
0102513	ROTHE AUG PLAN	33	2
0102518	PIONEER AUG PLAN	114	2
0102522	RIVERSIDE AUG	192	2
0102528	FT MORGAN AUG PLAN	120	2
0102529	UPPER PB AUG PLAN	128	2
0102535	LPB AUG PLAN	123	2
0102662	BRUSH AUG	12	2
0103339	BIJOU AUG PLAN	473	2
0703390	CoorsA_AugPlan	16	2
0802593	AuroraWellAugPlan	2	2
6402517	SEDGWICK CTY AUG PLAN	187	2
6402518	HARMONY AUG PLAN	87	2
6402519	DINSDALE AUG	33	2
6402525	CONDON AUG	21	2
6402526	STERLING AUG	7	2
6402536	LOWER LOGAN WELL USERS	219	2
6402539	LOGAN WELL USERS AUG	502	2

Aug. Plan ID	Aug. Plan Name	No. of Associated Well Rights	Plan Type
6402540	LOWLINE AUG PLAN	26	2
6402542	LSPWCD AUG	67	2
6403392	NORTH AUG PLAN	102	2
9902502	SACWSDAugPlan	18	2
9902541	BrightonAugPlan	32	2
9903334_A	GMSReachAAugPln	46	2
9903334_B	GMSReachBAugPln	137	2
9903334_C	GMSReachCAugPln	511	2
9903334_D	GMSReachDAugPln	95	2
9903334_E	GMSReachEAugPln	79	2
9903334_F	GMSReachFAugPln	325	2
9903394_A	WASReachAAugPln	12	2
9903394_B	WASReachBAugPln	6	2
9903394_C	WASReachCAugPln	150	2
9903394_D	WASReachDAugPln	24	2
9903394_E	WASReachEAugPln	6	2
9903394_F	WASReachFAugPln	50	2
AggWell_01	AggWell_01	178	2
AggWell_02	AggWell_02	681	2
AggWell_04	AggWell_04	44	2
AggWell_05	AggWell_05	27	2
AggWell_06	AggWell_06	11	2
AggWell_07	AggWell_07	10	2
AggWell_08	AggWell_08	34	2
AggWell_64	AggWell_64	66	2
GwOnly_01	GwOnly_01	475	2
GwOnly_02	GwOnly_02	93	2
GwOnly_04	GwOnly_04	9	2
GwOnly_05	GwOnly_05	1	2
GwOnly_06	GwOnly_06	2	2
GwOnly_07	GwOnly_07	2	2
GwOnly_08	GwOnly_08	285	2
GwOnly_64	GwOnly_64	88	2
Camp_Creek	Camp_Creek	21	10
Coffin_Well	Coffin_Well	7	10
Kiowa_Bijou	Kiowa_Bijou	846	10
Lost_Creek	Lost_Creek	150	10
Upper_Crow	Upper_Crow	82	10
Total Key Well Rights		**5,177**	

Aug. Plan ID	Aug. Plan Name	No. of Associated Well Rights	Plan Type
Total Agg. Well Rights		2,006	
Total Well Rights Assigned to Aug. Plans		7,183	

Where to find more information

- SPDSS Task Memorandum 7.2, “Well Use and Well Augmentation Plans,” available on the CDSS website.

5.8.3 Plan to Reservoir Recharge Data File (*.plr)

The plan to reservoir recharge data file links recharge areas to recharge plans, allowing the seepage from a recharge area to be accounted for under a reservoir recharge plan and ultimately to be used as a supply to augment well depletions. This file was created in a text editor and contains the association between modeled recharge areas and reservoir recharge plans. As discussed in the Section 4 Modeling Approach section, recharge areas are modeled in aggregate with one aggregate recharge area per ditch per augmentation plan. For augmentation plans that have recharge areas on multiple ditches (e.g. Lower Logan Well Users, 6402536), the multiple aggregate recharge areas are tied to a single overall reservoir recharge plan (*_PlR) in this file. As reflected in Table 5-13 , 50 recharge areas are associated with 24 reservoir recharge plans in the plan to reservoir recharge data file.

Table 5-13: Plan to Reservoir Recharge Plan Summary

Reservoir Recharge Plan ID	Reservoir Right ID	Reservoir Structure ID	Reservoir Structure Name
0102513_PlR	0102513_Rn.1	0102513_Rn	N Rothe Recharge Res
0102513_PlR	0102513_Rs.1	0102513_Rs	S Rothe Recharge Res
0102518_PlR	0102518_R.1	0102518_R	Pioneer Recharge Res
0102522_PlR	0102522_R.1	0102522_R	Riverside Recharge Res
0102528_PlR	0102528_R.1	0102528_R	Ft Morgan Canal Recharge
0102529_PlR	0102529_R.1	0102529_R	Upper PB Recharge Res
0102535_PlR	0102535_R.1	0102535_R	Lower PB Recharge Res
0103339_PlR	0103339_R.1	0103339_R	Bijou Aug Recharge Res
0103570_PlR	0103570_R.1	0103570	Bijou Res No. 2
0200824_PlR	0200824_R.1	0200824_R	Farmers Independent Rech
0200825_PlR	0200825_R.1	0200825_R	Hewes Cook Recharge
0202003_PlR	0202003_R.1	0202003_R	Ford Recharge
6402517_PlR	6402517_R.1	6402517_R	Sedgwick JIDSeep RA
6402517_PlR	6402517_RP.1	6402517_RP	Sedgwick Peterson RA

Reservoir Recharge Plan ID	Reservoir Right ID	Reservoir Structure ID	Reservoir Structure Name
6402517_PlR	6402517_RS.1	6402517_RS	Sedgwick SReserv RA
6402518_PlR	6402518_R.1	6402518_R	Harmony Recharge Res
6402519_PlR	6402519_R.1	6402519_R	Dinsdale Recharge Res
6402525_PlR	6402525_R.1	6402525_R	Condon Recharge Res
6402526_PlR	6402526_R.1	6402526_R	Sterling Recharge Res
6402526_PlR	6400525_A.1	6400525_A	HendersonSmith WR RA
6402526_PlR	6400528_A.1	6400528_A	SterlingNo1 WR RA
6402526_PlR	6402515.01	6402515	SterlingRechargeArea
6402536_PlR	6402536_RH.1	6402536_RH	LL UHD Recharge Res
6402536_PlR	6402536_RI.1	6402536_RI	LL IPV Recharge Res
6402536_PlR	6402536_RB.1	6402536_RB	LL Bravo Recharge Res
6402536_PlR	6402536_R.1	6402536_R	LLWUA Recharge Res
6402539_PlR	6402539_RC.1	6402539_RC	LWU Schneider Recharge R
6402539_PlR	6402539_RP.1	6402539_RP	LWU South Platte Recharg
6402539_PlR	6402539_RS.1	6402539_RS	LWU Springdale Recharge
6402539_PlR	6402539_RT.1	6402539_RT	LWU Sterling Recharge Re
6402539_PlR	6402539_RF.1	6402539_RF	LWU Farmers Recharge Res
6402539_PlR	6402539_R.1	6402539_R	LWU Recharge Res
6402540_PlR	6402540_R.1	6402540_R	Lowline Recharge Res
6402542_PlR	6402542_RL.1	6402542_RL	LSP Liddle Recharge Res
6402542_PlR	6402542_RP.1	6402542_RP	LSP Peterson Recharge Re
6402542_PlR	6402542_RH.1	6402542_RH	LSP Heyborne Recharge Re
6402542_PlR	6402542_R.1	6402542_R	LSP Recharge Res
6403392_PlR	6403392_R.1	6403392_R	NSterling Recharge Res
9902502_PlR	0200808_RS.1	0200808_RS	FulSAC WR RA
9902502_PlR	0200810_RS.1	0200810_RS	BriSAC WR RA
9902502_PlR	0200812_RS.1	0200812_RS	LBSAC WR RA
9902502_PlR	0200821_RS.1	0200821_RS	MI1SAC WR RA
9902541_PlR	0200808_RB.1	0200808_RB	FulBri WR RA
9903394_PlR	0200808_RC.1	0200808_RC	FulCen WR RA
9903394_PlR	0200810_RC.1	0200810_RC	BriCen WR RA
9903394_PlR	0200812_RC.1	0200812_RC	LBCen WR RA
9903394_PlR	0200813_RC.1	0200813_RC	PVCen WR RA
9903394_PlR	0200824_RC.1	0200824_RC	FIDCOCen WR RA
9903394_PlR	0200830_RC.1	0200830_RC	SN3 WR RA
9903394_PlR	0200837_RC.1	0200837_RC	HiCen WR RA

5.8.4 Reservoir Return File (*.rrf)

The reservoir return flow contains return flow information that is used to route reservoir seepage back to the river over time. The reservoir return flow file contains the return flow location(s) and associated delay pattern associated primarily with recharge areas, however also includes reservoirs that have seepage represented in the model. Refer to the reservoir station file (*.res) to determine the amount of seepage that is represented for each reservoir.

Although recharge areas are modeled in aggregate, the location and distance from the stream was reviewed for the individual recharge areas within the aggregate recharge area in order to assign appropriate delay patterns and locations where the reservoir seepage accrues. Exceptions include recharge areas for the City of Sterling; delay patterns were set from augmentation plan accounting data and adjusted for the immediate returns from the city's effluent.

Currently StateMod is not able to use changed water rights as a supply to meet augmentation plan depletions using a standard plan release operating rule (Type 27 or 28). Therefore, changed water rights are "routed" through a recharge area in order to make them available to an augmentation plan. This is achieved by using an "immediate" delay pattern (i.e. Pattern 4; water is returned in the same time-step) for the recharge areas included on the ditches with the changed water rights.

Table 5-14 summarizes the return flow information for the reservoirs.

Table 5-14: Reservoir Recharge Plan Return Flow Summary

Reservoir ID	Reservoir Name	Return Flow Location	Return Flow %	Delay Pattern
0102513_Rn	N Rothe Recharge Res	0100511	100	1100
0102513_Rs	S Rothe Recharge Res	0100514	100	1100
0102518_R	Pioneer Recharge Res	0100524	70	1500
0102518_R	Pioneer Recharge Res	0100688	30	1500
0102522_R	Riverside Recharge Res	0100513	60	1100
0102522_R	Riverside Recharge Res	0100507_D	40	1100
0102528_R	Ft Morgan Canal Recharge	0100518	100	1100
0102529_R	Upper PB Recharge Res	0100520	40	1100
0102529_R	Upper PB Recharge Res	0100524	50	1100
0102529_R	Upper PB Recharge Res	0100687	10	1100
0102535_R	Lower PB Recharge Res	0100524	20	1200
0102535_R	Lower PB Recharge Res	0100687	60	1200
0102535_R	Lower PB Recharge Res	6400535	20	1200
0103339_R	Bijou Aug Recharge Res	0100511	100	1100
0103570	Bijou Res	0100511	100	1100
0103816	Empire Res	0100507_D	100	1100
0103817	Jackson Res	0100514	100	1300
0103651	Riverside Res	0100503_D	100	1100
6402517_R	Sedgwick JIDSeep RA	6400502	100	1200

Reservoir ID	Reservoir Name	Return Flow Location	Return Flow %	Delay Pattern
6402517_RP	Sedgwick Peterson RA	6400502	100	1200
6402517_RS	Sedgwick SReserv RA	6400502	100	1600
6402518_R	Harmony Recharge Res	6400508	60	1200
6402518_R	Harmony Recharge Res	6400507	40	1200
6402519_R	Dinsdale Recharge Res	6400504	100	1700
6402525_R	Condon Recharge Res	6400508	50	1700
6402525_R	Condon Recharge Res	6400511_D	50	1700
6402526_R	Sterling Recharge Res	6400522_D	100	642526
6400525_A	HendersonSmith WR RA	6400524	100	4
6400528_A	SterlingNo1 WR RA	6400526	100	4
6402515	SterlingRechargeArea	6400522_D	100	642515
6402536_RH	LL UHD Recharge Res	6400508	60	1200
6402536_RH	LL UHD Recharge Res	6400507	40	1200
6402536_RI	LL IPV Recharge Res	6400516	100	1200
6402536_RB	LL Bravo Recharge Res	6400518	100	1200
6402536_R	LLWUA Recharge Res	6400516	60	1100
6402536_R	LLWUA Recharge Res	6400514	40	1100
6402539_RC	LWU Schneider Recharge R	6400526	100	1300
6402539_RP	LWU South Platte Recharg	6400532	80	1300
6402539_RP	LWU South Platte Recharg	6400531	20	1300
6402539_RS	LWU Springdale Recharge	6400526	70	1200
6402539_RS	LWU Springdale Recharge	6400522_D	30	1200
6402539_RT	LWU Sterling Recharge Re	6400522_D	56	1200
6402539_RT	LWU Sterling Recharge Re	6400519	44	1200
6402539_RF	LWU Farmers Recharge Res	6400528	60	1200
6402539_RF	LWU Farmers Recharge Res	6400522_D	40	1200
6402539_R	LWU Recharge Res	6400530	50	1300
6402539_R	LWU Recharge Res	6400525	10	1200
6402539_R	LWU Recharge Res	6400531	40	1200
6402540_R	Lowline Recharge Res	6400522_D	40	1600
6402540_R	Lowline Recharge Res	6400520	60	1600
6402542_RL	LSP Liddle Recharge Res	6499999	100	1600
6402542_RP	LSP Peterson Recharge Re	6400502	60	1200
6402542_RP	LSP Peterson Recharge Re	6499999	40	1200
6402542_RH	LSP Heyborne Recharge Re	6400501	100	1700
6402542_R	LSP Recharge Res	6400501	50	1700
6402542_R	LSP Recharge Res	6499999	50	1200
6403392_R	NSterling Recharge Res	6400525	40	1100
6403392_R	NSterling Recharge Res	6400533	30	1100

Reservoir ID	Reservoir Name	Return Flow Location	Return Flow %	Delay Pattern
6403552	Prewitt Res	6400533	100	1300
0200824_R	Farmers Independent Rech	0200828	79	2
0200824_R	Farmers Independent Rech	0200834	21	2
0200825_R	Hewes Cook Recharge	0200828	28	1
0200825_R	Hewes Cook Recharge	0200834	72	1
0202003_R	Ford Recharge	0200808	69.1	13
0202003_R	Ford Recharge	0200808	18.6	13
0202003_R	Ford Recharge	0200808	12.3	13
0200808_RC	FulCen WR RA	0200809	100	4
0200810_RC	BriCen WR RA	0200812	100	4
0200812_RC	LBCen WR RA	0200822	100	4
0200813_RC	PVCen WR RA	0200821	100	4
0200824_RC	FIDCOCen WR RA	0200825	100	4
0200830_RC	SN3 WR RA	0200834	100	4
0200837_RC	HiCen WR RA	06754000	100	4
0200808_RS	FulSAC WR RA	0200809	100	4
0200810_RS	BriSAC WR RA	0200812	100	4
0200812_RS	LBSAC WR RA	0200822	100	4
0200821_RS	MI1SAC WR RA	0200825	100	4
0200808_RB	FulBri WR RA	0200809	100	4

5.8.5 Plan Return Flow File (*.prf)

The plan return flow file contains return flow information that is used to route canal seepage back to the river over time (generally used with canal recharge plans) and plan efficiency information (generally used with T & C plans). In general, the plan return flow file contains the return flow location(s) and associated delay patterns associated with each canal recharge plan or T & C plan.

The location and delay patterns assigned to each canal recharge plan are based on the return flow information for the primary diversion structure used to carry the recharge supplies. For example, the return flow information assigned to the canal recharge plan for the Pioneer Augmentation Plan (0102518_PlC) is based on the return flow information for Tremont Ditch, which is the primary canal used to carry the Pioneer Augmentation Plan supplies. Table 5-15 summarizes the return flow information for the canal recharge plans.

Table 5-15: Canal Recharge Plan Return Flow Summary

Canal Recharge Plan ID	Canal Recharge Plan Name	Return Flow Location	Return Flow %	Delay Pattern
0102518_PlC	PIONEER Canal Plan	0100524	70	1500
0102518_PlC	PIONEER Canal Plan	0100688	30	1500

Canal Recharge Plan ID	Canal Recharge Plan Name	Return Flow Location	Return Flow %	Delay Pattern
0102522_PlC	RIVERSIDE Canal Plan	0100507_D	40	1100
0102522_PlC	RIVERSIDE Canal Plan	0100513	60	1100
0102528_PlC	FT MORGAN Canal Plan	0100518	100	1100
0102529_PlC	UPPER PB Canal Plan	0100520	40	1100
0102529_PlC	UPPER PB Canal Plan	0100524	50	1100
0102529_PlC	UPPER PB Canal Plan	0100687	10	1100
0102535_PlC	LPB CANAL PLAN	0100524	20	1200
0102535_PlC	LPB CANAL PLAN	0100687	60	1200
0102535_PlC	LPB CANAL PLAN	6400535	20	1200
0103339_PlC	BIJOU Canal Plan	0100511	100	1100
6402517_PCP	SEDGWICK Peterson Plan	6400502	100	1200
6402517_PCS	SEDGWICK SReserv Plan	6400502	100	1600
6402518_PlC	HARMONY CANAL PLAN	6400507	40	1200
6402518_PlC	HARMONY CANAL PLAN	6400508	60	1200
6402526_PlC	STERLING AUG	6400522_D	100	1700
6402536_PCB	LLWUA Bravo D	6400518	100	1200
6402536_PCH	LLWUA Harmony D	6400507	40	1200
6402536_PCH	LLWUA Harmony D	6400508	60	1200
6402536_PCI	LLWUA Iliff Platte D	6400516	100	1200
6402536_PCP	LLWUA Powell Blair D	6400513	100	1300
6402539_PCC	LWU Schneider D	6400526	100	1300
6402539_PCF	LWU Farmers Pawnee D	6400522_D	40	1200
6402539_PCF	LWU Farmers Pawnee D	6400528	60	1200
6402539_PCP	LWU South Platte D	6400531	20	1300
6402539_PCP	LWU South Platte D	6400532	80	1300
6402539_PCS	LWU Springdale D	6400522_D	30	1200
6402539_PCS	LWU Springdale D	6400526	70	1200
6402539_PCT	LWU Sterling No 1 D	6400519	44	1200
6402539_PCT	LWU Sterling No 1 D	6400522_D	56	1200
6402540_PlC	LOWLINE CANAL PLAN	6400520	60	1600
6402540_PlC	LOWLINE CANAL PLAN	6400522_D	40	1600
6402542_PCL	LSPWCD Liddle D	6499999	100	1600
6402542_PCP	LSPWCD Peterson D	6400502	60	1200
6402542_PCP	LSPWCD Peterson D	6499999	40	1200
6403392_PlC	NORTH CANAL PLAN	6400511_D	30	1100
6403392_PlC	NORTH CANAL PLAN	6400525	40	1100
6403392_PlC	NORTH CANAL PLAN	6400533	30	1100

The efficiency information provided for T & C plans in the plan return flow file informs the model of the location and delay pattern at which the return flow obligations are accounted for in the plans. The efficiency information for these T & C plans is presented in Table 5-16. Efficiency information is only a portion of the input data used by the model to estimate return flow obligations. In order to describe the terms and conditions for each changed water right inclusively, descriptions of the T & C plan operations, including information from the operating rule file (*.opr), delay file (*.dly), and plan return flow file (*.prf), are provided in other sections of this document. Note that a portion of these plans may be included as placeholders for future modeling scenarios.

Table 5-16: Terms and Conditions Plan Return Flow Summary

T & C Plan ID	T & C Plan Name	Return Flow Location	Return Flow % [1]	Delay Pattern
06538_B_RF	LowBoul Bo RFOblig	06BOU_RFO	100.00	4
06538_B_RF	LowBoul Bo RFOblig	06BOU_RFO	-100.00	6538
06538_L_RF	LBLafyt RFOblig	06LAF_RFO	100.00	4
06543_B_RF	NoBoFarm Bo RFOblig	06BOU_RFO	100.00	4
06543_B_RF	NoBoFarm Bo RFOblig	06BOU_RFO	-100.00	6543
06565_L_RF	LeynCott LAF RFOblig	06LAF_RFO	100.00	4
06565_V_RF	LeynCott LOU RFOblig	06LOU_RFO	100.00	4
06567_L_RF	Davidson Lafyt RFOb	06LAF_RFO	100.00	4
06567_V_RF	Davidson Louis RFOb	06LOU_RFO	100.00	4
06569_L_RF	DCDavd Lafyt RFOblig	06LAF_RFO	100.00	4
06576_L_RF	Entprs Lafyt RFOblig	06LAF_RFO	100.00	4
06650_L_RF	Goodhue Lafyt RFOblig	06LAF_RFO	100.00	4
06650_V_RF	Goodhue Louis RFOblig	06LOU_RFO	100.00	4
6400525_RF	HendersonSmith TCPlan	6400525_RF	100.00	4
6400525_RF	HendersonSmith TCPlan	6400525_RF	-100.00	640525
6400528_RF	SterlingNo1 TCPlan	6400528_RF	100.00	4
6400528_RF	SterlingNo1 TCPlan	6400528_RF	-100.00	640528
AurLastChRF	AuroraLastChanceD_RFs	AurLastChRF	100.00	4
BriFulRFs	BrightonFultonRFs	BriFulRFs	-100.00	115
CenBriRFs	CentralBrightonRFs	CenBriRFs	-100.00	125
CenFarmRFs	FarmersCentralRFs	CenFarmRFs	-100.00	165
CenFulRFs	CentalFultonRFs	CenFulRFs	-100.00	105
CenHighRFs	HighlandCentralRFs	CenHighRFs	-100.00	200
CenLBRFs	CentralLBRFs	CenLBRFs	-100.00	131
CenPVRFs	CentralPVRFs	CenPVRFs	-100.00	130
CenSN3RFs	SectionNo3CentralRFs	CenSN3RFs	-100.00	190
ConM_AgRFs	ConMutualAgDitchRFs	ConMClCkRFs	-25.00	240
ConM_AgRFs	ConMutualAgDitchRFs	ConMSPRRFs	-75.00	240
ConM_WelRFs	ConMutualWelchDitchRFs	ConMSPRRFs	-31.00	241
ConM_WelRFs	ConMutualWelchDitchRFs	ConMClCkRFs	-69.00	241

T & C Plan ID	T & C Plan Name	Return Flow Location	Return Flow % [1]	Delay Pattern
CoorsAug12	CoorsRenoJuchemAugStn	CoorsAug12	100.00	4
CoorsAug3	CoorsAg_RkyMtnAugStn	CoorsAug3	100.00	4
CoorsAug7	CoorsWannamakerAugStn	CoorsAug7	100.00	4
KershRFs	WestyKershawRFs	KershRFs	100.00	4
Longmont_TC	Longmont_RFOs	05LONG_RFOs	100.00	4
Longmont_TC	Longmont_RFOs	05LONG_RFOs	-100.00	515
NglennLBRFs	NglennLuptonBottomRFs	NglennLBRFs	-100.00	145
NglnBDCRFs	NorthglennBDCRFS	NglnBDCRFs	100.00	4
NglnBDCRFs	NorthglennBDCRFS	NglnBDCRFs	-100.00	112
NglnFulRFs	NorthglennFultonRFs	NglnFulRFs	-100.00	110
PSCoFishApr	PSCoFisherRFs	PSCoSPRFs	84.00	4
PSCoFishApr	PSCoFisherRFs	PSCoClCkRFs	16.00	4
PSCoFishApr	PSCoFisherRFs	PSCoSPRFs	-100.00	176
PSCoFishAug	PSCoFisherRFs	PSCoSPRFs	64.00	4
PSCoFishAug	PSCoFisherRFs	PSCoClCkRFs	36.00	4
PSCoFishAug	PSCoFisherRFs	PSCoSPRFs	-100.00	176
PSCoFishJul	PSCoFisherRFs	PSCoSPRFs	68.00	4
PSCoFishJul	PSCoFisherRFs	PSCoClCkRFs	32.00	4
PSCoFishJul	PSCoFisherRFs	PSCoSPRFs	-100.00	176
PSCoFishJun	PSCoFisherRFs	PSCoSPRFs	71.00	4
PSCoFishJun	PSCoFisherRFs	PSCoClCkRFs	29.00	4
PSCoFishJun	PSCoFisherRFs	PSCoSPRFs	-100.00	176
PSCoFishMay	PSCoFisherRFs	PSCoSPRFs	76.00	4
PSCoFishMay	PSCoFisherRFs	PSCoClCkRFs	24.00	4
PSCoFishMay	PSCoFisherRFs	PSCoSPRFs	-100.00	176
PSCoFishOct	PSCoFisherRFs	PSCoSPRFs	72.00	4
PSCoFishOct	PSCoFisherRFs	PSCoClCkRFs	28.00	4
PSCoFishOct	PSCoFisherRFs	PSCoSPRFs	-100.00	176
PSCoFishSep	PSCoFisherRFs	PSCoSPRFs	67.00	4
PSCoFishSep	PSCoFisherRFs	PSCoClCkRFs	33.00	4
PSCoFishSep	PSCoFisherRFs	PSCoSPRFs	-100.00	176
PSCoLBRFs	PSCoLuptonBottomRFs	PSCoLBRFs	100.00	4
PSCoLBRFs	PSCoLuptonBottomRFs	PSCoLBRFs	-100.00	140
PSCoMISPRFs	PSCoMeadowIsland2SPRFs	PSCoMISPRFs	-100.00	160
PSCoSPRFs	PSCoSPRRFsabvFulton	PSCoSPRFs	100.00	4
PSCoSPRFs	PSCoSPRRFsabvFulton	PSCoSPRFs	-100.00	176
PSCoSPRFs2	PSCoJTandHCRFs	PSCoSPRFs2	100.00	4
PSCoSPRFs2	PSCoJTandHCRFs	PSCoSPRFs2	-100.00	170
SABurRFsSum	SASummerBurlRFs	SABurRFsSum	100.00	4

T & C Plan ID	T & C Plan Name	Return Flow Location	Return Flow % [1]	Delay Pattern
SABurRFsYR	SAYearRoundBurlRFs	SABurRFsYR	-100.00	205
SAC_BriRFs	SACWSDBrightonRFs	SAC_BriRFs	-100.00	120
SAC_FulRFs	SACWSDFultonRFs	SAC_FulRFs	-100.00	100
SAC_LBRFs	SACWSDLuptonBottomRFs	SAC_LBRFs	-100.00	135
SAC_MI1RFs	SACWSDMdwIsland1RFs	SAC_MI1RFs	-100.00	155
SpinDRF_03	SpinneyWinterRFs_3%	SpinDRF_03	-100.00	303
SpinDRF_04	SpinneyWinterRFs_4%	SpinDRF_04	-100.00	304
SpinDRF_07	SpinneyWinterRFs_7%	SpinDRF_07	-100.00	307
SpinDRF_11	SpinneyWinterRFs_11%	SpinDRF_11	-100.00	311
SpinDRF_13	SpinneyWinterRFs_13%	SpinDRF_13	-100.00	313
SpinDRF_16	SpinneyWinterRFs_16%	SpinDRF_16	-100.00	316
SpinDRF_17	SpinneyWinterRFs_17%	SpinDRF_17	-100.00	317
SpinDRF_21	SpinneyWinterRFs_21%	SpinDRF_21	-100.00	321
SpinMtnDRF	SpinneyMtnWinterRFs	SpinMtnDRF	-100.00	300
ThBurRFsSum	ThornSummerBurlRFs	ThBurRFsSum	100.00	4
ThBurRFsYR	ThornYearRoundBurlRFs	ThBurRFsYR	-100.00	205
ThChurchRFs	ThorntonChurchReturns	ThChurchRFs	100.00	4
ThChurchRFs	ThorntonChurchReturns	ThChurchRFs	-100.00	251
ThCoAg02RFs	ThorntonCoAg02CW132RFs	ThornSPRFs2	54.00	4
ThCoAg02RFs	ThorntonCoAg02CW132RFs	ThornSPRFs1	46.00	4
ThCoAg02RFs	ThorntonCoAg02CW132RFs	ThornSPRFs1	-46.00	255
ThCoAg02RFs	ThorntonCoAg02CW132RFs	ThornSPRFs2	-54.00	255
ThCoAg89RFs	ThorntonCoAg89CW132RFs	ThornSPRFs1	100.00	4
ThCoAg89RFs	ThorntonCoAg89CW132RFs	ThornSPRFs1	-100.00	254
ThFHL_RFs	ThorntonFHLReturns	ThornSPRFs1	68.00	4
ThFHL_RFs	ThorntonFHLReturns	ThBDC_RFs	19.00	4
ThFHL_RFs	ThorntonFHLReturns	ThLCC_RFs	13.00	4
ThFHL_RFs	ThorntonFHLReturns	ThLCC_RFs	-13.00	252
ThFHL_RFs	ThorntonFHLReturns	ThBDC_RFs	-19.00	252
ThFHL_RFs	ThorntonFHLReturns	ThornSPRFs1	-68.00	252
ThFishRFs1	ThorntonFishApr-AugRFs	ThornSPRFs1	54.00	4
ThFishRFs1	ThorntonFishApr-AugRFs	ThLCC_RFs	46.00	4
ThFishRFs1	ThorntonFishApr-AugRFs	ThLCC_RFs	-46.00	253
ThFishRFs1	ThorntonFishApr-AugRFs	ThornSPRFs1	-54.00	253
ThFishRFs2	ThorntonFishSep-OctRFs	ThornSPRFs1	54.00	4
ThFishRFs2	ThorntonFishSep-OctRFs	ThLCC_RFs	46.00	4
ThLCC02RFs	ThorntonLCC02CW266RFs	ThornSPRFs1	69.00	4
ThLCC02RFs	ThorntonLCC02CW266RFs	ThornSPRFs2	31.00	4
ThLCC02RFs	ThorntonLCC02CW266RFs	ThornSPRFs2	-31.00	257

T & C Plan ID	T & C Plan Name	Return Flow Location	Return Flow % [1]	Delay Pattern
ThLCC02RFs	ThorntonLCC02CW266RFs	ThornSPRFs1	-69.00	257
ThLCC89RFs	ThorntonLCC89CW132RFs	ThornSPRFs1	100.00	4
ThLCC89RFs	ThorntonLCC89CW132RFs	ThornSPRFs1	-100.00	256
WestyChRFs	WestyChurchRFs	WestySPRFs	78.00	4
WestyChRFs	WestyChurchRFs	WestyLCCRFs	14.00	4
WestyChRFs	WestyChurchRFs	WestBDCRFs	8.00	4
WestyChRFs	WestyChurchRFs	WestBDCRFs	-8.00	261
WestyChRFs	WestyChurchRFs	WestyLCCRFs	-14.00	261
WestyChRFs	WestyChurchRFs	WestySPRFs	-78.00	261
WestyFHLRFs	WestyFHLRFs	WestySPRFs	82.00	4
WestyFHLRFs	WestyFHLRFs	WestBDCRFs	9.00	4
WestyFHLRFs	WestyFHLRFs	WestyLCCRFs	9.00	4
WestyFHLRFs	WestyFHLRFs	WestBDCRFs	-9.00	262
WestyFHLRFs	WestyFHLRFs	WestyLCCRFs	-9.00	262
WestyFHLRFs	WestyFHLRFs	WestySPRFs	-82.00	262

[1] Negative Return Flow % is used to designate a Fixed (Winter) Return Flow Obligation. See Section 5.8.6 for more information on the representation of different types of return flow obligations.

Where to find more information

- "Section 7.11.13: Terms and Conditions Operations" of the StateMod User's Manual Documentation provides information on how terms and conditions plans are developed and implemented in StateMod.

5.8.6 Terms and Conditions

"Terms and Conditions" is language used to collectively represent the return flow obligations associated with the transfer or change of water right. They generally represent the amount, timing, and location of non-consumed water returned to the river from the historical use of the changed water right. StateMod generates these return flow obligations during simulation based on:

- simulated diversion of the changed water right (Operating Rule File *.opr)
- consumptive use (CU) factors (Operating Rule File *.opr)
- efficiency information (Plan Return Flow File *.prf)
- delay pattern (Delay File *.dly)

When included in an operating rule, the T & C plan stores the return flow obligations (plan demand) associated with the simulated diversion for current and future time steps. There are three types of return flow patterns:

- **Standard Return Pattern** = (Data in the delay file (*.dly) * (Simulated Diversion from the Operating Rule) * (1.0-CU Factor), where the CU Factor is provided in the operating rule that releases water from the Changed Water Rights Plan. This return flow pattern either reflects the "immediate summer" return flow obligations owed to the river in the same time step as the release of water occurs, or reflects return flow obligations strictly based on the original irrigation pattern.
- **Fixed Return Pattern** = (Data in the delay file (*.dly) * (Simulated Diversion from the Operating Rule), whereby a "fixed" percentage of each month's releases becomes the return flow obligation. Generally used to represent "winter return flows" obligated based on the total amount released or "used" during the summer.
- **Mixed Return Pattern** = Standard Return Pattern + Fixed Return Pattern

The obligations can be "offset" by a number of supplies, including changed water rights, reusable supplies, and/or reservoir releases. Note that StateMod only accounts for the return flow obligation and supplies used to offset this plan demand; it does not limit the use of changed water rights if the supplies are insufficient to meet the full plan demand. The plan demand and supplies are reported in the plan summary (*.xpl) file and it is up to the user to confirm, if appropriate, that the full return flow obligation is being offset.

This section describes the model input associated with generating the return flow obligation in each T & C Plan. See Section 5.10 for more information, and the specific operations, on supplies used to "offset" the obligations.

Information used in this model dataset is based on available data collected and developed through the CDSS, including information recorded by the State Engineer's Office. The model dataset and results are intended for basin-wide planning purposes. Individuals seeking to use the model dataset or results in any legal proceeding are responsible for verifying the accuracy of information included in the model.

5.8.6.1 City of Longmont Terms and Conditions

The City of Longmont has changed water rights in several ditches in the St. Vrain Creek Basin; they were decreed in a series of cases in 1981 and 1987. In contrast to the representation of terms and conditions for other municipalities, Longmont's return flow obligations from these decrees are collectively stored in a single Longmont_TC plan. This model representation allows for the obligations to be aggregated into a single demand which is then offset collectively using several of the city's supplies. The decreed standard return patterns unique for each ditch are modeled explicitly and presented below.

Standard Return Pattern Data (%)

Ditch	Decree	April	May	June	July	Aug	Sep	Oct
Longmont Supply Canal (0500545)	1981	42.0	36.8	34.9	34.1	35.1	39.3	-
	1987	43.8	36.4	35.3	33.6	35.0	38.9	-
Rough and Ready Ditch (0500527)	1981	-	34.3	33.4	33.9	43.4	89.5	-
	1987	-	34.2	33.6	33.9	42.4	86.7	-
Oligarchy Ditch (0500547)	1981	61.1	36.6	36.8	34.6	38.9	58.1	-
	1987	61.1	36.5	36.7	34.3	39.1	58.1	-
Smede Ditch (0500530)	1981	-	72	59.1	59.8	77.4	-	-
Palmerton Ditch (0500528)	1981	-	41.6	37.1	40.2	57.4	-	-
Beckwith Ditch (0500560)	1987	49.8	51	50	46.1	53.9	73.1	-
Clover Ditch (0500552)	1987	2.8	17.7	76.2	52.5	28.6	20.6	-
Niwot Ditch (0500554)	1987	44.4	44.6	42.1	42.1	48.9	70	-
Pella Ditch (0500551)	1987	58.8	22.9	21.2	19.5	20.8	24.9	39.2
South Flat Ditch (0500558)	1987	28.2	23	25.6	28.3	33.8	54.9	-
Zweck and Turner Ditch (0500601)	1987	-	36.9	35.6	35.3	45.5	73.9	-

Longmont's use of changed water rights in Swede Ditch (0500529) is decreed for year round use and requires an immediate return flow of 40 percent each month.

The fixed return patterns from the decrees showed little variability and were therefore averaged into a single pattern. The single fixed return flow factors applied to simulated diversions are as follows:

Fixed Return Pattern Data (%)

Nov	Dec	Jan	Feb	Mar
2.5	1.9	1.5	1.2	1.0

Longmont's return flows are modeled on St. Vrain Creek upstream of the confluence with Boulder Creek. See Section 5.10.5.5 for more information on how these changed shares are used within the City of Longmont's system and what supplies are used to offset the obligations.

5.8.6.2 Lower Boulder Ditch (0600538_D)

Boulder and Lafayette have both changed shares in Lower Boulder Ditch, as decreed in Case No. 94CW284 for Boulder, and Case Nos. 90CW108 and 97CW195 for Lafayette. Return flow obligations associated with Boulder's and Lafayette's use of its changed shares are assigned to the plan ID 06538_B_RF and 06538_L_RF, respectively. Year round return flow obligations are modeled using both a standard and a fixed pattern. Return flow obligations are owed to Boulder Creek at the respective municipal outfalls of Boulder and Lafayette.

The decreed monthly return flow factors applied to simulated diversions for Boulder are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep
79.0	61.0	52.0	47.0	52.0	66.0

Fixed Return Pattern Data (%)

Oct	Nov	Dec	Jan	Feb	Mar
0	2.0	2.0	2.0	2.0	2.0

With respect to Lafayette, the decrees indicate that Lafayette's consumptive use of the changed shares is less than the historical irrigation consumptive use at the ditch therefore this it is assumed that return flow obligations are met by the returns from the Lafayette WWTP and lagged ground water flow. While there are decreed wintertime return flow obligations, they are small and are not explicitly represented. If the changed shares are stored in Baseline Reservoir, as opposed to being used directly at the municipal demand, monthly return flow factors applied to simulated diversions for Lafayette are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep	Oct
33.0	33.0	33.0	33.0	33.0	33.0	33.0

See Section 5.10.6.12 for more information on how these changed shares are used within Boulder and Lafayette's system and what supplies are used to offset the obligations.

5.8.6.3 North Boulder Farmers Ditch (0600543)

Return flow obligations associated with Boulder's use of its North Boulder Farmers Ditch changed shares decreed in Case No. 94CW285 are assigned to the plan ID 06543_B_RF. Year round return flow obligations are modeled using both a standard and a fixed pattern. Return flow obligations are owed to Boulder Creek at Boulder's municipal outfall. The decreed monthly return flow factors applied to simulated diversions are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep
79.0	61.0	52.0	47.0	52.0	66.0

Fixed Return Pattern Data (%)

Oct	Nov	Dec	Jan	Feb	Mar
3.3	0.9	0.9	0.9	0.9	0.9

See Section 5.10.6.12 for more information on how these changed shares are used within Boulder's system and what supplies are used to offset the obligations.

5.8.6.4 Leyner Cottonwood Ditch (0600565)

Lafayette and Louisville have both changed shares in Leyner Cottonwood Ditch, as decreed in Case Nos. 80CW468 and 85CW119 for Lafayette, and Case No. 87CW327 for Louisville. Return flow obligations associated with Lafayette's and Louisville's use of its changed shares are assigned to the plan ID 06565_L_RF and 06565_V _RF, respectively. Summertime return flow obligations are modeled using a standard pattern. Return flow obligations are owed to Boulder Creek at the respective municipal outfalls of Lafayette and Louisville, downstream of the Coal Creek confluence.

The decreed monthly return flow factors applied to simulated diversions for Louisville are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep
59.0	70.0	85.0	89.0	87.0	93.0

With respect to Lafayette, the decrees indicate that Lafayette's consumptive use of the changed shares is less than the historical irrigation consumptive use at the ditch therefore this it is assumed that return flow obligations are met by the returns from the Lafayette WWTP and lagged ground water flow. While there are decreed wintertime return flow obligations, they are small and are not explicitly represented. If the changed shares are stored in Baseline Reservoir, as opposed to being used directly at the municipal demand, monthly return flow factors applied to simulated diversions for Lafayette are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep	Oct
33.0	33.0	33.0	33.0	33.0	33.0	33.0

See Section 5.10.6.12 for more information on how these changed shares are used within Lafayette's and Louisville's systems and what supplies are used to offset the obligations.

5.8.6.5 Davidson Ditch (0600567)

Lafayette and Louisville have both changed shares in Davidson Ditch, as decreed in Case Nos. W8348, 80CW469, and 85CW119 for Lafayette, and Case No. 83CW319 for Louisville. Return flow obligations associated with Lafayette's and Louisville's use of its changed shares are assigned to the plan ID 06567_L_RF and 06567_V _RF, respectively. Summertime return flow obligations are modeled using a standard pattern. Return flow obligations are owed to Boulder Creek at the respective municipal outfalls of Lafayette and Louisville, downstream of the Coal Creek confluence.

The decreed monthly return flow factors applied to simulated diversions for Louisville are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug
34.2	34.2	34.2	34.2	34.2

With respect to Lafayette, the decrees indicate that Lafayette's consumptive use of the changed shares is less than the historical irrigation consumptive use at the ditch therefore this it is assumed that return flow obligations are met by the returns from the Lafayette WWTP and lagged ground water flow. While there are decreed wintertime return flow obligations, they are small and are not explicitly represented. If the changed shares are stored in Baseline Reservoir, as opposed to being used directly at the municipal demand, monthly return flow factors applied to simulated diversions for Lafayette are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug
38.0	38.0	38.0	38.0	38.0

See Section 5.10.6.12 for more information on how these changed shares are used within Lafayette's and Louisville's systems and what supplies are used to offset the obligations.

5.8.6.6 Dry Creek Davidson Ditch (0600569_D)

Lafayette and Louisville have both changed shares in Dry Creek Davidson Ditch, as decreed in Case Nos. 90CW108 and 80CW468 for Lafayette, and Case No. CA6517 for Louisville. The return flow obligations associated with Louisville's use are not modeled using a T & C plan because they are a fixed percentage each month. Rather, 16.7 percent of the changed water is turned out immediately at the ditch to represent the static return flow obligation, as represented in the model by a separate plan structure (060569_CS2).

Return flow obligations associated with Lafayette's use of its changed shares are assigned to the plan ID 06569_L_RF and owed to Boulder Creek at the municipal outfall, downstream of the Coal Creek confluence. Lafayette's decrees indicate that Lafayette's consumptive use of the changed shares is less than the historical irrigation consumptive use at the ditch therefore this it is assumed that return flow obligations are met by the returns from the Lafayette WWTP and lagged ground water flow. While there are decreed wintertime return flow obligations, they are small and are not explicitly represented. If the changed shares are stored in Baseline Reservoir, as opposed to being used directly at the municipal demand, monthly standard return flow factors applied to simulated diversions for Lafayette are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep	Oct
38.0	38.0	38.0	38.0	38.0	38.0	38.0

Coal Ridge Ditch Company (Case No. CA10000) has also changed shares in this ditch and takes deliver of these shares at Lower Boulder Ditch (0600538_D), however no return flows are required under that decree.

See Section 5.10.6.12 for more information on how these changed shares are used within Lafayette's and Louisville's systems and what supplies are used to offset the obligations.

5.8.6.7 Enterprise Ditch (0600576)

Lafayette and Louisville have both changed shares Enterprise Ditch, as decreed in Case Nos. 90CW108 and 80CW468 for Lafayette, and Case No. CA21299 and 82CW305 for Louisville. The return flow obligations associated with Louisville's use are not modeled using a T & C plan because they are a fixed percentage each month. Rather, 16.7 percent of the changed water is turned out immediately at the ditch to represent the static return flow obligation, as represented in the model by a separate plan structures (060576_CS3 and 060576_CS4).

Return flow obligations associated with Lafayette's use of its changed shares are assigned to the plan ID 06576_L_RF and owed to Boulder Creek at the municipal outfall, downstream of the Coal Creek confluence. Lafayette's decrees indicate that Lafayette's consumptive use of the changed shares is less than the historical irrigation consumptive use at the ditch therefore this it is assumed that return flow obligations are met by the returns from the Lafayette WWTP and lagged ground water flow. While there are decreed wintertime return flow obligations, they are small and are not explicitly represented. If the changed shares are stored in Baseline Reservoir, as opposed to being used directly at the municipal demand, monthly standard return flow factors applied to simulated diversions for Lafayette are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep	Oct
33.0	33.0	33.0	33.0	33.0	33.0	33.0

Coal Ridge Ditch Company (Case No. CA10000) has also changed shares in this ditch and takes deliver of these shares at Lower Boulder Ditch (0600538_D), however no return flows are required under that decree.

See Section 5.10.6.12 for more information on how these changed shares are used within Lafayette's and Louisville's systems and what supplies are used to offset the obligations.

5.8.6.8 Goodhue Ditch (0600650)

Lafayette and Louisville have both changed shares in Goodhue Ditch, as decreed in Case Nos. W8348, 80CW469, and 85CW119 for Lafayette, and Case No. 83CW319 for Louisville. Return flow obligations associated with Lafayette's and Louisville's use of its changed shares are assigned to the plan ID 06650_L_RF and 06567_V _RF, respectively. Summertime return flow obligations are modeled using a standard pattern. Return flow obligations are owed to Boulder Creek at the respective municipal outfalls of Lafayette and Louisville, downstream of the Coal Creek confluence.

The decreed monthly return flow factors applied to simulated diversions for Louisville are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug
38.0	38.0	38.0	38.0	38.0

With respect to Lafayette, the decrees indicate that Lafayette's consumptive use of the changed shares is less than the historical irrigation consumptive use at the ditch therefore this it is assumed that return flow obligations are met by the returns from the Lafayette WWTP and lagged ground water flow. While there are decreed wintertime return flow obligations, they are small and are not explicitly represented. If the changed shares are stored in Baseline Reservoir, as opposed to being used directly at the municipal demand, monthly return flow factors applied to simulated diversions for Lafayette are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug
38.0	38.0	38.0	38.0	38.0

See Section 5.10.6.12 for more information on how these changed shares are used within Lafayette's and Louisville's systems and what supplies are used to offset the obligations.

5.8.6.9 Additional Water District 6 Terms and Conditions

Boulder, Louisville and Lafayette have changed shares in various other ditches in the Boulder Creek Basin; however the return flow obligations are not represented using a T & C plan. The following summarizes these diches and the approach used to account for their return flow obligations.

- Boulder changed shares in the several ditches along Boulder Creek and Middle Boulder Creek both for municipal use and to dedicate the changed shares to instream flows, as decreed in Case Nos. CA8407, 10518, 15012, 90CW0193. There are no return flow obligations associated with the water available for direct use by the City of Boulder. For the water used to satisfy instream flows, Boulder is required to release 36 af of Windy Gap water down the Boulder Supply Canal in each month from October through March. This is represented in the model using a diversion node (06_BOU_RF) with a non-consumptive wintertime demand of 36 af per month. These operations apply to the changed shares on the following ditches:

  - Anderson Ditch (0600501)
  - Farmers Ditch (0600525)
  - Smith Goss (0600554)
  - Harden Ditch (0600530) as changed to Boulder Pipeline (0600599)
  - McCarty Ditch (0600542)

- Louisville changed shares in Community Ditch (0600564_D) as decreed in Case Nos. CA21299 and CA10232. The return flow obligations associated with Louisville's use on this ditch are not modeled using a T & C plan because they are a fixed percentage each month. Rather, 16.7 percent of the changed water is turned out immediately at the ditch to represent the static return flow obligation, as represented in the model by a separate plan structure (060564_CS1).

- Louisville changed shares in Cottonwood No. 2 Ditch (0600566) as decreed in Case Nos. W9193 and 99CW230. The return flow obligations associated with Louisville's use on this ditch are not modeled using a T & C plan because they are a fixed percentage each month. Rather, 19 percent of the changed water is turned out immediately at the ditch to represent the static return flow obligation, as represented in the model by separate plan structures (060566_CS1 and 060566_CS2).

- Louisville and Lafayette have both changed shares in Dry Creek Ditch No. 2 (0600570). The diversion amount associated with the changed shares was reduced in lieu of return flow obligations; therefore no obligations are represented for these shares.

- Lafayette changed shares in South Boulder Bear Creek Ditch (0600588). The diversion amount associated with the changed shares was reduced in lieu of return flow obligations; therefore no obligations are represented for these shares.

- Louisville changed shares in East Boulder Ditch (0600575) as decreed in Case No. 82CW305. The return flow obligations associated with Louisville's use on this ditch are not modeled using a T & C plan because they are a fixed percentage each month. Rather, 17 percent of the changed water is turned out immediately at the ditch to represent the static return flow obligation, as represented in the model by a separate plan structure (060575_CS1).

- Changed shares in Howard Ditch (0600580) are decreed in cases for Lafayette (CA8960, W8346 and W8348), Louisville (99CW0230, CA12698, CA21299 and W8500) and Eldora Ski Resort (W7786, 02CW400 and 07CW02). The return flow obligations associated with their uses on this ditch are not modeled using a T & C plan because they are a fixed percentage each month. Rather, 10 percent of Eldora's changed water and 20% of Louisville and Lafayette's changed water is turned out immediately at the ditch to represent the static return flow obligation, as represented in the model by separate plan structured (060580_CS1 – CS7).

- Louisville changed shares in Marshallville Ditch (0600585) as decreed in Case No. 87CW327. The return flow obligations associated with Louisville's use on this ditch are not modeled using a T & C plan because they are a fixed percentage each month. Rather, 20 percent less of the total changed water amount was put into the changed water right plan (060585_CH1), essentially leaving 20 percent additional water at the ditch.

- Louisville changed shares in McGinn Ditch (0600586) as decreed in Case No. 87CW327. The return flow obligations associated with Louisville's use on this ditch are not modeled using a T & C plan because they are a fixed percentage each month. Rather, 20 percent less of the total changed water amount was put into the changed water right plan (060586_CH1), essentially leaving 20 percent additional water at the ditch.

5.8.6.10 City of Aurora South Park Water Rights (Water District 23)

The City of Aurora has changed several water rights in the South Park area in Water District 23. These changed water rights are administered in aggregate at 18 administrative stream gages in the SPDSS model (IDs 2302900, 2302901, 2302902, 2302903, 2302904, 2302906, 2302907, 2302908, 2302909, 2302910, 2302911, 2302912, 2302913, 2302914, 2302915, 2302916, 2302917, and 2302918) on the upper South Platte River and Tarryall Creek basins.

The South Platte River water rights are typically stored in Spinney Mountain Reservoir before water is released from Spinney to meet Aurora's demands. The water stored in Spinney Mountain generates return flow obligations that represent a demand for the stored water that is released to the river during the winter months. The delayed return flow obligations generated by these uses vary by ditch, so a simplified approach was used. First, the total delayed return flow owed to the river based on the use each month averaged for all of the ditches represented at each gage. The total delayed return flow values were then averaged amongst all the gages to get the following pattern that is used for all of the South Platte River water rights.

Total Delayed Return Flow Pattern Data (%)

April	May	June	July	Aug
11.0	17.0	16.0	16.0	21.0

The total delayed return flow obligation is distributed according to the following lagged pattern:

Standard Return Lagged Pattern (%)

Jan	Feb	Mar	Apr	May - July	Aug	Sep	Oct	Nov	Dec
9.0	9.0	8.0	1.0	0.0	21.0	16.0	12.0	13.0	11.0

This unique representation was accomplished by using a separate T & C Plan for each month and a specific delay pattern for each T&C Plan, as shown below:

South Park Ditches T &C Plans and Delay Patterns (%)

Plan ID	Jan	Feb	Mar	Apr	May - July	Aug	Sep	Oct	Nov	Dec	Total
SpinDRF_11	1.0	1.0	0.9	0.1	0.0	2.3	1.8	1.3	1.4	1.2	11.0
SpinDRF_17	1.5	1.5	1.4	0.2	0.0	3.6	2.7	2.0	2.2	1.9	17.0
SpinDRF_16	1.4	1.4	1.3	0.2	0.0	3.4	2.6	1.9	2.1	1.8	16.0
SpinDRF_21	1.9	1.9	1.7	0.2	0.0	4.4	3.4	2.5	2.7	2.3	21.0

The Tarryall Creek water rights are typically used directly to meet Aurora's municipal demands; excess supplies can then be exchanged to Spinney Mountain. The total delayed return flow obligations for the use of Tarryall Creek rights were developed using the same approach as the South Platte River rights. The average delayed return flow obligation values used for all of the Tarryall Creek water rights is as follows:

Total Delayed Return Flow Pattern Data (%)

April	May	June	July	Aug	Sep
7.0	16.0	16.0	13.0	4.0	3.0

Similar to the South Platte River rights, the total delayed return flow obligation is distributed according to the following lagged pattern:

Standard Return Lagged Pattern (%)

Jan	Feb	Mar	Apr	May - July	Aug	Sep	Oct	Nov	Dec
9.0	9.0	8.0	1.0	0.0	21.0	16.0	12.0	13.0	11.0

This unique representation was accomplished by using a separate T & C Plan for each month and a specific delay pattern for each T&C Plan, as shown below:

Tarryall Creek T &C Plans and Delay Patterns (%)

Plan ID	Jan	Feb	Mar	Apr	May - July	Aug	Sep	Oct	Nov	Dec	Total
SpinDRF_7	0.6	0.6	0.6	0.1	0.0	1.5	1.1	0.8	0.9	0.8	7.0
SpinDRF_16	1.4	1.4	1.3	0.2	0.0	3.4	2.6	1.9	2.1	1.8	16.0
SpinDRF_13	1.2	1.2	1.0	0.1	0.0	2,7	2,1	1,6	1,7	1,4	13.0
SpinDRF_4	0.4	0.4	0.3	0.0	0.0	0.8	0.6	0.5	0.5	0.4	4.0
SpinDRF_3	0.3	0.3	0.2	0.0	0.0	0.6	0.5	0.4	0.4	0.3	3.0

In addition to the delay return flow obligations for the Tarryall Creek water rights, there are also requirements to bypass a specific percentage of the changed water right (the instantaneous return flows). These bypass requirements were incorporated in the model using carrier structures that "lose" the bypass amount as it carries the changed water right. The bypass requirements vary monthly and by administrative gage, as shown below.

Tarryall Creek Monthly Bypass Requirements (%)

Gage ID	Gage Name	Bypass Str.	Apr	May	Jun	Jul	Aug	Sep
2302906	TARCOMCO	2302906_A	90.0	38.0	9.0	13.0	21.0	20.0
2302907	MCHJEFCO	2302907_A	97.0	61.0	34.0	42.0	70.0	72.0
2302908	JEFJEFCO	2302908_A	95.0	30.0	13.0	19.0	50.0	81.0
2302909	TARBORCO	2302909_A	-	4.0	22.0	37.0	-	-
2302910	OHGJEFCO	2302910_A	-	31.0	0.0	48.0	44.0	67.0
2302914	FRNCRKCO	2302914_A	-	40.0	0.0	21.0	-	-
2302915	RCKTARCO	2302915_A	-	19.0	36.0	63.0	-	-
2302916	SCHFLMCO	2302916_A	-	39.0	0.0	15.0	-	-
2302917	JEFSNYCO	2302917_A	-	55.0	33.0	19.0	-	-
2302918	DIXCOMCO	2302918_A	-	50.0	27.0	31.0	-	-

Bypass obligations are owed to the river at the administrative gages. Delayed return flow obligations are owed to the South Platte River below the Spinney Mountain Reservoir. See Section 5.10.8.2.64 for more information on how these changed shares are used within the Aurora's system and what supplies are used to offset the obligations.

5.8.6.11 Burlington Canal (0200802)

The City of Thornton and SACWSD have both changed shares in Burlington Canal, as originally decreed in Case No. 87CW107. The City of Brighton has also acquired and changed Burlington and Wellington shares, however those shares are not represented in the model since they were changed near the end of the study period (2007 and later). Return flow obligations vary depending on the priority of the water used for simulated diversions. The following generally summarizes the return flow obligations for these changed shares.

- Return flow obligations associated with the Duggan 10.28 cfs right (ThBur10Pln and SABur10Pln) and the 1885 direct right (Th200_85Pln and SA200_85Pln) is set to a constant rate equal to 31 percent of the average annual delivery over the previous 20 years. This obligation equals 2.6 percent each month. Since StateMod calculates return flow obligations using river headgate diversions instead of augmentation station deliveries, this monthly rate was reduced to 2.3 percent each month to account for a 10 percent ditch loss. This delayed return flow obligation is accounted for in plan IDs ThBurRFsYR and SABurRFsYR using a fixed return pattern set to 2.3 percent each month.
- The consumptive use credit associated with the Wellington 7.987 cfs right (ThWell7Pln and SAWell7Pln) is 35 percent, therefore 65 percent must be returned in the same time-step. Since StateMod calculates return flow obligations using river headgate diversions instead of augmentation station deliveries, this monthly return flow was reduced to 58.5 percent each month to account for a 10 percent ditch loss. This return flow obligation is accounted for in plan IDs ThBurRFsSum and SABurRFsSum using a standard return flow pattern set to 58.5 percent each month for April through October.
- The consumptive use credit associated with the Sanstad 6.0 cfs right (ThSanstPln and SASanstPln) is 0 percent, therefore 100 percent must be returned in the same time-step. This return flow obligation is accounted for in plan IDs ThBurRFsSum and SABurRFsSum using a standard return flow pattern set to 0 percent each month.

See Section 5.10.8.17 for more information on how these changed shares are used within Thornton's and SACWSD's systems and what supplies are used to offset the obligations.

5.8.6.12 Fulton Ditch (0200808)

Several entities have changed shares in Fulton Ditch, including:

- Brighton (Case Nos. 04CW0174 and 00CW202)
- SACWSD (Case No. 02CW258)
- Northglenn (Case Nos. 79CW233, 79CW234, 79CW236, 82CW056 and 82CW057)
- Central (Case No. 01CW264)

The return flow obligations associated with these changed shares are modeled using a bypass structure and a fixed return flow pattern. The bypass structure is used instead of a standard return pattern because these entities only divert the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. In contrast, when a standard return pattern is used, the full changed water right amount is diverted and the return flow obligation is satisfied using other supplies. The bypass requirements were incorporated in the model using a carrier structure (0200808_A) that "loses" the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly for each entity, as shown below.

Fulton Ditch Monthly Consumptive Use Credits (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
Brighton[1]	48.0	80.0	84.0	85.0	84.0	81.0	68.0
SACWSD	28.0	69.0	76.0	79.0	76.0	69.0	47.0
Northglenn	11.0	57.0	57.0	56.0	55.0	53.0	48.0
Central	12.0	60.0	62.0	60.0	51.0	34.0	-

[1] Weighted based on farm headgate delivery limits on Case Nos. 04CW0174 and 00CW202

Fulton Ditch Monthly Bypass Requirements (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
Brighton	52.0	20.0	16.0	15.0	16.0	19.0	32.0
SACWSD	72.0	31.0	24.0	21.0	24.0	31.0	53.0
Northglenn	89.0	43.0	43.0	44.0	45.0	47.0	52.0
Central	88.0	40.0	38.0	40.0	49.0	66.0	-

Delayed return flow obligations associated with changed water rights are assigned to one plan per entity as shown in the table below. The decreed monthly return flow factors were adjusted for a 20 percent ditch loss resulting in the following return flow factors:

Fixed Return Pattern Data (%)

Entity	Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Brighton[1]	BriFulRFs	2.1	2.0	2.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	2.1	2.1
SACWSD	SAC_FulRFs	1.8	1.7	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.9
Northglenn	NglnFulRFs	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1
Central	CenFulRFs	2.3	1.8	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	2.8

[1] Weighted based on farm headgate delivery limits on Case Nos. 04CW0174 and 00CW202

The entities' return flow obligations are owed to the South Platte River generally above the Brighton Ditch. See Sections 5.10.8.15, 5.10.8.16, and 5.10.8.13 for more information on how these changed shares are used within these entities' systems and what supplies are used to offset the obligations.

5.8.6.13 Brighton Ditch (0200810)

The following entities have changed shares in Brighton Ditch:

- SACWSD (Case No. 01CW258)
- Central (Case No. 05CW080)

The return flow obligations associated with these changed shares are modeled using a bypass structure and a fixed return flow pattern. The bypass structure is used instead of a standard return pattern because these entities only divert the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. The bypass requirements were incorporated in the model using a carrier structure (0200810_A) that "loses" the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly for each entity, as shown below.

Brighton Ditch Monthly Consumptive Use Credits (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
SACWSD	52.0	65.0	65.0	64.0	60.0	54.0	40.0
Central	3.0	81.0	85.0	85.0	80.0	64.0	30.0

Brighton Ditch Monthly Bypass Requirements (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
SACWSD	48.0	35.0	35.0	36.0	40.0	46.0	60.0
Central	97.0	19.0	15.0	15.0	20.0	36.0	70.0

Delayed return flow obligations associated with changed water rights are assigned to one plan per entity as shown in the table below. The decreed monthly return flow factors were adjusted for a 25 percent ditch loss resulting in the following return flow factors:

Fixed Return Pattern Data (%)

Entity	Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SACWSD	SAC_BriRFs	0.5	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.8
Central	CenBriRFs	3.1	2.7	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.5

SACWSD return flow obligations are owed to Big Dry Creek near the confluence with the South Platte River, and Central obligations are owed to the South Platte River below the confluence with Big Dry Creek. See Section 5.10.8.16 for more information on how these changed shares are used within these entities' systems and what supplies are used to offset the obligations.

5.8.6.14 Lupton Bottom Ditch (0200812)

Several entities have changed shares in Lupton Bottom Ditch, including:

- SACWSD (Case No. 01CW258)
- Northglenn (Case Nos. 79CW233, 79CW234, 79CW236, 82CW056 and 82CW057)
- Central (Case No. 94CW085 and 02CW265)
    - o Includes Lupton Bottom (LB) and Lupton Meadow (LM) changed water rights
- PSCo (Case No. 02CW154A and 02CW154B)
    - o Includes Lupton Bottom and Lupton Meadow changed water rights

The return flow obligations associated with SACWSD, Northglenn and Central changed shares are modeled using a bypass structure and a fixed return flow pattern. PSCo changed portion is small and return flows were not represented in the model. The bypass structure is used instead of a standard return pattern because these entities only divert the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. In contrast, when a standard return pattern is used, the full changed water right amount is diverted and the return flow obligation is satisfied using other supplies. The bypass requirements were incorporated in the model using a carrier structure (0200812_A) that "loses" the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly for each entity, as shown below.

Lupton Bottom Ditch Monthly Consumptive Use Credits (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
SACWSD	48.0	66.0	67.0	67.0	61.0	48.0	18.0
Northglenn	11.0	34.0	47.0	61.0	58.0	41.0	25.0
Central (LB)	48.0	66.0	67.0	67.0	61.0	48.0	18.0
Central (LM)	48.0	48.0	48.0	48.0	48.0	48.0	48.0

Lupton Bottom Ditch Monthly Bypass Requirements (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
SACWSD	52.0	34.0	33.0	33.0	39.0	52.0	82.0
Northglenn	89.0	66.0	53.0	39.0	42.0	59.0	75.0
Central (LB)	52.0	34.0	33.0	33.0	39.0	52.0	82.0
Central (LM)	52.0	52.0	52.0	52.0	52.0	52.0	52.0

Delayed return flow obligations associated with changed water rights are assigned to one plan per entity as shown in the table below. The decreed monthly return flow factors were adjusted for a 35 percent ditch loss resulting in the following return flow factors:

Fixed Return Pattern Data (%)

Entity	Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SACWSD	SAC_LBRFs	1.0	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.4
Northglenn	NglennLBRFs	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Central (LM & LB)	CenLBRFs	1.1	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.4

The entities' return flow obligations are owed to the South Platte River generally above the Meadow Island No. 2 Ditch. See Sections 5.10.8.16 and 5.10.8.13 for more information on how these changed shares are used within these entities' systems and what supplies are used to offset the obligations.

5.8.6.15 Platteville Ditch (0200813)

Central has changed shares in Platteville Ditch, as decreed in Case No. 05CW069, for use in its GMS and WAS augmentation plans. The return flow obligations associated with these changed shares are modeled using a bypass structure and a fixed return flow pattern. The bypass structure is used instead of a standard return pattern because Central only diverts the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. The bypass requirements were incorporated in the model using a carrier structure (0200813_A) that "loses" the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly, as shown below.

Platteville Ditch Monthly Consumptive Use Credits (%)

Entity Name	Apr	May	Jun	Jul	Aug
Central	57.0	82.0	84.0	74.0	50.0

Platteville Ditch Monthly Bypass Requirements (%)

Entity Name	Apr	May	Jun	Jul	Aug
Central	43.0	18.0	16.0	26.0	50.0

Delayed return flow obligations associated with changed water rights are assigned to plan ID CenPVRFs. The decreed monthly return flow factors were adjusted for a 15 percent ditch loss resulting in the following return flow factors:

Fixed Return Pattern Data (%)

Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CenPVRFs	3.8	3.5	3.1	3.0	0.0	0.0	0.0	0.0	0.0	5.4	4.9	4.3

Central's return flow obligations are owed to the South Platte River generally above the Meadow Island No. 1 Ditch. See Section 5.10.10.1 for more information on how these changed shares are used within Central's WAS and GMS Augmentation Plan systems and what supplies are used to offset the obligations.

5.8.6.16 Meadow Island No. 1 Ditch (0200821)

SACWSD has changed shares in Meadow Island No. 1 Ditch, as decreed in Case No. 01CW258, for use in its augmentation plan. The return flow obligations associated with these changed shares are modeled using a bypass structure and a fixed return flow pattern. The bypass structure is used instead of a standard return pattern because SACWSD only diverts the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. The bypass requirements were incorporated in the model using a carrier structure (0200821_A) that "loses" the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly, as shown below.

Meadow Island No. 1 Ditch Monthly Consumptive Use Credits (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
SACWSD	36.0	62.0	66.0	67.0	64.0	51.0	25.0

Meadow Island No. 1 Ditch Monthly Bypass Requirements (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
SACWSD	64.0	38.0	34.0	33.0	36.0	49.0	75.0

Delayed return flow obligations associated with changed water rights are assigned to plan ID SAC_MI1RFs. The decreed monthly return flow factors were adjusted for a 25 percent ditch loss resulting in the following return flow factors:

Fixed Return Pattern Data (%)

Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SAC_MI1RFs	0.6	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.8

SACWSD's return flow obligations are owed to the South Platte River generally above the Hewes Cook Ditch. See Section 5.10.8.16 for more information on how these changed shares are used within the SACWSD system and what supplies are used to offset the obligations.

5.8.6.17 Farmers Independent Ditch (0200824)

Central has changed shares in Farmers Independent Ditch, as decreed in Case No. 04CW276, for use in its GMS and WAS augmentation plans. The return flow obligations associated with these changed shares are modeled using a bypass structure and a fixed return flow pattern. The bypass structure is used instead of a standard return pattern because Central only diverts the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. The bypass requirements were incorporated in the model using a carrier structure (0200824_A) that "loses" the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly, as shown below.

Farmers Independent Ditch Monthly Consumptive Use Credits (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
Central	80.0	60.0	16.0	9.0	12.0	22.0	84.0

Farmers Independent Ditch Monthly Bypass Requirements (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
Central	20.0	40.0	84.0	91.0	88.0	78.0	16.0

Delayed return flow obligations associated with changed water rights are assigned to plan ID CenFarmRFs. The decreed monthly return flow factors were adjusted for a 15 percent ditch loss resulting in the following return flow factors:

Fixed Return Pattern Data (%)

Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CenFarmRFs	2.6	2.1	2.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.7

Central's return flow obligations are owed to the South Platte River generally above the Lower Latham Ditch. See Section 5.10.10.1 for more information on how these changed shares are used within Central's WAS and GMS Augmentation Plan systems and what supplies are used to offset the obligations.

5.8.6.18 Section No. 3 Ditch (0200830)

Central has changed shares in Section No. 3 Ditch, as decreed in Case No. 05CW223, for use in its GMS and WAS augmentation plans. The return flow obligations associated with these changed shares are modeled using a bypass structure and a fixed return flow pattern. The bypass structure is used instead of a standard return pattern because Central only diverts the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. The bypass requirements were incorporated in the model using a carrier structure (0200830_A) that "loses" the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly, as shown below.

Section No. 3 Ditch Monthly Consumptive Use Credits (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
Central	51.0	48.0	47.0	47.0	49.0	54.0	68.0

Section No. 3 Ditch Monthly Bypass Requirements (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
Central	49.0	52.0	53.0	53.0	51.0	46.0	32.0

Delayed return flow obligations associated with changed water rights are assigned to plan ID CenSN3RFs. The decreed monthly return flow factors were adjusted for a 15 percent ditch loss resulting in the following return flow factors:

Fixed Return Pattern Data (%)

Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CenSN3RFs	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.3

Central's return flow obligations are owed to the South Platte River generally above the Lower Latham Ditch. See Section 5.10.10.1 for more information on how these changed shares are used within Central's WAS and GMS Augmentation Plan systems and what supplies are used to offset the obligations.

5.8.6.19 Highland Ditch (0200837)

Central has changed shares in Highland Ditch, as decreed in Case No. 07CW06, for use in its GMS and WAS augmentation plans. The return flow obligations associated with these changed shares are modeled using a bypass structure and a fixed return flow pattern. The bypass structure is used instead of a standard return pattern because Central only diverts the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. The bypass requirements were incorporated in the model using a carrier structure (0200837_A) that "loses" the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly, as shown below.

Highland Ditch Monthly Consumptive Use Credits (%)

Entity Name	May	Jun	Jul	Aug	Sep	Oct
Central	47.0	45.0	48.0	47.0	39.0	11.0

Highland Ditch Monthly Bypass Requirements (%)

Entity Name	May	Jun	Jul	Aug	Sep	Oct
Central	53.0	55.0	52.0	53.0	61.0	89.0

Delayed return flow obligations associated with changed water rights are assigned to plan ID CenHighRFs. The decreed monthly return flow factors were adjusted for a 20 percent ditch loss resulting in the following return flow factors:

Fixed Return Pattern Data (%)

Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CenHighRFs	0.9	0.7	0.6	1.1	0.0	0.0	0.0	0.0	0.0	3.1	1.6	1.1

Central's return flow obligations are owed to the South Platte River generally below the confluence with the Cache la Poudre River. See Section 5.10.10.1 for more information on how these changed shares are used within Central's WAS and GMS Augmentation Plan systems and what supplies are used to offset the obligations.

5.8.6.20 Agricultural Ditch (0700502)

Consolidated Mutual has changed shares in Agricultural Ditch, as decreed in Case No. 94CW197, for municipal supply. The return flow obligations associated with these changed shares are modeled using a bypass structure and a fixed return flow pattern. The bypass structure is used instead of a standard return pattern because Consolidated Mutual only diverts the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. The bypass requirements were incorporated in the model using a carrier structure (0700502_A) that "loses" the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly, as shown below.

Agricultural Ditch Monthly Consumptive Use Credits (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
Con. Mutual	29.0	78.0	86.0	79.0	76.0	62.0	17.0

Agricultural Ditch Monthly Bypass Requirements (%)

Entity Name	Apr	May	Jun	Jul	Aug	Sep	Oct
Con. Mutual	71.0	22.0	14.0	21.0	24.0	38.0	83.0

Delayed return flow obligations associated with changed water rights are assigned to an overall plan ID ConM_AgRFs. As the obligations are owed to two different locations, the overall plan is split into two plans: 75 percent to plan ID ConMSPRRFs located on the South Platte River below the Englewood gage, and 25 percent to plan ID ConMClCkRFs on Clear Creek above the Lena Gulch confluence. The decreed monthly return flow factors were adjusted for a 20 percent ditch loss resulting in the following return flow factors:

Fixed Return Pattern Data (%)

Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ConM_AgRFs (Split to ConMSPRRFs ConMClCkRFs)	1.9	1.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.0

See Section 5.10.8.9 for more information on how these changed shares are used within Consolidated Mutual's system and what supplies are used to offset the obligations.

5.8.6.21 Welch Ditch (0700699)

Consolidated Mutual has changed shares in Welch Ditch, as decreed in Case No. 94CW197, for municipal supply. The return flow obligations associated with these changed shares are modeled using a bypass structure and a fixed return flow pattern. The bypass structure is used instead of a standard return pattern because Consolidated Mutual only diverts the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. The bypass requirements were incorporated in the model using a carrier structure (0700699_A) that "loses" the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly, as shown below.

Welch Ditch Monthly Consumptive Use Credits (%)

Entity Name	May	Jun	Jul	Aug	Sep	Oct
Con. Mutual	77.0	83.0	81.0	80.0	64.0	53.0

Welch Ditch Monthly Bypass Requirements (%)

Entity Name	May	Jun	Jul	Aug	Sep	Oct
Con. Mutual	23.0	17.0	19.0	20.0	36.0	47.0

Delayed return flow obligations associated with changed water rights are assigned to an overall plan ID ConM_WelRFs. As the obligations are owed to two different locations, the overall plan is split into two plans; 31 percent to plan ID ConMSPRRFs located on the South Platte River below the Englewood gage, and 69 percent to plan ID ConMClCkRFs on Clear Creek above the Lena Gulch confluence. The decreed monthly return flow factors were adjusted for a 33 percent ditch loss resulting in the following return flow factors:

Fixed Return Pattern Data (%)

Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ConM_WelRFs (Split to ConMSPRRFs ConMClCkRFs)	1.9	1.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.0

See Section 5.10.8.9 for more information on how these changed shares are used within Consolidated Mutual's system and what supplies are used to offset the obligations.

5.8.6.22 PSCo Terms and Conditions

Xcel Energy (Public Service Company, PSCo) has changed water rights in a number of ditches in the Clear Creek and South Platte River basins.

PSCo owns shares in the following ditches:

- Fisher Ditch (0700570)
- Lupton Bottoms Ditch and Lupton Meadows Ditch (0200812)
- Meadows Island No. 2 Ditch (0200822)
- Hewes Cook Ditch (0200825)
- Jay Thomas Ditch (0200826)

Only the use of PSCO's changed Fisher Ditch shares is represented in the model, as a supply to meet the Cherokee Power Plant demands. PSCo's use of the CU credits in water district 2 is used to coordinate return flows and some exchanges between the Fort St. Vrain and Cherokee plants. The use of these CU credits has historically been pretty small and, therefore, the operations between the two plants are not explicitly represented in the SPDSS model. Note there are some placeholders in the <SP2016.opr> operating rules file for the use of the water district 2 shares by future modelers.

Fisher Ditch

Return flow obligations from PSCo's use of its Fisher Ditch shares is based on augmentation station deliveries (i.e., at the Cherokee plant). The monthly obligations from the PSCo decrees are split between a Clear Creek bypass (if Lower Clear Creek Ditch is calling) and the South Platte River below Metro WWTP. The return flows from Fisher Ditch operations are split to two locations (plan IDs PSCoClCkRFs and PSCoSPRFs).

The combination of a) variable return flow amounts, and b) variable split of those returns between the two T&C Plan locations, by month, is addressed using variable losses in the Fisher Ditch carrier (to meet Clear Creek return flow obligations), and multiple T&C Plans, with splits by month shown in the *.prf file.

The decreed monthly return flow factors applied to simulated diversions are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep	Oct
8.3	7.1	5.4	6.3	7.7	11.2	17.1

Fixed Return Pattern Data (%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3.7	3.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9

See Section 5.10.8.4 for more information on how these changed shares are used within PSCo's system and what supplies are used to offset the obligations.

5.8.6.23 City of Thornton Terms and Conditions

The City of Thornton has changed water rights in several ditches along Clear Creek and the South Platte River; they were decreed in three primary cases, Case Nos. 87CW334, 89CW132, and 02CW266. Thornton owns shares in the following ditches:

- Church Ditch (0700540)
- Farmers Highline Canal (0700569)
- Fisher Ditch (0700570)
- Colorado Agricultural Ditch (0700549)
- Lower Clear Creek Ditch (0700547)
- Burlington Canal (0200802)

The following sections discuss how the terms and conditions were developed to represent the return flow obligations for each ditch.

Church Ditch

Return flow obligations associated with Thornton's use of its changed shares on Church Ditch are assigned to the plan ID ThChurchRFs. Year round return flow obligations are modeled using both a standard and a fixed pattern. Return flow obligations are owed to the Clear Creek River below the Church Ditch headgate. The decreed monthly return flow factors applied to simulated diversions are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep	Oct
42.0	7.5	6.0	7.5	14.2	39.7	42.0

Fixed Return Pattern Data (%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2.4	2.4	2.1	2.1	3.1	4.5	4.7	4.5	3.7	2.4	2.4	2.4

Farmers Highline Canal

Return flow obligations associated with Thornton's use of its changed shares on Church Ditch are assigned to the overall plan ID ThFHL_RFs. As the obligations are owed to three different locations, the overall plan is split into three plans: 13 percent to plan ID ThLCC_RFs located on Clear Creek below Fisher Ditch, 19 percent to plan ID ThBDC_RFs located on lower Big Dry Creek, and 68 percent to plan ID ThornSPRFs1 located on the South Platte River above Fulton Ditch. Year round return flow obligations are modeled using both a standard and a fixed pattern. The decreed monthly return flow factors were adjusted for a 25 percent ditch loss (i.e. decreed factors are based on augmentation station deliveries, not headgate deliveries) resulting in the following return flow factors:

Standard Return Pattern Data (%)

Mar	April	May	June	July	Aug	Sep	Oct	Nov
39.0	24.0	9.0	6.7	9.7	17.2	24.7	30.0	33.0

Fixed Return Pattern Data (%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7

Fisher Ditch

Return flow obligations associated with Thornton's use of its changed shares on Fisher Ditch are assigned to two overall plan IDs, ThFishRFs1 and ThFishRFs2. Two overall plans are needed because wintertime delayed return flows are only required for simulated diversions in April through July. Therefore ThFishRFs1 accounts for year round return flow obligations using both a both a standard and a fixed pattern for simulated diversions in April through July. ThFishRFs2 accounts for summertime return flow obligations using a standard pattern in August through September.

As the obligations are owed to two different locations, the overall plans are split into two plans: 46 percent to plan ID ThLCC_RFs located on Clear Creek below Fisher Ditch, and 54 percent to plan ID ThornSPRFs1 located on the South Platte River above Fulton Ditch. The decreed monthly return flow factors were adjusted for a 10 percent ditch loss (i.e. decreed factors are based on augmentation station deliveries, not headgate deliveries) resulting in the following return flow factors:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep
58.5	46.8	37.8	36.0	45.9	65.7

Fixed Return Pattern Data (%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.3	3.5	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	5.3

Colorado Agricultural Ditch

Return flow obligations associated with Thornton's use of its changed shares on Colorado Agricultural Ditch are assigned to two overall plan IDs, ThCoAg89RFs and ThCoAg02RFs. Two overall plans in order to represent the terms and conditions associated with separate decrees, Case No. 89CW132 and 02CW266, respectively. Return flow obligations associated with ThCoAg89RFs are owed to the Clear Creek River at the Colorado Agricultural Ditch. Obligations accounted for under are ThCoAg02RFs owed to two different locations, therefore the overall plan is split into two plans: 46 percent to plan ID ThornSPRFs1 located on the South Platte River above Fulton Ditch, and 54 percent to plan ID ThornSPRFs2 located on the South Platte River below Fulton Ditch.

Year round return flow obligations are modeled using both a standard and a fixed pattern. The decreed monthly return flow factors were adjusted for a 15 percent ditch loss (i.e. decreed factors are based on augmentation station deliveries, not headgate deliveries) resulting in the following return flow factors:

Standard Return Pattern Data (%)

Plan ID	April	May	June	July	Aug	Sep	Oct
ThCoAg89RFs	58.6	33.1	31.4	34.0	51.8	83.3	-
ThCoAg02RFs	51.0	29.7	27.2	28.0	40.8	64.6	76.5

Fixed Return Pattern Data (%)

Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ThCoAg89RFs	2.7	2.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	3.6
ThCoAg02RFs	1.9	1.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	2.5

Lower Clear Creek Ditch

Return flow obligations associated with Thornton's use of its changed shares on Lower Clear Creek Ditch are assigned to two overall plan IDs, ThLCC89RFs and ThLCC02RFs. Two overall plans in order to represent the terms and conditions associated with separate decrees, Case No. 89CW132 and 02CW266, respectively. Return flow obligations associated with ThLCC89RFs are owed to the Clear Creek River at the Lower Clear Creek Ditch. Obligations accounted for under are ThLCC02RFs owed to two different locations, therefore the overall plan is split into two plans: 69 percent to plan ID ThornSPRFs1 located on the South Platte River above Fulton Ditch, and 31 percent to plan ID ThornSPRFs2 located on the South Platte River below Fulton Ditch.

Year round return flow obligations are modeled using both a standard and a fixed pattern. The decreed monthly return flow factors were adjusted for a 10 percent ditch loss (i.e. decreed factors are based on augmentation station deliveries, not headgate deliveries) resulting in the following return flow factors:

Standard Return Pattern Data (%)

Plan ID	April	May	June	July	Aug	Sep
ThLCC89RFs	51.0	41.6	40.8	45.0	61.2	84.1
ThLCC02RFs	49.3	39.1	32.3	36.5	53.5	78.2

Fixed Return Pattern Data (%)

Plan ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ThLCC89RFs	2.0	1.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	3.0
ThLCC02RFs	2.6	1.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	3.9

Burlington Canal

Due to the similarities between Thornton and SACWSD return flow obligations associated with their changed uses on Burlington Canal, the obligations for both entities are discussed together under the Burlington Canal section.

See Section 5.10.8.12 for more information on how these changed shares are used within Thornton's system and what supplies are used to offset the obligations.

5.8.6.24 City of Westminster Terms and Conditions

The City of Westminster has changed water rights in ditches along Clear Creek; they were decreed in three primary cases, Case Nos. W-8743, 86CW398, 86CW266, 90CW101, and 00CW263. Thornton owns shares in the following ditches:

- Church Ditch (0700540)
- Farmers Highline Canal (0700569)
- Kershaw Ditch (0700597)

The following sections discuss how the terms and conditions were developed to represent the return flow obligations for each ditch.

Church Ditch

Return flow obligations associated with Westminster's use of its changed shares on Church Ditch are assigned to the overall plan ID WestyChRFs. As the obligations are owed to three different locations, the overall plan is split into three plans: 8 percent to plan ID WestBDCRFs located on the Big Dry Creek below Whipple Ditch, 14 percent to plan ID WestyLCCRFs on Clear Creek below Fisher Ditch, and 78 percent to plan ID WestySPRFs on the South Platte River above Fulton Ditch. Year round return flow obligations are modeled using both a standard and a fixed pattern. The decreed monthly return flow factors applied to simulated diversions are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep	Oct
42.0	7.5	6.0	7.5	14.2	39.7	42.0

Fixed Return Pattern Data (%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.3	1.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.3

Farmers Highline Canal

Return flow obligations associated with Westminster's use of its changed shares on Farmers Highline Ditch are assigned to the overall plan ID WestyFHLRFs. As the obligations are owed to three different locations, the overall plan is split into three plans: 9 percent to plan ID WestBDCRFs located on the Big Dry Creek below Whipple Ditch, 9 percent to plan ID WestyLCCRFs on Clear Creek below Fisher Ditch, and 82 percent to plan ID WestySPRFs on the South Platte River above Fulton Ditch. Year round return flow obligations are modeled using both a standard and a fixed pattern. The decreed monthly return flow factors applied to simulated diversions are as follows:

Standard Return Pattern Data (%)

Mar	April	May	June	July	Aug	Sep	Oct	Nov
39.0	24.0	9.0	6.7	9.7	17.2	24.7	30.0	33.0

Fixed Return Pattern Data (%)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.0	0.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.0

Kershaw Ditch

Return flow obligations associated with Westminster's use of its changed shares in Kershaw Ditch are modeled using a bypass structure. The bypass structure is used instead of a standard return pattern because these entities only divert the consumptive use credits of the changed water right; the remaining non-consumptive portion remains in the river. The bypass requirements were incorporated in the model using a carrier structure (0700597_A) that “loses” the non-consumptive portion as it carries the changed water right. The consumptive use credits and the resulting bypass amounts vary monthly as shown below. Note, no delayed return flow obligations are required

Kershaw Ditch Monthly Consumptive Use Credits (%)

Apr	May	Jun	Jul	Aug	Sep	Oct
48.0	67.0	69.0	71.0	71.0	66.0	58.0

Kershaw Ditch Monthly Bypass Requirements (%)

Apr	May	Jun	Jul	Aug	Sep	Oct
52.0	33.0	31.0	29.0	29.0	34.0	42.0

See Section 5.10.8.11 for more information on how these changed shares are used within Westminster’s system and what supplies are used to offset the obligations.

5.8.6.25 Henderson Smith Ditch (6400525)

Return flow obligations associated with the City of Sterling’s use of its Henderson Smith Ditch changed shares decreed in Case No. 00CW253 are assigned to the plan ID 6400525_RF. Year round return flow obligations are modeled using both a standard and a fixed pattern. Return flow obligations are owed to the South Platte River below the Henderson Smith Ditch headgate. The decreed monthly return flow factors applied to simulated diversions are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep
51.5	36	46.8	31.1	40.4	62.7

Fixed Return Pattern Data (%)

Oct	Nov	Dec	Jan	Feb	Mar
7.4	5.2	3.3	2.5	2.0	1.7

See Section 5.10.10.15 for more information on how these changed shares are used within the City of Sterling Augmentation Plan system and what supplies are used to offset the obligations.

5.8.6.26 Sterling No. 1 Ditch (6400528)

Return flow obligations associated with the City of Sterling’s use of its Sterling No. 1 Ditch changed shares decreed in Case No. 00CW253 are assigned to the plan ID 6400528_RF. Year round return flow obligations are modeled using both a standard and a fixed pattern. Return flow obligations are owed to the South Platte River below the Sterling No. 1 Ditch headgate. The decreed monthly return flow factors applied to simulated diversions are as follows:

Standard Return Pattern Data (%)

April	May	June	July	Aug	Sep	Oct
41.4	33.2	27.8	23.5	25.4	36.7	91.1

Fixed Return Pattern Data (%)

Nov	Dec	Jan	Feb	Mar
2.5	2.3	2.0	1.7	1.5

See Section 5.10.10.15 for more information on how these changed shares are used within the City of Sterling Augmentation Plan system and what supplies are used to offset the obligations.

5.9 Well Files

This section includes files that describe well characteristics and their interaction with surface water systems.

5.9.1 Well Station File (*.wes)

The well station file describes the physical properties for the co-mingled structures and ground water only aggregate well structures simulated in the South Platte Model. This file must be created with StateDMI Version 04.05.00 or greater to accommodate the recent switch from irrigated parcel-based aggregate list files to well ID-based aggregate list files.

In Section 7, Table 7-5 is a summary of the South Platte Model's well station file contents, including each structure's pumping capacity, irrigated acreage served, average annual system efficiency, and average annual pumping demand. The average annual pumping demand parameter was summarized from data in the well demand file rather than the well station file, but it was included here as an important characteristic of each well station. In addition to the tabulated parameters, the *.wes file also specifies return flow nodes and depletion nodes. Note that co-mingled structures that have both a surface water and ground water demand are included in both Table 7-5 and the diversion structure summary table (Table 7.1).

Co-mingled structures are designated in the network using a diversion and well (DW) node type, which informs StateDMI that these structures are included in both the diversion files and the well files. For these structures, the well station ID, name, irrigated acreage, and return flow nodes match the diversion structure information in the *.dds file. Refer to Section 4.11 above for more information on how the co-mingled structure information was developed.

Ground water only aggregates are designated in the network using a well (W) node type, and the information included in the *wes file is primarily provided to StateDMI using an aggregate well list file (SP_GWAgg_10032016.csv). The aggregate list file contains the ground water only aggregate well station ID (e.g. 01_AWP001), name, and the individual well WDIDs associated with the aggregate structure. Irrigated acreage values from 2010 were read in using a list file (SP2016_2010Acreage.csv). Return flow locations for ground water only aggregates were specified to StateDMI in a hand-edited file SP2016_SW.rtn. Return flow information was based on the physical location of irrigated lands within the aggregate boundary.

For both co-mingled and ground water only aggregate structures, pumping capacity is set based on the well rights associated to the well structure, as read in from the well rights file (*.wer). Depletion locations were specified to StateDMI in a hand-edited file SP2016_GW.rtn. The depletion nodes are generally the same as the return flow nodes; however any overland return flows that accrue to the river in the same time-step were revised to be lagged depletion nodes. For structures located in a Designated Basin, their return flow and depletion nodes were disconnected from the river system using a delay pattern with no returns (ID 1002). For structures served by Denver Basin wells, the return flow nodes were set based on the physical location of irrigated lands however the depletion is set to zero.

Irrigation well structures operate based on "variable efficiency", as discussed in the *.dds file section above. For non-irrigation well structures, annual efficiency was user-supplied. No monthly efficiency information has been included the *.wes file.

For additional details on key structure selection of co-mingled structures, refer to Section 4.2.1.1. For details on aggregate node development, refer to Section 4.2.1.2. For details on the approach to municipal and industrial demand nodes, refer to Section 4.2.1.3.

Where to find more information

- SPDSS Task Memorandum 3, "Aggregate Non-Key Agricultural Diversion Structure," available on the CDSS website.

5.9.1.1 Augmentation and Recharge Aggregate Well Structures

Augmentation and recharge wells used as supplies for augmentation plans are modeled in aggregate structures, and are included in the well station file. Aggregate augmentation well and recharge well structure IDs consist of the augmentation plan ID they supply and a _AuW or _ReW suffix. These aggregates, and their associated well IDs, are included in the ground water only aggregate list file. The capacities for these structures are generally set to the sum of the well rights for the associated wells. Augmentation well structures are represented with lagged depletions, but return flows accrue to the river in the same time-step. Recharge well structures are generally located near the river and pump water to recharge areas; therefore they are represented with depletions and return flows that occur in the same time-step.

5.9.2 Historical Pumping and Well Demand File (*.weh)

The historical pumping file contains time series of pumping for each well structure. For this historical dataset, the historical pumping file also serves as the well pumping demand file. The file was created in TSTool.

Historical pumping for irrigation structures is based on the ground water pumping output file from the StateCU scenario. Pumping is estimated based on crop irrigation water requirement on lands served by ground water and application efficiency. Then pumping estimates for structures served by wells covered under Central Colorado Water Conservancy District's WAS and GMS augmentation plans are reduced based on their annual pumping quotas for 2005 to 2012. See Section 7.8 for more information on this process.

Historical pumping from HydroBase was used when available for non-irrigation structures, including the Aurora Well Field (0805065), PSCO Pawnee Well Field (0100711), and augmentation and recharge well structures. Pumping for Coors A was set to 3.75 cfs year-round to reflect the brewing washing demand. Pumping for the remaining non-irrigation structures, which includes the aggregated municipal and industrial structures, were estimated based on population and per capita usage rates, and user-supplied information, respectively.

For details on the approach to municipal and industrial demand nodes, refer to Section 4.2.1.3.

> **Where to find more information**
>
> - "Historical Crop Consumptive Use Report for the South Platte River Basin" report documents the process for estimating irrigation pumping.
> - SPDSS Task Memorandum 66.2, "Collect and Develop Municipal and Industrial Consumptive Use Estimates," available on the CDSS website.

5.9.3 Well Rights File (*.wer)

The well rights file contains a list of well rights for the co-mingled and ground water only aggregate well structures in the model. StateDMI creates the file by querying for water rights and permits associated with the wells assigned to each structure. Similar to the *.wes file, this file must be created with StateDMI Version 04.05.00 or greater to accommodate the recent switch from irrigated parcel-based aggregate list files to well ID-based aggregate list files.

The well rights file contains the unique well right ID, well right name, associated co-mingled or ground water only structure, priority date, and decreed right in CFS, and the year associated with the permit or decree. Note there are options in StateDMI to output additional information in the well rights file, however it is not considered by StateMod. There are over 7,000 unique well rights in the *.wer file, therefore the file contents have not been provided in this documentation.

Irrigation well rights are queried automatically by StateDMI using the new approach based on the co-mingled structures and ground water only aggregate list files. The following are noted:

- Wells can be assigned to more than one well structure. If this occurs, the full well right is assigned to both structures.
- Well rights are numerated based on the associated well structure ID (e.g. 01_AWP001002)
- A portion of the wells assigned to irrigated parcels are not decreed. If the aggregate part reflects a permit, the permitted information is used in the well rights file.
- If a decreed well no longer has active water rights (e.g. abandoned), no information is included in the well file.
- APEX rights were included for this simulation; this allows wells decreed as an alternate point for surface water rights to pump under their more senior water rights.

Non-irrigation well rights are not queried automatically and must be set in StateDMI. Well rights were set for Aurora Well Field (0805065), PSCO Pawnee Well Field (0100711), Coors' Springs (07_CoorsA), augmentation and recharge well structures, and aggregated municipal and industrial structures.

Note that the new approach was recently implemented and has not been fully vetted. StateDMI does not yet remove duplicate well right IDs therefore the well rights file was post-processed to remove them.

Where to find more information

- "Refer to the *ReadWellRightsFromHydroBase ()* section in the StateDMI User's Manual for more information on how well rights and permits were queried from HydroBase.

5.10 Operating Rights File (*.opr)

The operating rights file specifies operations that are more complicated than a direct diversion or direct storage in an on-stream reservoir. The file was created by hand. Each operating right was assigned an administration number consistent with the structures' other rights and operations.

Information used in this model dataset is based on available data collected and developed through the CDSS, including information recorded by the State Engineer's Office. The model dataset and results are intended for basin-wide planning purposes. Individuals seeking to use the model dataset or results in any legal proceeding are responsible for verifying the accuracy of information included in the model.

In the South Platte Model, several different types of operating rights are used. These rules are listed below; refer to the StateMod User's Manual for more information on these operations.

- Type 1 – a release from storage to the stream to satisfy an instream flow demand.
- Type 2 – a release from storage to the stream, for shepherded delivery to a downstream diversion or carrier. Typically, the reservoir supply is supplemental, and its release was given an administration number junior to direct flow rights at the destination structure. A release is made only if demand at the diversion structure is not satisfied after direct flow rights have diverted. Releases to irrigation structures are made only if there is remaining crop irrigation requirement.
- Type 3 – a release from storage directly to a carrier (a ditch or canal as opposed to the river), for delivery to a diversion station. Typically, the reservoir supply is supplemental, and its release is given an administration number junior to direct flow rights at the destination structure. A release is made only if demand at the diversion structure is not satisfied after direct flow rights have diverted. Releases to irrigation structures are made only if there is remaining crop irrigation requirement.
- Type 4 – a release from storage in exchange for a direct diversion elsewhere in the system. The release can occur only to the extent that there is legally available water in the exchange reach. Typically, the storage water is supplemental, and is given an administration number junior to direct flow rights at the diverting structure.
- Type 5 – a release from storage in exchange for reservoir storage elsewhere in the system. The release can occur only to the extent that there is legally available water in the exchange reach. Typically, the storage water is supplemental, and is given an administration number junior to storage rights at the storing reservoir.
- Type 6 – a reservoir to reservoir transfer (book-over). The book-over is commonly used to transfer water from one reservoir storage account to another in a particular month. It can also transfer water from one storage account to another based on the amount of water diverted by an operating rule.
- Type 7 – a release from storage in exchange for diversion by a carrier elsewhere in the system. The release can occur only to the extent that there is legally available water in the exchange reach. Typically, the storage water is supplemental, and is given an administration number junior to carrier's operating right. Releases to irrigation structures are made only if there is remaining crop irrigation requirement.
- Type 9 – a release from storage to the river to meet a reservoir target. Targets allow maximum storage control of reservoir levels by storage rights and releases to meet demands. This rule is commonly used during calibration.
- Type 10 – a general replacement release from storage for a diversion by river direct or by exchange elsewhere in the system.

- Type 11 – a direct flow diversion to another diversion or reservoir through an intervening carrier. This rule type uses the administration number and decreed amount of the direct flow right associated with the carrier, regardless of the administration number assigned to the operating right itself.

- Type 14 – a direct flow diversion to another diversion or reservoir through an intervening carrier limited by the demand at the carrier. This rule type uses the administration number and decreed amount of the direct flow right associated with the carrier, regardless of the administration number assigned to the operating rule itself.

- Type 22 – The type 22 operating rule directs StateMod to consider soil moisture in the variable efficiency accounting. For structures with crop irrigation water requirements, excess diverted water not required by the crops during the month of diversion is stored in the soil reservoir zone, up to the soil reservoir's available capacity. If diversions are not adequate to meet crop irrigation water requirements during the month of diversion, water is withdrawn from the soil reservoir to meet unsatisfied demands. The depth of the soil zone is defined in the control file (*.ctl). For the South Platte Model, the effective soil depth or root zone was set to 3 feet. As discussed in section 5.5.1, the available water content, in inches per inch, was defined for each irrigating structure in the StateCU structure file (*.str).

- Type 26 –The type 26 operating rule allows a changed water right to be diverted from the river and temporarily stored in an accounting plan. Once the changed water right is stored in an accounting plan, it can be released at a junior priority by a direct release, by exchange, or spilled using Type 27, Type 28, or Type 29 operating rule.

- Type 27 – a release from a reservoir, a reuse plan, an out-of-priority plan, an account plan, or a changed water right plan to a diversion, reservoir, instream flow, or carrier directly.

- Type 28 – The type 28 operating rule provides a method to release water from a reservoir, a reuse Plan, an out-of-priority plan, an accounting plan, or changed water right plan to a diversion, reservoir, instream flow, or carrier by exchange.

- Type 29 – The type 29 operating rule provides a method to release (spill) water from a reservoir, a reuse plan, an accounting plan, or a changed water right plan to the system.

- Type 34 – a reservoir to reservoir transfer, which could be used to book-over water from one account to another within a reservoir or transfer water from one reservoir to another reservoir via a pipeline or carrier. This rule type can also limit the amount of the book-over or transfer based on another operating rule or amount within a plan structure.

- Type 37 – pumps ground water from an augmentation well in order to satisfy a Terms and Conditions or augmentation plan demand.

- Type 38 – the out-of-priority diversion rule provides a method to divert to a reservoir or diversion based on the upstream storage statute (out-of-priority). This rule works in coordination with the subordinating water right and a plan structure to track the volume of water diverted and subsequently owed to the subordinating water right.

- Type 41 – reservoir storage with special limits allows a reservoir to store water via a reservoir right up to the volume of water stored in out-of-priority plans. The rule also reduces more than one out-of-priority plans pro rata by the amount stored under this rule.

- Type 42 – the plan demand reset rule provides a method to reset a plan demand at a given time.

- Type 43 – determines if depletions from pumping that occurred in a previous time step are impacting the river in priority. When depletions are impacting the river out of priority, the type 43 rule generates Terms and Conditions Requirement or a Well Augmentation Requirement. This rule is used the augmentation plans.

- Type 45 – The type 45 operating rule provides a method to divert water to a carrier with loss. The carrier then delivers water to a diversion or reservoir.

- Type 46 – The type 46 operating rule provides a method to distribute water from one accounting plan to multiple accounting plans at the same priority.

- Type 47 – The type 47 operating rule provides a method to impose monthly and annual limits for one or more operating rules.

- Type 48 – release water from a reservoir, recharge site, or reuse plan to a Terms and Conditions or well augmentation plan via a direct release to the river.

- Type 49 – release water from a reservoir, recharge site, or reuse plan to a Terms and Conditions or well augmentation plan by exchange.

5.10.1 Soil Moisture

A type 22 operating rule is used. This operating rule directs StateMod to consider soil moisture in the variable efficiency accounting. For structures with crop irrigation water requirements, excess diverted water not required by the crops during the month of diversion will be stored in the soil reservoir zone, up to the soil reservoir's available capacity. If diversions are not adequate to meet crop irrigation water requirements during the month of diversion, water can be withdrawn from the soil reservoir to meet unsatisfied demands. The depth of the soil zone is defined in the control file (*.ctl). The available water content, in inches per inch, is defined for each irrigating structure in the structure parameter file (*.str).

5.10.2 Colorado-Big Thompson Project Overview

The Colorado-Big Thompson (C-BT) Project is the largest transmountain diversion project in Colorado. This section provides an overview of the C-BT Project. A map of the East Slope distribution system is shown in Figure 5-1 below. C-BT is owned by the U.S. Bureau of Reclamation (USBR). Northern Colorado Water Conservancy District (Northern) is the contract beneficiary. Northern operates and maintains the project's water collection and distribution facilities. The C-BT Project collects water on the West Slope in a system of reservoirs (Willow Creek, Granby, Shadow Mountain, and Grand Lake) on tributaries to the Colorado River. Green Mountain Reservoir on the West Slope serves as a replacement reservoir for the C-BT Project.

Water is transported from the West Slope to the East Slope via the Alva B. Adams Tunnel (560 cubic feet per second capacity) for power generation, and irrigation and municipal use in the South Platte River Basin. Water delivered by Adams Tunnel enters the Big Thompson River upstream of Estes Park through a series of pipelines and regulating reservoirs. C-BT water can either be diverted at Olympus Dam in Estes Park into Olympus Tunnel or it can flow down the Big Thompson River. In addition to transmountain water from Adams Tunnel, native Big Thompson water in excess of the minimum outflow requirements can also be diverted into Olympus Tunnel. Native Big Thompson water picked up for power generation is referred to as "skim" water.

Water that is diverted into Olympus Tunnel flows through a series of pipelines, regulating reservoirs, and hydropower plants. Below Pinewood Reservoir, water from the tunnel reaches the trifurcation structure. From this point, it can be gravity-delivered to the Charles Hansen Feeder Canal or Carter Lake. Charles Hansen Feeder Canal can deliver water back to the Big Thompson River or to Horsetooth Reservoir, which primarily supplies the northern portions of Northern's service area. Carter Lake primarily supplies water to the St. Vrain Supply Canal (SVSC) and to the Southern Water Supply Project Pipeline. It is possible for Northern to pump water out of Carter Lake back to the trifurcation structure, but this operation is very energy-intensive and avoided whenever possible. The Southern Water Supply Pipeline delivers water to 12 water providers, including Longmont, Broomfield, Lafayette, Louisville, Superior, Fort Lupton, and Fort Morgan. The SVSC delivers water to the Little Thompson River, St. Vrain Creek, and the Boulder Feeder Canal. The Boulder Feeder Canal continues south and delivers water to the third major East Slope reservoir, Boulder Reservoir. Boulder Reservoir supplies water to Boulder Creek and eventually to the South Platte Supply Canal (SPSC). SPSC is an extention of the Lower Boulder Ditch (0600538_D), which then flows into Coal Ridge Ditch and delivers water to Sand Hill Lake. Sand Hill Lake is a regulating reservoir and releases water to the South Platte River for use by the Platte Valley Irrigation Company.

Water that flows down the Big Thompson River can be diverted into Dille Tunnel in the Big Thompson Canyon to generate electricity. Both transmountain water and native water in excess of minimum flow requirements can be diverted. Dille Tunnel can deliver water to the Hansen Feeder Canal or return water back to the Big Thompson River via the Big Thompson Power Plant or the Hansen Feeder Waste Way at the mouth of the Big Thompson Canyon. Transmountain water that continues down the Big Thompson River is available for delivery to C-BT project participants.

On average, C-BT imports approximately 232,000 acre-feet via Adams Tunnel annually. The following summary table provides information on the average annual C-BT distribution within the South Platte Model. Note that these values are specific to the operations of the model and may not specifically reflect C-BT shareholder deliveries.

	Sub-basin Destination	Sub-basin Delivery	Avg. Annual Distribution (AF)
Adams Tunnel	Cache la Poudre	Hansen Feeder Canal	112,000
	Cache la Poudre	Greeley Filters Plant	8,300
	Big Thompson	Big Thompson (in-basin users) and Lower South Platte deliveries	39,500
	St. Vrain Creek/ Boulder Creek	Boulder Reservoir (releases to in-basin users in Boulder Creek)	18,000
	St. Vrain Creek	St. Vrain Supply Canal (in-basin users)	17,600
	St. Vrain Creek	City of Longmont (directly delivered)	5,500
	St. Vrain Creek	Left Hand Ditch users	5,600
	Boulder Creek	Southern Water Supply Pipeline (in-basin users)	17,000
	South Platte	South Platte Mainstem users	8,500
	Total		*232,000*

Northern Water also operates the Windy Gap Project. Water is collected from the West Slope in Windy Gap Reservoir and pumped via pipeline to Lake Grandby. When there is excess capacity in the C-BT infrastructure, Windy Gap water is transported to the South Platte Basin and delivered to project participants.

Where to find more information

- SPDSS Task Memorandum 3, "Identify Key Diversion Structures Notes from Water District 4 Meeting," available on the CDSS website.
- SPDSS Task Memorandum 3, "Identify Key Diversion Structures Notes from Water District 5 Meeting," available on the CDSS website.
- SPDSS Task Memorandum 3, "Identify Key Diversion Structures Notes from Water District 6 Meeting," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, Alva B. Adams Tunnel," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, City of Boulder," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, Northern Colorado Water Conservancy District and Colorado-Big Thompson Project," available on the CDSS website.
- Northern Colorado Water Conservancy District website - http://www.northernwater.org/

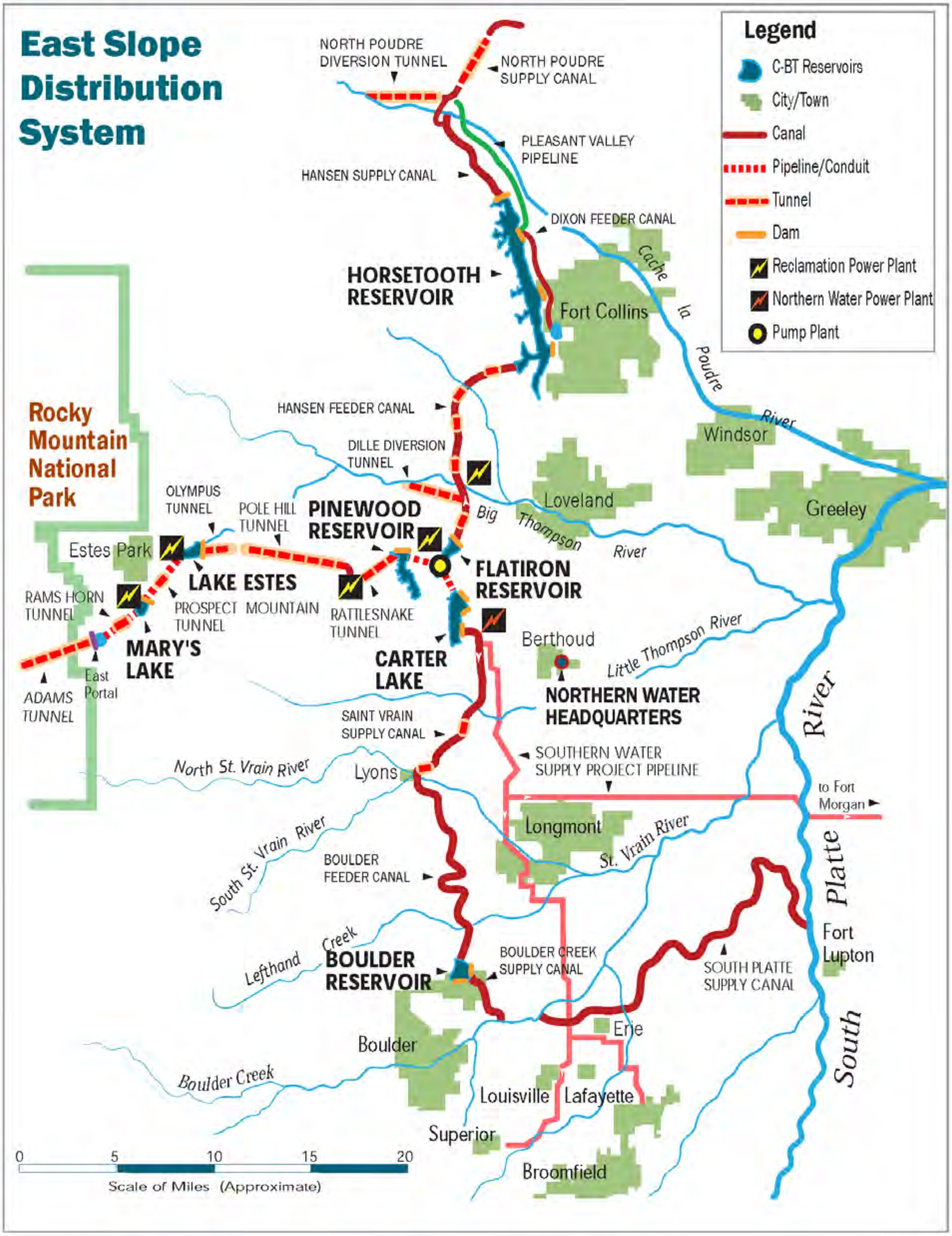


Figure 5-1: Colorado-Big Thompson East Slope Distribution System

5.10.3 Colorado-Big Thompson Project Operations

C-BT water is a large supplement supply for the South Platte Basin. This section explains how water is brought into the South Platte Basin via the Adams Tunnel and how it is distributed to the water districts and then to individual diversion structures. Several simplifying assumptions have been made in the modeling approach:

- The same infrastructure for Colorado-Big Thompson water is also used to distribute Windy Gap Project water. Windy Gap water is not accounted for separately from C-BT water in StateMod.
- Horsetooth Reservoir is not explicitly modeled in StateMod because all of Water District 3 is currently excluded from the model.
- Mary's Lake, Pinewood Reservoir, and Flatiron Reservoirs are not explicitly modeled because they serve as short term regulating reservoirs.

5.10.3.1 Alva B. Adams Tunnel (0404634), Olympus Tunnel (0401000), Dille Tunnel (0400540), Big Thompson Power Plant (0401001), Hansen Feeder Waste Way (0401002)

The Adams Tunnel is represented as an import node (0404634). The observed historical water deliveries are set as the import time series. Operating rules move all of the imported water immediately into an accounting plan "CBT_AllPln". From this accounting plan, C-BT water is distributed to two accounting plans. Ninety percent of the imports are moved to the Adams Tunnel Imports Plan "AdamsTunPln" and 10% to the City of Loveland C-BT Plan "LoveCBTPln". From the "AdamsTunPln", water is sent throughout Northern's East Slope distribution system. The modeling decision was made to maintain the historical distribution of C-BT deliveries by Water District. From Water District 4, C-BT water is delivered to the Hansen Feeder Canal (0400691) and the St. Vrain Supply Canal (0400692). Adams Tunnel water is first delivered to Hansen Feeder Canal, then to storage in Carter Lake, and then to the St. Vrain Supply Canal. C-BT users inside of Water District 4 have operating rules to access water in the "AdamsTunPln" after they have used their direct diversion rights. The City of Loveland has relatively junior direct diversion rights, which made them the last users in Water District 4 to attempt to access the Adams Tunnel water and frequently, there was no water left for the City of Loveland. Therefore, 10% of Adams Tunnel water is reserved for the City of Loveland in the "LoveCBTPln". The City of Loveland attempts to access that plan after its direct rights. C-BT exports to users outside of Water District 4 and C-BT users inside Water District 4 have operating rules to deliver remaining water from "LoveCBTPln" after the City of Loveland. Deliveries to users in the lower South Platte are also made via the Big Thompson River, as shown in the operating rule table below.

Olympus Tunnel (0401000) and Dille Tunnel (0400540) are both modeled as carriers. No demand sits at either structure. Olympus Tunnel and Dille Tunnel both have native water rights. These water rights are used to conduct the native diversion (skim) operation (discussed in C-BT overview above). These rights are relatively junior in the basin and generally are only in priority during high flow events. Native water is diverted at either Olympus Tunnel or Dille Tunnel to meet demands at the Big Thompson Power Plant (0401001) and the Hansen Feeder Waste Way (0401002). The Big Thompson Power Plant and the Hansen Feeder Waste Way have historical gaged records and return 100% of their diversions to the Big Thompson River. They are included to maintain the correct C-BT delivery volume to Water District 4. The Power Plant and Waste Way first have operating rules to use the C-BT native Big Thompson water rights at Olympus Tunnel and Dille Tunnel. One of the last operations in the Water District 4 is for the Power Plant and Waste Way to access C-BT transmountain water held in the “AdamsTunPln” accounting plan. Additionally, native water can be diverted at either Olympus Tunnel or Dille Tunnel to supplement the Hansen Feeder Canal demand. Olympus Tunnel can transport native water to Carter Lake.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Xbasin.01	1.00000	CBT_AllPln		0404634	35
CBTSplit.01	1.00001	AdamsTunPln LoveCBTPln	90 10	CBT_AllPln	46
AdamsTun.08	1.00007	C-BT Delivery to District 2 via the Big Thompson River	Olympus Tunnel (0401000), Olympus Tunnel Return Point (0401000_R)	AdamsTunPln	27
AdamsTun.12	90000.00007	Big Thompson Power Plant (0401001)	Olympus Tunnel (0401000),	AdamsTunPln	27
AdamsTun.13	90000.00007	Hansen Feeder Waste Way (0401002)	Olympus Tunnel (0401000),	AdamsTunPln	27
OlyTun.01	30572.00004	Big Thompson Power Plant (0401001)		0401000.01	11
DilTun.01	30572.00004	Big Thompson Power Plant (0401001)		0400540.01	11
OlyTun.02	30572.00004	Hansen Feeder Waste Way (0401002)		0401000.01	11
DilTun.02	30572.00004	Hansen Feeder Waste Way (0401002)		0400540.01	11
OlyTun.03	30572.00002	Hansen Feeder Canal Export to Water District 3	Hansen Feeder Canal (0400691)	0401000.01	11
DilTun.03	30572.00000	Hansen Feeder Canal Export to Water District 3	Hansen Feeder Canal (0400691)	0400540.01	11
OlyTun.05	30572.00001	Carter Lake (0404513)		0401000.01	11

5.10.3.2 Hansen Feeder Canal System (0400691, 0400691_I, 0400691_L, 0400961_X)

The Hansen Feeder Canal primarily diverts C-BT water to Horsetooth Reservoir is Water District 3. Minor diversions off the Canal are made for a small amount of irrigation in Water District 4. A turn-out from the Canal can supply water to the City of Loveland’s Green Ridge Glade Reservoir (0403659). More details on the City of Loveland operations can be found in the City of Loveland section below. To model the Hansen Feeder Canal System, node 0400691 is located on the mock tributary that also hosts Carter Lake (0404513), Big Thompson Power Plant (0401001), Hansen

Feeder Waste Way (0401002), St. Vrain Canal headgate (0400692), and the Olympus Tunnel return point (0401000_R).

The Hansen Feeder Canal headgate node (0400691) serves as a carrier. Water is diverted at this location to meet the Hansen Feeder Canal System demands. The irrigation demand in Water District 4 satisfied directly from the Canal, represented at node 0400691_I. The historical exports from Water District 4 to Water District 3 via Hansen Feeder Canal are represented at 0400691_X. The turn-out to the City of Loveland's Green Ridge Glade Reservoir is modeled as a carrier and does not have its own demand.

The following operating rules are used to meet the demands at 0400691_I and 0400691_X. C-BT water is the preferred source of water. Using the native Big Thompson water rights at Olympus Tunnel and Dille Tunnel, water can be diverted through either structure to meet the Hansen Feeder Canal Export Demand with operating rules. These rules fire late in the C-BT delivery sequence because that is not the preferred operations.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
AdamsTun.01	1.00001	Hansen Feeder Canal Export to Water District 3	Olympus Tunnel (0401000), Hansen Feeder Canal (0400691)	AdamsTunPln	27
AdamsTun.02	1.00002	Irrigation directly off Hansen Feeder Canal in Water District 4	Olympus Tunnel (0401000), Hansen Feeder Canal (0400691)	AdamsTunPln	27
Carter.04	30572.00003	Hansen Feeder Canal Export to Water District 3 (0400691_X)	Hansen Feeder Canal (0400691)	Carter Lake (0404513), Account 1	3
OlyTun.03	30572.00002	Hansen Feeder Canal Export to Water District 3	Hansen Feeder Canal (0400691)	0401000.01	11
DilTun.03	30572.00000	Hansen Feeder Canal Export to Water District 3	Hansen Feeder Canal (0400691)	0400540.01	11
LCBTSetA.01	58000.00001	Hansen Feeder Canal Export to Water District 3	Olympus Tunnel (0401000), Hansen Feeder Canal (0400691)	LoveCBTPln	27
LCBTSetA.02	58000.00001	Irrigation directly off Hansen Feeder Canal in Water District 4	Olympus Tunnel (0401000), Hansen Feeder Canal (0400691)	LoveCBTPln	27

5.10.3.3 Estes Lake (0404128) and Estes Park (0400518_I and 0400518_O)

Estes Lake is operated as a regulating reservoir. It does not have a large storage capacity. It is filled with C-BT water with operating rules and native Big Thompson water under a free river right. It releases to meet the Town of Estes Park indoor and outdoor demands. The Estes Park indoor and outdoor demands are first met with transmountain C-BT water from the AdamsTunPln.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
AdamsTun.09	1.00008	Estes Park Indoor (0400518_I)		AdamsTunPln	27
AdamsTun.10	1.00009	Estes Park Outdoor (0400518_O)		AdamsTunPln	27
AdamsTun.11	1.00010	Lake Estes (0404128)		AdamsTunPln	27
04041280.01	5.00001	Estes Park Indoor (0400518_I)		Lake Estes	3
04041280.02	5.00001	Estes Park Outdoor (0400518_O)		Lake Estes	3

5.10.3.4 Carter Lake (0404513) and the St. Vrain Supply Canal System (0400692)

Carter Lake is a large storage reservoir for C-BT water. It is filled with C-BT water from Adams Tunnel. It releases to the St. Vrain Supply Canal and to irrigation directly off the St. Vrain Canal in Water District 4. Carter Lake also releases to the Handy Ditch Reservoir System (0404146RS). This operation replaces the small amount of water that is intercepted by Carter Lake from Dry Creek, which historically was available to the Handy Ditch. The operation only occurs during the winter (November through March). Water is carried through the St. Vrain Supply Canal and tracked at node 0400692_L2. Lastly, Carter Lake can release to the Hansen Feeder Canal export demand. This operation does not happen frequently because it is expensive to pump water back out of Carter Lake.

The St. Vrain Supply Canal System primarily delivers C-BT water from Water District 4 to Water District 5. Additionally, there are turnouts to deliver C-BT water to the Little Thompson River and to irrigation directly off the Canal. C-BT deliveries to the Little Thompson River are tracked through node 0400692_L1, which does not have a demand, but serves as a carrier. Irrigation demand off St. Vrain Supply Canal in Water District 4 is represented at node 0400692_I.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
AdamsTun.03	3.00003	Carter Lake (0404513)	Olympus Tunnel (0401000)	AdamsTunPln	27
Carter.01	2.00001	St. Vrain Supply Canal Export to Water District 5 (040692_X)	St. Vrain Supply Canal (0400692)	Carter Lake (0404513)	3
Carter.02	2.00002	Irrigation directly off St. Vrain Supply Canal in Water District 4 (0400692_I)	St. Vrain Supply Canal (0400692)	Carter Lake (0404513)	3
Carter.03	2.00003	Handy Ditch Reservoir System (0400521)	St. Vrain Supply Canal (0400692) St. Vrain/Hertha Turnout (0400692_L2)	Carter Lake (0404513)	27
Carter.04	30572.00003	Hansen Feeder Canal Export to Water District 3 (0400691_X)	Hansen Feeder Canal (0400691)	Carter Lake (0404513)	3

AdamsTun.05	3.00004	St. Vrain Supply Canal Export to Water District 5 (0400692_X)	Olympus Tunnel (0401000), St. Vrain Supply Canal (0400692)	AdamsTunPln	27
AdamsTun.06	3.00005	Irrigation directly off St. Vrain Supply Canal in Water District 4 (0400692_I)	Olympus Tunnel (0401000), St. Vrain Supply Canal (0400692)	AdamsTunPln	27

5.10.3.5 Supplemental C-BT Deliveries in Water District 4

Northern Water provided a list of C-BT allottees, which were assigned to irrigation systems in Water District 4. In general, StateMod simulates the irrigation systems to divert their direct diversion and off-channel storage rights in priority. Releases from off-channel storage to meet irrigation demand occur after the most junior direct diversion right. If the irrigation demand is not met, then the irrigation system can request C-BT water from the Adams Tunnel Plan. Finally, if the off-channel storage has been drawn-down farther than it was historically, the storage can be refilled with C-BT water. This is a modeling concept to correct for real-time decisions made by irrigators to use their C-BT water instead of their reservoir storage. The operating rules that model supplemental C-BT deliveries are included in the irrigation systems described below. Irrigation systems are presented from upstream to downstream.

5.10.4 Water District 4 (Big Thompson Basin) Operations

This section describes the operations for diversion structures located in the Big Thompson Basin.

Where to find more information

- SPDSS Task Memorandum 3, “Identify Key Diversion Structures Notes from Water District 4 Meeting,” available on the CDSS website.
- SPDSS Task Memorandum 5, “Key Structure, Boulder Larimer Ditch,” available on the CDSS website.
- SPDSS Task Memorandum 5, “Key Structure, City of Loveland,” available on the CDSS website.
- SPDSS Task Memorandum 5, “Key Structure, Greeley Loveland Irrigation Company,” available on the CDSS website.
- SPDSS Task Memorandum 5, “Key Structure, Home Supply Ditch,” available on the CDSS website.

5.10.4.1 Handy Ditch System (0400521, 0400521_I, and 0404146RS)

Handy Ditch (0400521) diverts water from the Big Thompson River for irrigation (0400521_I) and an off-channel reservoir system (0404146RS). The off-channel reservoir system includes four connected reservoirs. Welch Reservoir (0404146), Hertha Reservoir (0404166), Coleman Reservoir (0404113), and Loveland Reservoir (0404133) release water for irrigation in the late season. Additionally, the Town of Berthoud owns a senior water right in the Handy Ditch and takes delivery of this water from Welch Reservoir. However, the Town of Berthoud is not explicitly modeled, so this operation is not captured in StateMod.

In addition to diversions from the Big Thompson, Handy Ditch can receive water from Carter Lake via Dry Creek to Hertha Reservoir. This operation replaces the small amount of water (190 af per year) that is intercepted by Carter Lake from Dry Creek, which historically was available to the Handy Ditch. The operation only occurs during the winter (November through March). Water is carried through the St. Vrain Supply Canal and tracked at node 0400692_L2.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
HandyDir.01	4839.00000	Handy Irrigation Demand (0400521_I)	Handy Ditch (0400521)	0400521.01	45
HandyDir.02	5235.00000	Handy Irrigation Demand (0400521_I)	Handy Ditch (0400521)	0400521.02	45
HandyDir.03	5535.00000	Handy Irrigation Demand (0400521_I)	Handy Ditch (0400521)	0400521.03	45
HandyDir.04	6269.00000	Handy Irrigation Demand (0400521_I)	Handy Ditch (0400521)	0400521.04	45
HandyDir.05	8157.00000	Handy Irrigation Demand (0400521_I)	Handy Ditch (0400521)	0400521.05	45
HandyDir.06	10286.00000	Handy Irrigation Demand (0400521_I)	Handy Ditch (0400521)	0400521.06	45
HandyDir.07	11307.00000	Handy Irrigation Demand (0400521_I)	Handy Ditch (0400521)	0400521.07	45
HandyDir.08	12201.10150	Handy Irrigation Demand (0400521_I)	Handy Ditch (0400521)	0400521.08	45
HandySto.01	24286.11597	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.01	45
HandySto.02	24286.12875	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.02	45
HandySto.03	24286.14209	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.03	45
HandySto.04	24286.19099	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.04	45
HandySto.05	24286.19754	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.05	45
HandySto.06	24286.21862	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.06	45
HandySto.07	26084.00000	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.07	45
HandySto.08	27531.00000	Handy Reservoir System	Handy Ditch (0400521)	0404146RS.08	45

		(0404146RS), all accounts			
HandySto.09	29675.17790	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.09	45
HandySto.11	29675.20426	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.11	45
HandySto.12	29675.26828	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.12	45
HandySto.13	29675.26828	Handy Reservoir System (0404146RS), all accounts	Handy Ditch (0400521)	0404146RS.13	45
HandySto.14	29685.20427	Handy Irrigation Demand (0400521_I)		Handy Reservoir System (0404146RS)	2
HandyCBT.90	29685.20428	Handy Irrigation Demand (0400521_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Handy Ditch (0400521)	AdamsTunPln	27
HandyCBT.91	58000.00000	Handy Reservoir System (0404146RS), all accounts	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Handy Ditch (0400521)	AdamsTunPln	27
HandyCBT.92	58000.00001	Handy Irrigation Demand (0400521_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Handy Ditch (0400521)	LoveCBTPln	27
HandyCBT.93	58000.00001	Handy Reservoir System (0404146RS), all accounts	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Handy Ditch (0400521)	LoveCBTPln	27

5.10.4.2 City of Loveland (0400511, 04_Lovelnd_I, 04_Lovelnd_O, 0403659)

The City of Loveland is the largest municipality in the Big Thompson Basin. The City has direct rights, storage rights, changed water rights from ditches in the basin, and Colorado-Big Thompson water. It does not have ground water supplies. The main diversion point for Loveland is the Loveland Pipeline (0400511), which carries water to either the raw water treatment plant or to Green Ridge Glade Reservoir (0403659) aka Loveland Municipal Reservoir. The pipeline headgate shares a river dam with the Home Supply Ditch (0400524). The capacity of the pipeline is 72 cfs, but historically, Loveland has not used the full capacity. In addition to the Loveland Pipeline, water can be delivered to Green Ridge Glade Reservoir from the Loveland Turnout (0400691_L) on the Hansen Feeder Canal (0400691). This is primarily used to receive C-BT water, but Loveland also has an agreement with Reclamation that up to 75 cfs of excess capacity in Hansen Feeder Canal can be used to deliver native Big Thompson water diverted under Loveland’s water rights. Water from Green Ridge Glade Reservoir is delivered to the water treatment plant. In StateMod, the Loveland Pipeline is used as the carrier for water and the Hansen Feeder Turnout to Loveland is not used. Indoor demand is modeled at diversion node 04_Lovelnd_I and outdoor demand is modeled at diversion node 04_Lovelnd_O. The wastewater treatment plant is located upstream of Hillsborough Ditch (0400523).

Loveland has a portfolio of water rights. The Loveland Pipeline has two direct diversion rights. Several court cases throughout time have been used to transfer water rights from irrigation use to municipal use. The early cases (CA5279 and CA8445) are referred to as the "Original Transfers". The majority of Loveland's changed water rights were adjudicated in Case No. 82CW202A – referred to as the 202A transfers. One unique aspect of the 202A transfers is that the water rights were fully transferred to the Loveland Pipeline, which means the water can be diverted without consideration for exchange potential.

The following table summarizes Loveland's changed water rights:

Ditch	Water Right ID	Total Amount (cfs)	Percent Changed	Admin No.	Case
Hillsborough	0400511.01	3.44	100%	4332.00000	CA5279
Big T Mfg.	0400511.03	1.39	100%	4839.00000	CA8445
Big T Mfg.	0400511.06	1.53	100%	5235.00000	CA8445
Big T Mfg.	0400511.11	2.69	100%	6269.00000	CA8445
Big T Mfg.	0400511.17	0.4	100%	8157.00000	CA8445
Barnes	0400511.09	18.56	57%	5772.00000	82CW202A
Barnes	0400511.14	12.06	57%	6361.00000	82CW202A
Barnes	0400511.21	19.93	57%	8575.00000	82CW202A
Big T Mfg.	0400511.04	15.05	12%	4839.00000	82CW202A
Big T Mfg.	0400511.07	16.31	10%	5235.00000	82CW202A
Big T Mfg.	0400511.12	28.9	10%	6269.00000	82CW202A
Big T Mfg.	0400511.18	4.3	10%	8157.00000	82CW202A
Chubbuck	0400511.10	8.36	25%	5784.00000	82CW202A
Chubbuck	0400511.15	39.04	25%	7598.00000	82CW202A
Chubbuck	0400511.22	35.5	25%	8699.00000	82CW202A
Greeley Loveland Irrigation Canal	0400511.24	11.48	32%	10532.00000	82CW202A
George Rist	0400511.20	73	3%	8522.00000	82CW202A
Louden	0400511.02	7	28%	4332.00000	82CW202A
Louden	0400511.16	40	28%	7944.00000	82CW202A
Louden	0400511.23	89.19	38%	10167.00000	82CW202A
South Side	0400511.05	1.39	18.7%	4839.00000	82CW202A
South Side	0400511.08	1.52	18.4%	5235.00000	82CW202A
South Side	0400511.13	2.68	18.3%	6269.00000	82CW202A
South Side	0400511.19	0.4	17.5%	8157.00000	82CW202A
South Side	0400511.25	40.88	22.7%	11269.00000	82CW202A

For all of the 202A water rights, the decree established Terms and Conditions based on how the water rights are used. For direct use, Loveland must leave 15% of its decreed rates in the ditches to replace historic ditch losses. Historic return flow obligations from the direct municipal use of the changed water rights are satisfied with outfall at the waste water treatment plant. For storage use, Loveland must leave the 15% ditch loss, plus additional decreed rates in the river to replace summertime return flows. These are summarized by ditch in the table below. Loveland must also make wintertime replacements. The decree established that 13% of the total amount of water stored during the previous irrigation season must be either released from storage or drawn from Green Ridge Glade Reservoir for municipal use.

Ditch-Specific Consumptive Use Factors (%)

Ditch	May	June	July	August	September	October
Barnes	56	76	75	68	14	0
Big T Mfg.	66	72	74	72	64	44
Chubbuck	68	75	75	68	23	0
George Rist	67	76	75	55	0	35
Louden	65	76	75	62	45	0
South Side	64	75	74	69	62	36

In StateMod, the changed water rights are put into ditch specific plans, subject to monthly and annual volumetric limitations. The Original Transfers Plan does not have return flow obligations. As discussed above, the 202A water rights have Terms and Conditions. To model the T&C, the water rights are split into Loveland Plans and Ditch Loss Plans, with 85% going to the Loveland Plans and 15% going to the Ditch Loss Plans. First, water in the various Loveland Plans is made available to Loveland indoor and outdoor demands. Second, water in the various Loveland Plans is made available to Loveland Storage demand, subject to carrier losses that represent the monthly ditch-specific consumptive use factors. A simplified approach is taken to modeling the wintertime return flow obligations for stored water. Water that is released from storage for use during the wintertime is not available to meet other return flow obligations, while summertime releases from storage are available. For the ditch loss plans, operating rules documented under the individual ditches make the plan water available to the ditch. Finally, if any water is left in the accounting plans, it is released back to the river at the Loveland Pipeline headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
OrigXfer.01	4332.00000	OrigXferPln		0400511.01	26
OrigXfer.02	4839.00000	OrigXferPln		0400511.03	26
OrigXfer.03	5235.00000	OrigXferPln		0400511.06	26
OrigXfer.04	6269.00000	OrigXferPln		0400511.11	26
OrigXfer.05	8157.00000	OrigXferPln		0400511.17	26
Barnes.01	5772.00000	Barnes_Pln		0400511.09	26

Barnes.02	6361.00000	Barnes_Pln		0400511.14	26
Barnes.03	8575.00000	Barnes_Pln		0400511.21	26
Barnes.04	8575.00001	BarnLV_Pln BarnDL_Pln	85% 15%	Barnes_Pln	46
BigTMfg.01	4839.00000	BigTMfg_Pln		0400511.04	26
BigTMfg.02	5235.00000	BigTMfg_Pln		0400511.07	26
BigTMfg.03	6268.00000	BigTMfg_Pln		0400511.12	26
BigTMfg.04	8157.00000	BigTMfg_Pln		0400511.18	26
BigTMfg.05	8157.00001	BigTLV_Pln BigTDL_Pln	85% 15%	BigTMfg_Pln	46
Chubbuck.01	5784.00000	ChubbuckPln		0400511.10	26
Chubbuck.02	7598.00000	ChubbuckPln		0400511.15	26
Chubbuck.03	8699.00000	ChubbuckPln		0400511.22	26
Chubbuck.04	10532.00000	ChubbuckPln		0400511.24	26
Chubbuck.05	10532.00001	ChubLV_Pln ChubDL_Pln	85% 15%	ChubbuckPln	46
GeoRist.01	8522.00000	GeoRist_Pln		0400511.20	26
GeoRist.02	8522.00001	GeoRLV_Pln GeoRDL_Pln	85% 15%	GeoRist_Pln	46
Louden.01	4332.00000	Louden_Pln		0400511.02	26
Louden.02	7994.00000	Louden_Pln		0400511.16	26
Louden.03	10167.00000	Louden_Pln		0400511.23	26
Louden.04	10167.00001	LoudLV_Pln LoudDL_Pln	85% 15%	Louden_Pln	46
SouSide.01	4839.00000	SouSide_Pln		0400511.05	26
SouSide.02	5235.00000	SouSide_Pln		0400511.08	26
SouSide.03	6269.00000	SouSide_Pln		0400511.13	26
SouSide.04	8157.00000	SouSide_Pln		0400511.19	26
SouSide.05	11269.00000	SouSide_Pln		0400511.25	46
SouSide.06	11269.00001	SouSdLV_Pln SouSdDL_Pln	85% 15%	SouSide_Pln	26
Loveland.01	8157.00002	04_Lovelnd_I	Loveland Pipeline (0400511)	OrigXferPln	27
Loveland.02	8157.00003	04_Lovelnd_O	Loveland Pipeline (0400511)	OrigXferPln	27
Loveland.03	8575.00002	04_Lovelnd_I	Loveland Pipeline (0400511)	BarnLV_Pln	27
Loveland.04	8575.00003	04_Lovelnd_O	Loveland Pipeline (0400511)	BarnLV_Pln	27
Loveland.05	8157.00002	04_Lovelnd_I	Loveland Pipeline (0400511)	BigTLV_Pln	27

Loveland.06	8157.00003	04_Lovelnd_O	Loveland Pipeline (0400511)	BigTLV_Pln	27
Loveland.07	10532.00002	04_Lovelnd_I	Loveland Pipeline (0400511)	ChubLV_Pln	27
Loveland.08	10532.00003	04_Lovelnd_O	Loveland Pipeline (0400511)	ChubLV_Pln	27
Loveland.09	8522.00002	04_Lovelnd_I	Loveland Pipeline (0400511)	GeoRLV_Pln	27
Loveland.10	8522.00003	04_Lovelnd_O	Loveland Pipeline (0400511)	GeoRLV_Pln	27
Loveland.11	10167.00002	04_Lovelnd_I	Loveland Pipeline (0400511)	LoudLV_Pln	27
Loveland.12	10167.00003	04_Lovelnd_O	Loveland Pipeline (0400511)	LoudLV_Pln	27
Loveland.13	11269.00002	04_Lovelnd_I	Loveland Pipeline (0400511)	SouSdLV_Pln	27
Loveland.14	11269.00003	04_Lovelnd_O	Loveland Pipeline (0400511)	SouSdLV_Pln	27
Loveland.15	14691.13563	04_Lovelnd_I		0400511.26	11
Loveland.16	14691.13563	04_Lovelnd_O		0400511.26	11
Loveland.17	18719.00000	04_Lovelnd_I		0400511.27	11
Loveland.18	18719.00000	04_Lovelnd_O		0400511.27	11
Loveland.19	56247.53171	04_Lovelnd_I		0400511.28	11
Loveland.20	56247.53171	04_Lovelnd_O		0400511.28	11
LoveCBT.01	56247.53175	04_Lovelnd_I	Loveland Pipeline (0400511)	LoveCBTPln	27
LoveCBT.02	56247.53175	04_Lovelnd_O	Loveland Pipeline (0400511)	LoveCBTPln	27
LoveCBT.03	56247.53175	Green Ridge Glade Reservoir (0403659), account 1	Loveland Pipeline (0400511)	LoveCBTPln	27
LoveCBT.04	56247.53175	04_Lovelnd_I	Loveland Pipeline (0400511)	AdamsTunPln	27
LoveCBT.05	56247.53175	04_Lovelnd_O	Loveland Pipeline (0400511)	AdamsTunPln	27
LoveCBT.06	56247.53175	Green Ridge Glade Reservoir (0403659), account 1	Loveland Pipeline (0400511)	AdamsTunPln	27
GrnRdg.01	45290.45081	Green Ridge Glade Reservoir (0403659), accounts 1 and 2	Loveland Turnout (0400691_L)	0403659.01	11
GrnRdg.02	49673.47545	Green Ridge Glade Reservoir (0403659), accounts 1 and 2	Loveland Turnout (0400691_L)	0403659.02	11
GrnRdg.03	49673.47545	Green Ridge Glade Reservoir (0403659), accounts 1 and 2	Loveland Turnout (0400691_L)	0403659.03	11

GrnRdg.03a (May) - GrnRdg.03e (September)	8575.00005	Green Ridge Glade Reservoir (0403659), account 3	Loveland Pipeline (0400511)	BarnLV_Pln	27
GrnRdg.04a (May) - GrnRdg.04f (October)	8157.00005	Green Ridge Glade Reservoir (0403659), account 3	Loveland Pipeline (0400511)	BigTLV_Pln	27
GrnRdg.05a (May) - GrnRdg.05e (September)	10532.00005	Green Ridge Glade Reservoir (0403659), account 3	Loveland Pipeline (0400511)	ChubLV_Pln	27
GrnRdg.06a (May) - GrnRdg.06f (October)	8522.00005	Green Ridge Glade Reservoir (0403659), account 3	Loveland Pipeline (0400511)	GeoRLV_Pln	27
GrnRdg.07a (May) - GrnRdg.07e (September)	10167.00005	Green Ridge Glade Reservoir (0403659), account 3	Loveland Pipeline (0400511)	LoudLV_Pln	27
GrnRdg.08a (May) - GrnRdg.08f (October)	11269.00005	Green Ridge Glade Reservoir (0403659), account 3	Loveland Pipeline (0400511)	SouSdLV_Pln	27
GrnRdg.09	58000.00000	04_Lovelnd_I		Green Ridge Glade Reservoir (0403659), account 1	2
GrnRdg.10	58000.00001	04_Lovelnd_O		Green Ridge Glade Reservoir (0403659), account 1	2
GrnRdg.11 (winter)	58000.00002	04_Lovelnd_I		Green Ridge Glade Reservoir (0403659), account 3	27
GrnRdg.12 (summer)	58000.00002	04_Lovelnd_I		Green Ridge Glade Reservoir (0403659), account 3	27
OrigXferPln	90000.00000	0400511		OrigXferPln	29
Barnes_Pln	90000.00000	0400511		Barnes_Pln	29
BarnLV_Pln	90000.00000	0400511		BarnLV_Pln	29
BarnDL_Pln	90000.00000	0400511		BarnDL_Pln	29
BigTMfg_Pln	90000.00000	0400511		BigTMfg_Pln	29

BigTLV_Pln	90000.00000	0400511		BigTLV_Pln	29
BigTDL_Pln	90000.00000	0400511		BigTDL_Pln	29
ChubbuckPln	90000.00000	0400511		ChubbuckPln	29
ChubLV_Pln	90000.00000	0400511		ChubLV_Pln	29
ChubDL_Pln	90000.00000	0400511		ChubDL_Pln	29
GeoRist_Pln	90000.00000	0400511		GeoRist_Pln	29
GeoRLV_Pln	90000.00000	0400511		GeoRLV_Pln	29
GeoRDL_Pln	90000.00000	0400511		GeoRDL_Pln	29
Louden_Pln	90000.00000	0400511		Louden_Pln	29
LoudLV_Pln	90000.00000	0400511		LoudLV_Pln	29
LoudDL_Pln	90000.00000	0400511		LoudDL_Pln	29
SouSide_Pln	90000.00000	0400511		SouSide_Pln	29
SouSdLV_Pln	90000.00000	0400511		SouSdLV_Pln	29
SouSdDL_Pln	90000.00000	0400511		SouSdDL_Pln	29

5.10.4.3 Home Supply and George Rist Ditch System (0400524, 0400524_I, 0400520, 0400520_I, 0404137RS)

Home Supply Ditch (0400524) and George Rist Ditch (0400520) divert water from the Big Thompson River for irrigation (0400524_I) and off-channel reservoir system (0404137RS). The off-channel reservoir system includes three interconnected reservoirs. Lone Tree Reservoir (0404137) and Lon Hagler Reservoir (0404136) can be filled by Home Supply Ditch. Mariano Reservoir (0404134) can be filled by George Rist Ditch and with releases from Lon Hagler Reservoir. Lone Tree Reservoir releases to Home Supply irrigation demands and to Johnston Municipal Demand. In StateMod, Johnston is not modeled explicitly; therefore releases from Lone Tree are only made to irrigation demand. Home Supply and George Rist irrigators use Lon Hagler and Mariano Reservoirs to make releases back to the Big Thompson River so they can divert at the headgates by exchange. Lon Hagler and Mariano Reservoirs cannot make releases directly to irrigation. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
HmSupDir.01	4332.00000	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	0400524.01	45
HmSupDir.02	4839.00000	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	0400524.02	45
HmSupDir.03	5235.00000	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	0400524.03	45
HmSupDir.04	6269.00000	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	0400524.04	45
HmSupDir.05	8157.00000	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	0400524.05	45

HmSupDir.07	11519.00000	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	0400524.07	45
HmSupDir.08	12201.11396	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	0400524.08	45
HmSupDir.09	16902.00000	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	0400524.09	45
HmSupDir.12	50038.11519	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	0400524.12	45
GRistDir.01	8522.00000	George Rist Irrigation Demand (0400520_I)	George Rist Ditch (0400520)	0400520.01	45
GRistDir.01a	8522.00009	George Rist Irrigation Demand (0400520_I)	George Rist Ditch (0400520)	George Rist Ditch Loss Plan (GeoRDL_Pln)	27
HmSupSto.01	11355.00000	Reservoir System (0404137RS), all accounts	Home Supply Ditch (0400524)	0404137RS.01	45
HmSupSto.02	29675.20984	Reservoir System (0404137RS), all accounts	Home Supply Ditch (0400524)	0404137RS.03	45
GRistSto.01	14093.00000	Reservoir System (0404137RS), all accounts	George Rist Ditch (0400520)	0404137RS.02	45
GRistSto.02	29675.20986	Reservoir System (0404137RS), all accounts	George Rist Ditch (0400520)	0404137RS.04	45
HmSupSto.03	43829.39999	Reservoir System (0404137RS), all accounts	Home Supply Ditch (0400524)	0404137RS.05	45
HmSupSto.04	47481.47349	Reservoir System (0404137RS), all accounts	Home Supply Ditch (0400524)	0404137RS.06	45
HmSupSto.05	50038.11520	Home Supply Irrigation Demand (0400524_I)		Reservoir System (0404137RS), Lone Tree pool	3
HmSupSto.06	50038.11521	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	Reservoir System (0404137RS), Lon Hangler pool	28
HmSupSto.07	50038.11522	Home Supply Irrigation Demand (0400524_I)	Home Supply Ditch (0400524)	Reservoir System (0404137RS), Mariano pool	28
HmSupCBT.90	50038.11523	Home Supply Irrigation Demand (0400524_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Home Supply Ditch (0400524)	AdamsTunPln	27
GRistCBT.90	29586.20988	George Rist Irrigation Demand (0400520_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), George Rist Ditch (0400520)	AdamsTunPln	27
HmSupCBT.91	58000.00000	Reservoir System (0404137RS), all accounts	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Home Supply Ditch (0400524)	AdamsTunPln	27
HmSupCBT.92	58000.00001	Home Supply Irrigation Demand (0400524_I)	Olympus Tunnel (0401000), Olympus Tunnel return point	LoveCBTPln	27

			(0401000_R), Home Supply Ditch (0400524)		
GRistCBT.92	58000.00001	George Rist Irrigation Demand (0400520_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), George Rist Ditch (0400520)	LoveCBTPln	27
HmSupCBT.93	58000.00001	Reservoir System (0404137RS), all accounts	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Home Supply Ditch (0400524)	LoveCBTPln	27

5.10.4.4 South Side Ditch System (0400543, 0400543_I, and 0404171RS)

South Side Ditch (0400543) diverts water from the Big Thompson River for irrigation (0400543_I) and its off-channel reservoir system (0404171RS). The off-channel reservoir system includes two connected reservoirs. South Side Reservoir (0404142) and Ryan Gulch Reservoir (0404171) are filled by South Side Ditch. The reservoir system releases to South Side irrigation demands. In StateMod, the occasional releases from the reservoir system back to the Big Thompson for exchange purposes are not captured because this operation is sporadic. The ditch system also can request C-BT water from the Adams Tunnel Plan and later from the Loveland set-aside plan. Some of the water rights in the ditch have been changed for municipal use by the City of Loveland. As part of the terms and conditions, the City of Loveland must replace ditch losses. This is accomplished with operating rule SSideDir.06. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SSideDir.01	4839.00000	South Side Irrigation Demand (0400543_I)	South Side Ditch (0400543)	0400524.01	45
SSideDir.02	5235.00000	South Side Irrigation Demand (0400543_I)	South Side Ditch (0400543)	0400524.02	45
SSideDir.03	6269.00000	South Side Irrigation Demand (0400543_I)	South Side Ditch (0400543)	0400524.03	45
SSideDir.04	8157.00000	South Side Irrigation Demand (0400543_I)	South Side Ditch (0400543)	0400524.04	45
SSideDir.05	11269.00000	South Side Irrigation Demand (0400543_I)	South Side Ditch (0400543)	0400524.05	45
SSideDir.06	11269.00009	South Side Irrigation Demand (0400543_I)	South Side Ditch (0400543)	SouSdDL_Pln	27
SSideSto.01	19825.00000	South Side Reservoir System (0404171RS)	South Side Ditch (0400543)	0404171RS.01	45
SSideSto.02	19826.00000	South Side Reservoir System (0404171RS)	South Side Ditch (0400543)	0404171RS.02	45
SSideSto.03	29675.20987	South Side Reservoir System (0404171RS)	South Side Ditch (0400543)	0404171RS.03	45
SSideSto.04	29675.20988	South Side Reservoir System (0404171RS)	South Side Ditch (0400543)	0404171RS.04	45
SSideSto.05	29675.26152	South Side Reservoir	South Side Ditch	0404171RS.05	45

		System (0404171RS)	(0400543)		
SSideSto.06	29675.26828	South Side Reservoir System (0404171RS)	South Side Ditch (0400543)	0404171RS.06	45
SSideSto.07	29675.26829	South Side Irrigation Demand (0400543_I)		South Side Reservoir System (0404171RS)	2
SSideCBT.90	29675.26830	South Side Irrigation Demand (0400543_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), South Side Ditch (0400534)	AdamsTunPln	27
SSideCBT.91	58000.00000	South Side Reservoir System (0404171RS)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), South Side Ditch (0400534)	AdamsTunPln	27
SSideCBT.92	58000.00001	South Side Irrigation Demand (0400543_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), South Side Ditch (0400534)	LoveCBTPln	27
SSideCBT.94	58000.00001	South Side Reservoir System (0404171RS)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), South Side Ditch (0400534)	LoveCBTPln	27

5.10.4.5 Louden Ditch System (0400530, 0400530_I, and 0404138RS)

Louden Ditch (0400530) aka Rist Benson Ditch diverts water from the Big Thompson River for irrigation (0400530_I) and its off-channel reservoir system (0404138RS). The off-channel reservoir system includes a series of three reservoirs. Rist Benson Reservoir (0404138), Donath Reservoir (0404116) and Fairport Reservoir (0404118) are filled by Louden Ditch. The reservoir system releases to Louden Ditch irrigation demands. In StateMod, the occasional releases from Rist Benson Reservoir directly to Big Barnes Ditch for exchange purposes are not captured because this operation is sporadic. Similarly, the occasion exchanges operated by the City of Loveland through the ditch are not captured. The ditch system can request C-BT water from the Adams Tunnel Plan and later from the Loveland set-aside plan. Some of the water rights in the ditch have been changed for municipal use by the City of Loveland. As part of the terms and conditions, the City of Loveland must replace ditch losses. This is accomplished with operating rule RistDir.04. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
RistDir.01	4332.00000	Louden Irrigation Demand (0400530_I)	Louden Ditch (0400530)	0400530.01	45
RistDir.02	7944.00000	Louden Irrigation Demand (0400530_I)	Louden Ditch (0400530)	0400530.02	45

RistDir.03	10167.00000	Louden Irrigation Demand (0400530_I)	Louden Ditch (0400530)	0400530.03	45
RistDir.04	10167.00009	Louden Irrigation Demand (0400530_I)	Louden Ditch (0400530)	LoudDL_Pln	27
RistSto.01	12108.00000	Louden Reservoir System (0404138RS)	Louden Ditch (0400530)	0404138RS.01	45
RistSto.02	19473.00000	Louden Reservoir System (0404138RS)	Louden Ditch (0400530)	0404138RS.02	45
RistSto.03	24286.11879	Louden Reservoir System (0404138RS)	Louden Ditch (0400530)	0404138RS.03	45
RistSto.04	29675.19473	Louden Reservoir System (0404138RS)	Louden Ditch (0400530)	0404138RS.04	45
RistSto.05	29675.20985	Louden Reservoir System (0404138RS)	Louden Ditch (0400530)	0404138RS.05	45
RistSto.06	29675.29584	Louden Reservoir System (0404138RS)	Louden Ditch (0400530)	0404138RS.06	45
RistSto.07	29675.25985	Louden Reservoir System (0404138RS)		Louden Reservoir System (0404138RS)	2
LoudnCBT.90	29675.25986	Louden Irrigation Demand (0400530_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Louden Ditch (0400530)	AdamsTunPln	27
LoudnCBT.91	58000.00000	Louden Reservoir System (0404138RS)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Louden Ditch (0400530)	AdamsTunPln	27
LoudnCBT.92	58000.00001	Louden Irrigation Demand (0400530_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Louden Ditch (0400530)	LoveCBTPln	27
LoudnCBT.93	58000.00001	Louden Reservoir System (0404138RS)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), Louden Ditch (0400530)	LoveCBTPln	27

5.10.4.6 Greeley Loveland Irrigation Canal (GLIC) System (0400501, 0400532, 0400532_I, 0400702, 0404110RS)

Barnes Ditch aka Big Barnes Ditch aka Chubbuck Ditch (0400501) and Greeley Loveland Irrigation Canal (0400532), aka the Loveland Greeley Canal, divert water from the Big Thompson River for irrigation (0400532_I), off-channel reservoir system (0404110RS) and City of Greeley municipal supply (0400702). The off-channel reservoir system includes three connected reservoirs. Loveland Greeley Reservoir aka Lake Loveland (0404131), Horseshoe Reservoir No. 2 aka seven Lakes Reservoir (0404155), and Boyd Lake (0404110) can be filled by Barnes Ditch. Water can be transferred from Lake Loveland through Horseshoe Reservoir down to Boyd Lake. The reservoir system releases to GLIC irrigation demands (0400532_I) and to City of Greeley municipal demand. In StateMod, City of Greeley is not fully represented because its main water supply is the Poudre River (Water District 3 is not included in this model). Only the historical diversions at the Greeley Filter Plant (0400702) are included. The Greeley Filter Plant is used to meet peak summer demand and pulls water directly from Boyd Lake. The ditch system can request C-BT water from the Adams Tunnel Plan and later from the Loveland set-aside plan. Additionally, the City of Evans has an agreement to take their C-BT water through the GLIC system and have it treated at the Greeley Filter Plant. Some of the water rights that were originally under the Chubbuck Ditch and Barnes Ditch water rights have been changed for municipal use by the City of Loveland. As part of the terms and conditions, the City of Loveland must replace ditch losses. This is accomplished with operating rules GLIC_Dir.04 and GLIC_Dir.09. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
GLIC_Dir.01	5772.00000	GLIC Irrigation Demand (0400532_I)	Barnes Ditch (0400501)	0400501.01	45
GLIC_Dir.02	6361.00000	GLIC Irrigation Demand (0400532_I)	Barnes Ditch (0400501)	0400501.02	45
GLIC_Dir.03	8575.00000	GLIC Irrigation Demand (0400532_I)	Barnes Ditch (0400501)	0400501.03	45
GLIC_Dir.04	8575.00009	GLIC Irrigation Demand (0400532_I)	Barnes Ditch (0400501)	BarnDL_Pln	27
GLIC_Dir.05	5784.00000	GLIC Irrigation Demand (0400532_I)	GLIC (0400532)	0400532.01	45
GLIC_Dir.06	7598.00000	GLIC Irrigation Demand (0400532_I)	GLIC (0400532)	0400532.02	45
GLIC_Dir.07	10532.00000	GLIC Irrigation Demand (0400532_I)	GLIC (0400532)	0400532.03	45
GLIC_Dir.08	11414.00000	GLIC Irrigation Demand (0400532_I)	GLIC (0400532)	0400532.04	45
GLIC_Dir.09	10532.00009	GLIC Irrigation Demand (0400532_I)	GLIC (0400532)	ChubDL_Pln	27
GrlyFilt.01	5784.00000	Greeley Filter Plant (0400702)	GLIC (0400532)	0400532.01	45
GrlyFilt.02	7598.00000	Greeley Filter Plant (0400702)	GLIC (0400532)	0400532.02	45
GrlyFilt.03	10532.00000	Greeley Filter Plant (0400702)	GLIC (0400532)	0400532.03	45
GrlyFilt.04	11414.00000	Greeley Filter Plant (0400702)	GLIC (0400532)	0400532.04	45
GLIC_Sto.01	15720.00000	GLIC Reservoir System (0404110RS), all accounts	Barnes Ditch (0400501)	0404110RS.01	45
GLIC_Sto.02	19110.00000	GLIC Reservoir System (0404110RS), all accounts	Barnes Ditch (0400501)	0404110RS.02	45
GLIC_Sto.03	19110.00000	GLIC Reservoir System (0404110RS), all accounts	Barnes Ditch (0400501)	0404110RS.03	45
GLIC_Sto.04	46386.15720	GLIC Reservoir System	Barnes Ditch (0400501)	0404110RS.04	45

		(0404110RS), all accounts			
GLIC_Sto.05	46386.19110	GLIC Reservoir System (0404110RS), all accounts	GLIC (0400532)	0404110RS.05	45
GLIC_Sto.06	46386.19110	GLIC Reservoir System (0404110RS), all accounts	Barnes Ditch (0400501)	0404110RS.06	45
GLIC_Sto.07	46836.19111	GLIC Irrigation Demand (0400532_I)		GLIC Reservoir System (0404110RS), Irrigator account	2
GLIC_Sto.08	29675.14732	Greeley Filter Plant (0400702)		GLIC Reservoir System (0404110RS), Irrigator account	2
EvansCBT.90	57000.00003	Greeley Filter Plant (0400702)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), GLIC (0400532)	AdamsTunPln	27
GLIC_CBT.90	46836.19112	GLIC Irrigation Demand (0400532_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), GLIC (0400532)	AdamsTunPln	27
GLIC_CBT.92	58000.00000	GLIC Reservoir System (0404110RS), all accounts	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), GLIC (0400532)	AdamsTunPln	27
EvansCBT.92	58000.00001	Greeley Filter Plant (0400702)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), GLIC (0400532)	LoveCBTPln	27
GLIC_CBT.93	58000.00001	GLIC Irrigation Demand (0400532_I)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), GLIC (0400532)	LoveCBTPln	27
GLIC_CBT.95	58000.00001	GLIC Reservoir System (0404110RS), all accounts	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R), GLIC (0400532)	LoveCBTPln	27

5.10.4.7 Big Thompson Ditch and Manufacturing Company (0400503)

The City of Loveland has changed some water under the Big Thompson Ditch and Manufacturing Company to municipal use. As part of the terms and conditions, the City must replace ditch lose. This is accomplished with operating rule BigTMDir.01. The ditch system can request C-BT water from the Adams Tunnel Plan and later from the Loveland set-aside plan. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BigTMDir.01	8157.00002	Big Thompson Ditch and Manufacturing Company (0400503)		BigTDL_Pln	27
BigTMCBT.90	8157.00003	Big Thompson Ditch and Manufacturing Company (0400503)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R)	AdamsTunPln	27
BigTMCBT.92	58000.00001	Big Thompson Ditch and Manufacturing Company (0400503)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R)	LoveCBTPln	27

5.10.4.8 Hillsborough Ditch (0400523)

Hillsborough Ditch (0400523) diverts water from the Big Thompson River for irrigation. The ditch system can request C-BT water from the Adams Tunnel Plan and later from the Loveland set-aside plan. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
HillBCBT.90	29586.20988	Hillsborough Ditch (0400523)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R)	AdamsTunPln	27
HillBCBT.92	58000.00001	Hillsborough Ditch (0400523)	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R)	LoveCBTPln	27

5.10.4.9 Boulder Larimer Ditch System (0400588, 0400588_I, 0404156)

Boulder Larimer Ditch (0400588) aka Ish Ditch diverts water from the Little Thompson River for irrigation (0400588_I) and the off-channel Ish Reservoir (0404156) aka Boulder Larimer Reservoir. Ish Reservoir releases to Boulder Larimer Ditch irrigation demands. In StateMod, the connection between the Highland Ditch System (0500526) and the Boulder Larimer Ditch is represented as a delivery from Foothills Reservoir. Physically, the water would come via Highland Reservoir No. 2 (0504032), but the operations are simplified in StateMod. For more details on the Highland Ditch System, see the Highland Ditch (0500526) section.

The Boulder Larimer Ditch system can request C-BT water from the Adams Tunnel Plan and later from the Loveland set-aside plan. C-BT water is delivered through Olympus Tunnel (0401000) to the

St. Vrain Canal (0400692) and then turned out to the Little Thompson through 0400692_L1. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
IshDir.01	9312.00000	Boulder Larimer Irrigation Demand (0400588_I)	Boulder Larimer Ditch (0400588)	0400588.01	45
IshDir.01	10002.00000	Boulder Larimer Irrigation Demand (0400588_I)	Boulder Larimer Ditch (0400588)	0400588.02	45
IshSto.01	14691.09312	Ish Reservoir (0404156), irrigator account	Boulder Larimer Ditch (0400588)	0404156.01	45
IshSto.02	14691.10002	Ish Reservoir (0404156), irrigator account	Boulder Larimer Ditch (0400588)	0404156.02	45
IshSto.03	14869.00000	Ish Reservoir (0404156), irrigator account	Boulder Larimer Ditch (0400588)	0404156.03	45
IshSto.04	19726.00000	Ish Reservoir (0404156), irrigator account	Boulder Larimer Ditch (0400588)	0404156.04	45
IshSto.05	53691.50198	Ish Reservoir (0404156), irrigator account	Boulder Larimer Ditch (0400588)	0404156.05	45
IshSto.06	53691.50199	Boulder Larimer Irrigation Demand (0400588_I)		Ish Reservoir (0404156), irrigator account	2
FH_BoLarIsh	53691.50200	0400588_I		0504071	3
IshCBT.90	53691.50200	Boulder Larimer Irrigation Demand (0400588_I)	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1), Larimer Boulder (0400588)	AdamsTunPln	27
IshCBT.91	57500.00000	Ish Reservoir (0404156), irrigator account	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1), Larimer Boulder (0400588)	AdamsTunPln	27
04AUP2_I.01	5.00002	04_AUP002_I	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R)	AdamsTunPln	27
04AUP2_O.01	5.00002	04_AUP002_O	Olympus Tunnel (0401000), Olympus Tunnel return point (0401000_R)	AdamsTunPln	27
IshCBT.92	58000.00001	Boulder Larimer Irrigation Demand (0400588_I)	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R)	LoveCBTPln	27

			(0400692_L1), Larimer Boulder (0400588)		
IshCBT.91	58000.00001	Ish Reservoir (0404156), irrigator account	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1), Larimer Boulder (0400588)	LoveCBTPln	27

5.10.4.10 Eagle Ditch (0400592)

Eagle Ditch (0400592) diverts water from the Little Thompson River for irrigation. The ditch system can request C-BT water from the Adams Tunnel Plan and later from the Loveland set-aside plan. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
EagleCBT.90	9922.00001	Eagle Ditch (0400592)	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1)	AdamsTunPln	27
EagleCBT.91	58000.00001	Eagle Ditch (0400592)	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1)	LoveCBTPln	27

5.10.4.11 Osborne Caywood Ditch (0400600)

Osborne Caywood Ditch (0400600) diverts water from the Little Thompson River for irrigation. The ditch system can request C-BT water from the Adams Tunnel Plan and later from the Loveland set-aside plan. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
OsCayCBT.90	9922.00001	Osborne Caywood Ditch (0400600)	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1)	AdamsTunPln	27
OsCayCBT.91	58000.00001	Osborne Caywood Ditch (0400600)	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1)	LoveCBTPln	27

5.10.4.12 Rockwell Ditch (0400601)

Rockwell Ditch (0400601) diverts water from the Little Thompson River for irrigation. The ditch system can request C-BT water from the Adams Tunnel Plan and later from the Loveland set-aside plan. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
RkwllCBT.90	14691.11659	Rockwell Ditch (0400601)	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1)	AdamsTunPln	27
RkwellCBT.91	58000.00001	Rockwell Ditch (0400601)	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1)	LoveCBTPln	27

5.10.4.13 Miner Longan Ditch (0400599)

Minter Longan Ditch (0400599) diverts water from the Little Thompson River for irrigation. The ditch system can request C-BT water from the Adams Tunnel Plan and later from the Loveland set-aside plan. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
MinLnCBT.90	15941.00001	Miner Longan Ditch (0400599)	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1)	AdamsTunPln	27
MinLnCBT.91	58000.00001	Miner Longan Ditch (0400599)	Olympus Tunnel (0401000), St. Vrain Canal (0400692), St. Vrain/Little Thompson Turnout (R) (0400692_L1)	LoveCBTPln	27

5.10.5 Water District 5 (St. Vrain) Operations

This section explains how the irrigation, reservoirs, and municipal systems of the St. Vrain Creek are modeled.

Where to find more information

- SPDSS Task Memorandum 3, "Identify Key Diversion Structures Notes from Water District 5 Meeting," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, City of Longmont," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, Highland Ditch," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, Left Hand Ditch," available on the CDSS website.

5.10.5.1 C-BT Imports and Exports through the St. Vrain Basin

C-BT water is delivered to the St. Vrain Basin either by the St. Vrain Supply Canal (SVSC) or by the Southern Water Supply Pipeline (SWSP). The SVSC starts at Carter Lake and terminates at St. Vrain Creek, just downstream of Lyons. The Boulder Feeder Canal, which carries water to Boulder Reservoir, begins at the terminus of the St. Vrain Supply Canal. Boulder Reservoir operations are included in this section of the document. SWSP also starts at Carter Lake, but its water never appears in the river. It provides raw water to municipal water treatment plants that have direct connections to the pipeline. After delivering water to Longmont, SWSP bifurcates and continues east toward Fort Morgan and south toward Louisville and Lafayette.

C-BT imports are split between four locations in the St. Vrain Basin. C-BT water is accounted for separately at the following locations:

- Deliveries to Longmont from SWSP and the SVSC (05_LongCBT). This total volume was provided by Northern Water. Water is available to meet Longmont Indoor and Outdoor demand, as shown in the table below.
- Deliveries to St. Vrain Creek from the St. Vrain Supply Canal (05_SVCBT). This volume is calculated as the total supply in the St. Vrain Supply Canal minus deliveries to Longmont and minus the total supply in the Boulder Feeder Canal, as measured at the BFCLYCOC gage. Water is available to C-BT participates in Water District 5 that divert from the St. Vrain Creek. The full list is documented in the table below.
- Deliveries to Left Hand Creek via a turnout from the Boulder Feeder Canal (05_LHCBT). This was calculated as the total supply in the Boulder Feeder Canal minus deliveries to Boulder Reservoir. Water is available to diversion structures on Left Hand Ditch, as documented in the table below.

- Deliveries to Boulder Reservoir (05_BRCBT). This was calculated from change in Boulder Reservoir storage and releases to the Boulder Creek Supply Canal when gaged inflow to Boulder Reservoir is not available.

C-BT water released from Boulder Reservoir to the Boulder Supply Canal is modeled as an export.

In the table below, rules to release water from the LongCBT_Pln are shown. The plan holds Longmont's municipal C-BT supply from the Southern Water Supply Project Pipeline. It is used to meet 05LONG_OUT and 05LONG_IN demands.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
05LngCBT	2.00000	LongCBT_Pln		05_LongC-BT	35
05LngCBTPln1	2.00001	Longmont Indoor Use (05LONG_IN)		LongCBT_Pln	27
05LngCBTPln2	2.00002	Longmont Outdoor Use (05LONG_OUT)		LongCBT_Pln	27
05LngCBTSpl	2.00003	Longmont Outdoor Use (05LONG_OUT)		LongCBT_Pln	29

In the table below, rules to release water from the 05_STVCBT_Pln are shown. The plan holds C-BT water from the St. Vrain Supply Canal and delivered to users via the St. Vrain.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
05SVCBT	1.00000	05_SVCBT_Pln		05_SVCBT	35
05SVCBTPln1	19861.00001	LEFT HAND DITCH DIVERSION (0500603)		05_SVCBT_Pln	28
05SVCBTPln2	12677.00001	SOUTH LEDGE DITCH (0500520)		05_SVCBT_Pln	28
05SVCBTPln3	11841.04110	REESE STILES DITCH (0500519)		05_SVCBT_Pln	28
05SVCBTPln4	42907.00001	LYONS PIPELINE (0500512)		05_SVCBT_Pln	28
05SVCBTPln5	21702.00001	LONGMONT NORTH PIPELINE (0500511)		05_SVCBT_Pln	28
05SVCBTPln6	41785.00002	BUTTON ROCK RES (0504010), Account 1		05_SVCBT_Pln	28
05SVCBTPln7	52960.48364	SUPPLY DITCH (0500523)		05_SVCBT_Pln	27
05SVCBTPln8	35184.00006	HIGHLAND IRRIGATION (0500526_I)	HIGHLAND DITCH (0500526)	05_SVCBT	35
05SVCBTPln9	35184.00007	HIGHLAND RESERVOIR NO. 2 (0504032), Account 1	HIGHLAND DITCH (0500526)	05_SVCBT_Pln	27
05SVCBTPln10	35184.00008	HIGHLAND RESERVOIR NO. 1 (0504037), Account 1	HIGHLAND DITCH (0500526)	05_SVCBT_Pln	27
05SVCBTPln11	35184.00009	HIGHLAND RESERVOIR NO. 3 (0504038), Account 1	HIGHLAND DITCH (0500526)	05_SVCBT_Pln	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
05SVCBTPln12	40609.00001	ROUGH READY DITCH (0500527)		05_SVCBT_Pln	27
05SVCBTPln13	29219.00001	ST VRAIN PALMERTON DITCH (0500528)		05_SVCBT_Pln	27
05SVCBTPln14	49673.49490	SWEDE DITCH (0500529)		05_SVCBT_Pln	27
05SVCBTPln15	50000.00002	FOOTHILLS RESERVOIR (0504071), Account 1	FOOTHILLS INLET (0500532)	05_SVCBT_Pln	27
05SVCBTPln16	5600.00001	LONGMONT SUPPLY DITCH (0500545)		05_SVCBT_Pln	27
05SVCBTPln17	29219.00002	OLIGARCHY IRRIGATION (0500547_I)	OLIGARCHY DITCH (0500547)	05_SVCBT_Pln	27
05SVCBTPln18	11841.08690	DENIO TAYLOR DITCH (0500548)		05_SVCBT_Pln	27
05SVCBTPln19	4488.00001	Clough & True Ditch (0500535)	South Branch Diversion Structure (05_SBRANCH)	05_SVCBT_Pln	27
05SVCBTPln20	5665.00001	Webster & McCaslin Ditch (0500537)	South Branch Diversion Structure (05_SBRANCH)	05_SVCBT_Pln	27
05SVCBTPln21	29219.00001	James Ditch (0500539)	South Branch Diversion Structure (05_SBRANCH)	05_SVCBT_Pln	27
05SVCBTPln22	9771.00001	Davis & Downing Ditch (0500542)	South Branch Diversion Structure (05_SBRANCH)	05_SVCBT_Pln	27
05SVCBTPln23	10745.00001	Clover Basin Ditch (0500552)	South Branch Diversion Structure (05_SBRANCH)	05_SVCBT_Pln	27
05SVCBTPln24	6339.00001	Peck Ditch (0500550)	South Branch Diversion Structure (05_SBRANCH)	05_SVCBT_Pln	27
05SVCBTPln25	4462.00001	Pella Ditch (0500551)		05_SVCBT_Pln	27
05SVCBTPln26	14549.00001	NIWOT DITCH (0500554)	South Branch Diversion Structure (05_SBRANCH)	05_SVCBT_Pln	27
05SVCBTPln27	29219.00003	MCINTOSH RESERVOIR (0504073), Account 1	OLIGARCHY DITCH (0500547)	05_SVCBT_Pln	27
05SVCBTPln28	46386.46001	UNION RESERVOIR (0503905), Account 1	South Branch Diversion Structure (05_SBRANCH)	05_SVCBT_Pln	27
05SVCBTSpl	52960.48365	SUPPLY DITCH (0500523)		05_SVCBT_Pln	29

The table below shows the rules that release water from 05_LHCBT_Pln. This plan holds the C-BT delivery into Lefthand Creek and is used for diversions listed in the table below. Other diversions from Lefthand Creek receive C-BT water, but it is through the Left Hand Ditch and originates from the St. Vrain C-BT delivery.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
05LHCBT	4.00000	05_LHCBT_Pln		05_LHCBT	35
05LHCBTPln1	36798.00001	TABLE MOUNTAIN DITCH (0500569)		05_LHCBT_Pln	27
05LHCBTPln2	7761.00001	STAR DITCH (0500572)		05_LHCBT_Pln	27
05LHCBTPln3	7761.00001	HINMAN DITCH (0500573)		05_LHCBT_Pln	27
05LHCBTPln4	8695.00001	HOLLAND DITCH (0500574)		05_LHCBT_Pln	27
05LHCBTPln5	7760.00001	DODD TREATMENT PLANT DEMAND (0500619_b)		05_LHCBT_Pln	27
05LHCBTSpl	36798.00002	LAKE DITCH (0500564)		05_LHCBT_Pln	29

In the table below, rules to release water from the 05_BRCBT_Pln are shown. The plan holds the Boulder Reservoir's C-BT supply from the Boulder Feeder Canal. Deliveries to BCSC and 0600800 can be thought of as a Boulder Reservoir pass-through.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
05BRCBT	3.00000	05_BRCBT_Pln		C-BT inflow to Boulder Reservoir (05_BRCBT)	35
05BRCBTPln1	3.00001	BOULDER CREEK SUPPLY CANAL OUT (BCSC)		05_BRCBT_Pln	27
05BRCBTPln2	3.00002	BOULDER RES MUNICIPAL DEMAND (0600800_SV)		05_BRCBT_Pln	27
05BRCBTPln3	3.00005	BOULDER RESERVOIR (0504515), Account 1		05_BRCBT_Pln	27
05BRCBTSpl	51134.47666	BOULDER RESERVOIR (0504515)		05_BRCBT_Pln	29

5.10.5.2 Highland Irrigation System – Highland Ditch (0500526), Highland Reservoir No. 1, Highland Reservoir No. 2, Highland Reservoir No. 3, Foothills Reservoir, McIntosh Lake, Beaver Park Reservoir, and Highland Irrigation Demand (0500526_I)

Highland Ditch diverts water from the St. Vrain Creek for irrigation and off-channel reservoir storage. From 1990 to 2007, municipal water for the City of Longmont was diverted through Highland ditch and delivered to Burch Lake water treatment plant. This operation does not represent current practices and is not included in the model. The municipal water has been removed from the total diversions at the headgate and are modeled at the City of Longmont's other diversion points. See the section on the City of Longmont below for more information.

The Highland System consists of three off-channel reservoirs located on the Highland Ditch and access to stored water in three off-channel reservoirs. The three reservoirs on Highland Ditch are Highland Reservoir No. 1, Highland Reservoir No.2, and Highland Reservoir No. 3. These reservoirs are filled with diversions through the Highland Ditch headgate and release to meet Highland Irrigation Demand. The other off-channel reservoirs are Foothills Reservoir, McIntosh Lake, and Beaver Park Reservoir. Foothills Reservoir is owned entirely be Highland Ditch Company. It is filled by the Foothills Inlet Ditch (0500532). Water is released back to the St. Vrain Creek from Foothills for diversions by exchange. McIntosh Lake is also owned by the Highland Ditch Company, but is located on the Oligarchy Ditch. It makes releases to Oligarchy Ditch in exchange for diversions at the Highlands Ditch. The ditch company has 49% ownership in Beaver Park Reservoir. As described in Section 5.6, Beaver Park Reservoir is modeled with two accounts, one for Highland and one for the majority owner Supply Ditch (0500523). It is located upstream of the Highlands Ditch headgate and water is released for direct diversion at the headgate. These operations are further documented under the Beaver Park Reservoir (0504071) section below.

Although the primary use of water is in Water District 5, there are some Highland Ditch shareholders located in Water District 4 on the Boulder Larimer Ish Irrigation System (0400588) and water can be delivered from the Highland system to Ish Reservoir (0404156). To simplify this operation in StateMod, water is released from Foothills Reservoir directly to the Boulder Larimer Ish irrigation demand (0400588_I).

The McIntosh Reservoir exchange with Oligarchy Ditch is not modeled because the Highland Irrigation Demand is satisfied with the operations captured in the table below.

The Highlands Irrigation System receives C-BT water from the St. Vrain Supply Canal. It takes C-BT junior to the Highlands Res 1, 2, and 3, McIntosh, Foothills, and Beaver Park releases to irrigation demand.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
0504032_C1	11642.00000	HIGHLAND RESERVOIR NO. 2 (0504032), Account 1	HIGHLAND DITCH (0500526)	0504032.01	45
0504032_C2	11841.09967	HIGHLAND RESERVOIR NO. 2 (0504032), Account 1	HIGHLAND DITCH (0500526)	0504032.02	45
0504032_C3	14424.00000	HIGHLAND RESERVOIR NO. 2 (0504032), Account 1	HIGHLAND DITCH (0500526)	0504032.03	45
0504032_C4	20067.00000	HIGHLAND RESERVOIR NO. 2 (0504032), Account 1	HIGHLAND DITCH (0500526)	0504032.04	45
0504032_C5	28031.00000	HIGHLAND RESERVOIR NO. 2 (0504032), Account 1	HIGHLAND DITCH (0500526)	0504032.05	45
0504032_C6	29219.00000	HIGHLAND RESERVOIR NO. 2 (0504032), Account 1	HIGHLAND DITCH (0500526)	0504032.06	45
0504037_C1	10911.00000	HIGHLAND RESERVOIR NO. 1 (0504037), Accounts 1-2	HIGHLAND DITCH (0500526)	0504037.01	45
0504037_C2	27910.26588	HIGHLAND RESERVOIR NO. 1 (0504037), Accounts 1-2	HIGHLAND DITCH (0500526)	0504037.02	45
0504037_C3	29219.00000	HIGHLAND RESERVOIR NO. 1 (0504037), Accounts 1-2	HIGHLAND DITCH (0500526)	0504037.03	45
0504038_C1	11642.00000	HIGHLAND RESERVOIR NO. 3 (0504038), Accounts 1-2	HIGHLAND DITCH (0500526)	0504038.01	45

0504038_C2	19265.00000	HIGHLAND RESERVOIR NO. 3 (0504038), Accounts 1-2	HIGHLAND DITCH (0500526)	0504038.02	45
0504038_C3	29219.00000	HIGHLAND RESERVOIR NO. 3 (0504038), Accounts 1-2	HIGHLAND DITCH (0500526)	0504038.03	45
0504071_C1	22108.00000	FOOTHILLS RESERVOIR (0504071), Accounts 1-2	FOOTHILLS INLET (0500532)	0504071.01	45
0504071_C2	29219.00000	FOOTHILLS RESERVOIR (0504071), Accounts 1-2	FOOTHILLS INLET (0500532)	0504071.02	45
0500526_C1	8004.00000	HIGHLAND IRRIGATION (0500526_I)	HIGHLAND DITCH (0500526)	0500526.01	45
0500526_C2	10379.00000	HIGHLAND IRRIGATION (0500526_I)	HIGHLAND DITCH (0500526)	0500526.03	45
0500526_C3	11841.10546	HIGHLAND IRRIGATION (0500526_I)	HIGHLAND DITCH (0500526)	0500526.05	45
0504032_i1	35184.00001	HIGHLAND IRRIGATION (0500526_I)	Account 1	HIGHLAND RESERVOIR NO. 2 (0504032)	2
0504037_i1	35184.00002	HIGHLAND IRRIGATION (0500526_I)	Account 1	HIGHLAND RESERVOIR NO. 1 (0504037)	2
0504038_i1	35184.00003	HIGHLAND IRRIGATION (0500526_I)	Account 1	HIGHLAND RESERVOIR NO. 3 (0504038)	2
FH_BoLarIsh	53691.50200	0400588_I		0504071	3
BP_Highland	35184.00004	HIGHLAND IRRIGATION (0500526_I)	Account 1	Beaver Park Res (0504020)	2

5.10.5.3 Beaver Park Reservoir (0504020)

Beaver Park Reservoir is located above Lyons on Beaver Creek, a tributary to South Fork St. Vrain Creek. Beaver Park Reservoir has two owners. The Highland ditch company has 49% ownership and Supply Ditch has 51% ownership. As described in Section 5.6, Beaver Park Reservoir is modeled with two accounts, one for Highland (0500526) and one for the Supply Ditch (0500523). It is located upstream of both headgates and water is released for direct diversion at the headgates. These operations are documented in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BP_Highland	35184.00004	HIGHLAND IRRIGATION (0500526_I)	Account 1	BEAVER PARK RESERVOIR (0504020)	2
BP_Supply	52960.48364	SUPPLY DITCH (0500523)	Account 2	BEAVER PARK RESERVOIR (0504020)	2

5.10.5.4 Oligarchy Ditch System

Oligarchy Ditch (0500547) diverts water from the St. Vrain Creek for irrigation (0500547_I) and off-channel reservoirs. Two reservoirs are located on the Oligarchy ditch system: McIntosh Reservoir (0504073) which is owned by Highland Ditch Company, and Union Reservoir (0503905) which is operated for the City of Longmont and to meet augmentation demands. Neither reservoir releases directly to meet Oligarchy Irrigation Demand. McIntosh Reservoir is documented under the Highland Ditch (0500526) section and Union Reservoir (0503905) is documented in its own section.

The City of Longmont has changed water rights under Oligarchy Ditch. See the City of Longmont section for details on changed water rights. The senior irrigation water right is placed into a type 13 accounting plan and then split between the City of Longmont and the Oligarchy ditch so that any shortages are shared.

The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
0504073_C1	19273.00000	MCINTOSH RESERVOIR (0504073), Accounts 1-2	OLIGARCHY DITCH (0500547)	0504073.01	45
0504073_C2	29219.00000	MCINTOSH RESERVOIR (0504073), Accounts 1-2	OLIGARCHY DITCH (0500547)	0504073.02	45
0500547_C1	5996.00002	OLIGARCHY IRRIGATION (0500547_I)	OLIGARCHY DITCH (0500547)	547_PlnI	27
0500547_C2	7640.00000	OLIGARCHY IRRIGATION (0500547_I)	OLIGARCHY DITCH (0500547)	0500547.02	45
0500547_C3	8096.00000	OLIGARCHY IRRIGATION (0500547_I)	OLIGARCHY DITCH (0500547)	0500547.03	45
0500547_C4	8857.00000	OLIGARCHY IRRIGATION (0500547_I)	OLIGARCHY DITCH (0500547)	0500547.04	45

5.10.5.5 City of Longmont - Longmont Indoor Demand (05LONG_IN) and Longmont Outdoor Demand (05LONG_OUT) – North Pipeline (0500511), South Pipeline (0500522), Lyons Pipeline (0500212), Union Reservoir (0503905), and Button Rock Reservoir (0504010)

Longmont's demand was split up between indoor and outdoor use. Longmont provided annual water treatment plant production values from 1970 through 2001 and monthly water treatment production values from 2002 through 2012. Prior to 1970, demand was estimated using population data and per capita use. Total demand was divided between indoor and outdoor use based on the pattern of monthly use from 2002 through 2012. A winter use baseline (Nov-Mar) was established for year-round indoor use and the surplus from April through October (total use minus winter average) was designated outdoor use.

The City of Longmont is the largest municipality in the St. Vrain Basin. The City has direct rights, storage rights, change water rights from ditches in the basin, and Colorado-Big Thompson water. It does not have ground water supplies. Longmont has three pipelines that can divert surface water. The primary pipeline is 0500511 – North Pipeline, which is located on the North Fork St. Vrain, downstream of Button Reservoir aka Ralph Price Reservoir. The secondary pipeline is 0500522 – South Pipeline, which is located on the South Fork St. Vrain, just upstream of Lyons. Finally, a small pipeline 0500512 – Lyons Pipeline is located downstream of the North Pipeline on the North Fork St. Vrain.

In addition to native St. Vrain water, C-BT water can be delivered to Longmont using a several different mechanisms. C-BT water can be diverted from the St. Vrain Supply Canal via a pipeline directly to Longmont's Wade Gaddis Treatment Plant. Longmont also has a connection to the Southern Water Supply Pipeline (SWSP), and can accept delivery of C-BT water directly from SWSP. Lastly, C-BT water from the St. Vrain Supply Canal can be delivered to the St. Vrain Creek and exchanged up to one of Longmont's pipelines, depending on exchange potential.

Note that in HydroBase, it appears that C-BT diversions are being recorded at the North Pipeline for water that is received via SWSP and/or the St. Vrain Supply Canal pipeline connection. However, a record of C-BT deliveries to Longmont is also maintained by Northern. Therefore, C-BT was being double accounted for. To account for this, the C-BT water was subtracted from the North Pipeline total diversions for calibration purposes. In StateMod, the diversions simulated at the North Pipeline are smaller than the recorded historical diversions, but the historical demand is still being satisfied. C-BT water is only represented once in the StateMod simulation.

Longmont has access to several storage reservoirs, including Button Rock (aka Ralph Price Reservoir), Pleasant Valley Reservoir (aka Terry Lake), McCall Lake, Oligarchy Reservoir No. 1 (aka Burch Lake), Clover Basin Reservoir, and Union Reservoir. Of these reservoirs, Button Rock and Union reservoirs are modeled in StateMod.

Longmont has a portfolio of water rights. The North and South Pipelines have original water rights and early water rights that were transferred to the pipelines. Longmont has changed irrigation water rights from several ditches throughout the basin in two waves. The first round of transfers occurred in 1981 and the second round was in 1987, under the following Case Numbers: 81CW355, 81CW356, 81CW357, 81CW360, 81CW361, 81CW362, 87CW212, 87CW213, 87CW214, 87CW215, 87CW216, 87CW218, 87CW219, 87CW220, 87CW221, 87CW222, 87CW231, and 87CW253.

In StateMod, Longmont indoor and outdoor demand first tries to be met with the historical C-BT water delivery. Next, the direct rights are taken at the Pipelines and then the changed water rights are taken. Finally, reservoir storage in Button Rock is used. The table below captures the C-BT and direct water right operations. Changed water rights and reservoir storage are presented in detail in the next section.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
0500511_C1	5600.00000	05LONG_IN		0500511.01	11
0500511_C2	5630.00000	05LONG_IN		0500511.02	11
0500511_C3	21623.00000	05LONG_IN		0500511.03	11
0500511_C4	21702.00000	05LONG_IN		0500511.04	11

0500512_C1	15528.00000	05LONG_IN		0500512.01	11
0500512_C2	37093.15528	05LONG_IN		0500512.02	11
0500512_C3	37093.21953	05LONG_IN		0500512.03	11
0500512_C4	42907.00000	05LONG_IN		0500512.04	11
0500522_C1	11748.00000	05LONG_IN		0500522.01	11
0500522_C2	18762.00000	05LONG_IN		0500522.02	11
0500511_C6	5600.00000	05LONG_OUT		0500511.01	11
0500511_C7	5630.00000	05LONG_OUT		0500511.02	11
0500511_C8	21623.00000	05LONG_OUT		0500511.03	11
0500511_C9	21702.00000	05LONG_OUT		0500511.04	11
0500512_C6	15528.00000	05LONG_OUT		0500512.01	11
0500512_C7	37093.15528	05LONG_OUT		0500512.02	11
0500512_C8	37093.21953	05LONG_OUT		0500512.03	11
0500512_C9	42907.00000	05LONG_OUT		0500512.04	11
0500522_C4	11748.00000	05LONG_OUT		0500522.01	11
0500522_C5	18762.00000	05LONG_OUT		0500522.02	11

5.10.5.5.1 Longmont Supply Ditch (0500545) 1981 and 1987 Changed Rights

The City of Longmont changed water right shares under the Longmont Supply Ditch in 1981 and 1987. A total of 73.4 percent portion of the senior water right is stored in the 545_Pln accounting plan, limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees. The 545_Pln is split between the 1981 and 1987 change cases because they have different terms and conditions, volumetric limitations, ditch losses, return flow obligations (RFOs), and reusable factors.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LInReuse plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
545_Pln1	1.00000	NA		545_Pln81DF	47
545_Pln2	1.00000	NA		545_Pln87DF	47
545_Pln3	5600.00000	545_Pln	73.4%	0500545.01	26
545_Pln4	5600.00001	545_Pln81 545_Pln87	83% 17%	545_Pln	43
545_Pln5	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	545_Pln81	28
545_Pln6	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	545_Pln87	28
545_Pln7	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	545_Pln81	28
545_Pln8	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	545_Pln87	28
545_Pln11	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	545_Pln81	28
545_Pln12	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	545_Pln87	28
545_Pln13	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	545_Pln81	28
545_Pln14	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	545_Pln87	28
545_Pln17	41785.00001	BUTTON ROCK RES (0504010), Account 1		545_Pln81	28
545_Pln18	41785.00001	BUTTON ROCK RES (0504010), Account 1		545_Pln87	28
545_Pln19	46386.46001	UNION RES (0503905), Account 1	OLIGARCHY DITCH (0500547)	545_Pln81	27
545_Pln20	46386.46001	UNION RES (0503905), Account 1	OLIGARCHY DITCH (0500547)	545_Pln87	27
545_Pln21	46386.46002	LONGMONT SUPPLY DITCH (0500545)		545_Pln81	29
545_Pln22	46386.46002	LONGMONT SUPPLY DITCH (0500545)		545_Pln87	29
545_Pln23	46386.46002	LONGMONT SUPPLY DITCH (0500545)		545_Pln	29

5.10.5.5.2 Rough and Ready (0500527) 1981 and 1987 Changed Water Rights

The City of Longmont changed water right shares under the Rough and Ready Ditch in 1981 and 1987. A total of 37.4 percent of the senior water right is stored in the 527_Pln accounting plan, limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees. The 527_Pln is then split into 81 and 87 plans because the change cases each have different terms and conditions, volumetric limitations, ditch losses, RFOs, and reusable factors. Changed uses associated with the one junior right are not represented because the senior rights satisfy the volumetric limitations or the demand was already met.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LInReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
527_Pln1	1.00000	NA		527_Pln81DF	47
527_Pln2	1.00000	NA		527_Pln87DF	47
527_Pln3	7012.00000	527_Pln	37.4%	0500527.01	26
527_Pln4	7012.00001	527_Pln81 527_Pln87	56% 44%	527_Pln	46
527_Pln5	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	527_Pln81	28
527_Pln6	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	527_Pln87	28
527_Pln7	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	527_Pln81	28
527_Pln8	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	527_Pln87	28
527_Pln11	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	527_Pln81	28
527_Pln12	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	527_Pln87	28
527_Pln13	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	527_Pln81	28
527_Pln14	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	527_Pln87	28
527_Pln17	41785.00001	BUTTON ROCK RES (0504010), Account 1		527_Pln81	28
527_Pln18	41785.00001	BUTTON ROCK RES (0504010), Account 1		527_Pln87	28
527_Pln19	46386.46001	UNION RES (0503905), Account 1	OLIGARCHY DITCH (0500547)	527_Pln81	27
527_Pln20	46386.46001	UNION RES (0503905), Account 1	OLIGARCHY DITCH (0500547)	527_Pln87	27
527_Pln21	46386.46002	ROUGH READY DITCH (0500527)		527_Pln81	29
527_Pln22	46386.46002	ROUGH READY DITCH		527_Pln87	29

		(0500527)			
527_Pln23	46386.46002	ROUGH READY DITCH (0500527)	LONGMONT SOUTH PIPELINE (0500522)	527_Pln	29

5.10.5.5.3 Oligarchy Ditch (0500547) 1981 and 1987 Changed Water Rights

The City of Longmont changed water right shares under the Oligarchy Ditch in 1981 and 1987. One hundred percent of the senior water right priority is stored in the 547_Pln accounting plan limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees. The 547_Pln is split between the 81 and 87 plans, because the change cases each have different terms and conditions, volumetric limits, ditch losses, RFOs, and reusable factors. The 547_Plan is also split to an irrigation plan. The irrigation split of the water right (61%) is sent to the irrigation demand through a carrier. Changed uses associated with the three junior water rights are not represented because the senior rights satisfy the volumetric limitations or the demand was already met.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LinReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
547_Pln1	1.00000	NA		547_Pln81DF	47
547_Pln2	1.00000	NA		547_Pln87DF	47
547_Pln3	5996.00000	547_Pln	100%	0500547.01	26
547_Pln4	5996.00001	547_Pln81 547_Pln87 547_PlnI	26.1% 12.8% 61.1%	547_Pln	46
0500547_C1	5996.00002	OLIGARCHY IRRIGATION (0500547_I)	OLIGARCHY DITCH (0500547)	547_PlnI	27
547_Pln5	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	547_Pln81	28
547_Pln6	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	547_Pln87	28
547_Pln7	18762.00001	Longmont Indoor Demand	LONGMONT SOUTH	547_Pln81	28

		(05LONG_IN)	PIPELINE (0500522)		
547_Pln8	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	547_Pln87	28
547_Pln11	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	547_Pln81	28
547_Pln12	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	547_Pln87	28
547_Pln13	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	547_Pln81	28
547_Pln14	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	547_Pln87	28
547_Pln21	21702.00002	OLIGARCHY DITCH (0500547)		547_Pln81	29
547_Pln22	21702.00002	OLIGARCHY DITCH (0500547)		547_Pln87	29
547_Pln23	5996.00003	OLIGARCHY DITCH (0500547)		547_PlnI	29
547_Pln24	21702.00002	OLIGARCHY DITCH (0500547)		547_Pln	29

5.10.5.5.4 Smead Ditch (0500530) 1981 Changed Water Rights

The City of Longmont changed water right shares under the Smead Ditch in 1981.The 25 percent portion of the senior water right priority is stored in the 530_Pln accounting plan limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LinReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
530_Pln1	1.00000	NA		530_Pln81DF	47
530_Pln2	4657.00000	530_Pln81	25%	0500530.01	26
530_Pln3	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	530_Pln81	28

530_Pln4	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	530_Pln81	28
530_Pln6	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	530_Pln81	28
530_Pln7	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	530_Pln81	28
530_Pln9	41785.00001	BUTTON ROCK RES (0504010), Account 1		530_Pln81	28
530_Pln10	46386.46001	UNION RESERVOIR (0503905), Account 1	OLIGARCHY DITCH (0500547)	530_Pln81	27
530_Pln11	46386.46002	SMEAD DITCH (0500530)		530_Pln81	29

5.10.5.5.5 Palmerton Ditch (0500528) 1981 Changed Water Rights

The City of Longmont changed water right shares under the Palmerton Ditch in 1981.The 6.5 percent portion of the senior water right priority is stored in the 528_Pln accounting plan limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees. Changed uses associated with the two junior water rights are not represented because the senior rights satisfy the volumetric limitations or the demand was already met.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock’s storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union’s absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LinReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
528_Pln1	1.00000	NA		530_Pln81DF	47
528_Pln2	5630.00000	528_Pln81	6.5%	0500528.01	26
528_Pln3	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	528_Pln81	28
528_Pln4	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	528_Pln81	28
528_Pln6	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	528_Pln81	28
528_Pln7	18762.00001	Longmont Outdoor Demand	LONGMONT SOUTH	528_Pln81	28

		(05LONG_OUT)	PIPELINE (0500522)		
528_Pln9	41785.00001	BUTTON ROCK RES (0504010)		528_Pln81	28
528_Pln10	46386.46001	UNION RESERVOIR (0503905)	OLIGARCHY DITCH (0500547)	528_Pln81	27
528_Pln11	46386.46002	ST VRAIN PALMERTON DITCH (0500528)		528_Pln81	29

5.10.5.5.6 Swede Ditch (0500529) 1981 Changed Water Rights

The City of Longmont changed water right shares under the Swede Ditch in 1981. A 5.6 percent portion of each of the three senior water rights is stored in the 529_Pln accounting plan limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees. Changed uses associated with the junior water right are not represented because the senior rights satisfy the volumetric limitations or the demand was already met.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LinReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
529_Pln1	1.00000	NA		529_Pln81DF	47
529_Pln2	7791.00000	529_Pln81	5.6%	0500529.01	26
529_Pln3	8461.00000	529_Pln81	5.6%	0500529.02	26
529_Pln4	13454.00000	529_Pln81	5.6%	0500529.03	26
529_Pln5	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	529_Pln81	28
529_Pln6	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	529_Pln81	28
529_Pln8	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	529_Pln81	28
529_Pln9	18762.00001	LONGMONT SOUTH PIPELINE (0500522)	LONGMONT SOUTH PIPELINE (0500522)	529_Pln81	28

529_Pln11	41785.00001	BUTTON ROCK RES (0504010)		529_Pln81	28
529_Pln12	46386.46001	UNION RES (0503905)		529_Pln81	27
529_Pln13	46386.46002	SWEDE DITCH (0500529)		529_Pln81	29

5.10.5.5.7 Beckwith (0500560) 1987 Changed Water Rights

The City of Longmont changed water right shares under the Beckwith Ditch in 1987. A 43.9 percent portion of the senior water right priority is stored in the 560_Pln accounting plan limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LinReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
560_Pln1	1.00000	NA		560_Pln87DF	47
560_Pln2	4085.00000	560_Pln87	43.9%	0500560.01	26
560_Pln3	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	560_Pln87	28
560_Pln4	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	560_Pln87	28
560_Pln6	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	560_Pln87	28
560_Pln7	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	560_Pln87	28
560_Pln9	41785.00001	BUTTON ROCK RES (0504010)		560_Pln87	28
560_Pln10	46386.46001	UNION RES (0503905)	OLIGARCHY DITCH (0500547)	560_Pln87	28
560_Pln11	46386.46002	BECKWITH DITCH (0500560)		560_Pln87	29

5.10.5.5.8 Clover Basin Ditch (0500552) 1987 Changed Water Rights

The City of Longmont changed water right shares under the Clover Basin Ditch in 1987. The 75.5 percent portion of the senior water right priority is stored in the 552_Pln accounting.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LinReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
552_Pln1	1.00000	NA		552_Pln87DF	47
552_Pln2	8553.00000	552_Pln87	75.5%	0500552.01	26
552_Pln4	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	552_Pln87	28
552_Pln5	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	552_Pln87	28
552_Pln7	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	552_Pln87	28
552_Pln8	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	552_Pln87	28
552_Pln10	41785.00001	BUTTON ROCK RES (0504010)		552_Pln87	28
552_Pln11	46386.46001	UNION RES (0503905)	OLIGARCHY DITCH (0500547)	552_Pln87	28
552_Pln12	46386.46002	Clover Basin Ditch (0500552)		552_Pln87	29

5.10.5.5.9 Niwot Ditch (0500554) 1987 Changed Water Rights

The City of Longmont changed water right shares under the Niwot Ditch in 1987. The 48.5 percent portion of each of the two senior water right priorities is stored in the 554_Pln accounting plan limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LinReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
554_Pln1	1.00000	NA		554_Pln87DF	47
554_Pln2	4883.00000	554_Pln87	45.8%	0500554.01	26
554_Pln3	5631.00000	554_Pln87	45.8%	0500554.02	26
554_Pln4	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	554_Pln87	28
554_Pln5	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	554_Pln87	28
554_Pln7	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	554_Pln87	28
554_Pln8	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	554_Pln87	28
554_Pln10	41785.00001	BUTTON ROCK RES (0504010)		554_Pln87	28
554_Pln11	46386.46001	UNION RES (0503905)	OLIGARCHY DITCH (0500547)	554_Pln87	28
554_Pln12	46386.46002	NIWOT DITCH (0500554)		554_Pln87	29

5.10.5.5.10 Pella Ditch (0500551) 1987 Changed Water Rights

The City of Longmont changed water right shares under the Pella Ditch in 1987. The 34.0 percent portion of the senior water right priority is stored in the 551_Pln accounting plan limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in

Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LinReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
551_Pln1	1.00000	NA		551_Pln87DF	47
551_Pln2	4462.00000	551_Pln87	34.0%	0500551.01	26
551_Pln4	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	551_Pln87	28
551_Pln5	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	551_Pln87	28
551_Pln7	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	551_Pln87	28
551_Pln8	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	551_Pln87	28
551_Pln10	41785.00001	BUTTON ROCK RES (0504010)		551_Pln87	28
551_Pln11	46386.46001	UNION RES (0503905)	OLIGARCHY DITCH (0500547)	551_Pln87	28
551_Pln12	46386.46002	Pella Ditch (0500551)		551_Pln87	29

5.10.5.5.11 South Flat Ditch (0500558) 1987 Changed Water Rights

The City of Longmont changed water right shares under the South Flat Ditch in 1987. The 37.5 percent portion of the senior water right priority is stored in the 558_Pln accounting plan limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LinReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
558_Pln1	1.00000	NA		558_Pln87DF	47
558_Pln2	4883.00000	558_Pln87	37.5%	0500558.01	26
558_Pln3	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	558_Pln87	28
558_Pln4	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	558_Pln87	28
558_Pln6	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	558_Pln87	28
558_Pln7	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	558_Pln87	28
558_Pln9	41785.00001	BUTTON ROCK RES (0504010)		558_Pln87	28
558_Pln10	46386.46001	UNION RES (0503905)	OLIGARCHY DITCH (0500547)	558_Pln87	28
558_Pln11	46386.46002	SOUTH FLAT DITCH (0500558)		558_Pln87	29

5.10.5.5.12 Zweck and Turner (0500601) 1987 Changed Water Rights

The City of Longmont changed water right shares under the Zweck Turner Ditch in 1987. The 23.0 percent portion of the senior water right priority is stored in the 601_Pln accounting plan limited to the April through October season. The monthly and annual limits are based on the flow limits for the average hydrology conditions set in the decrees.

Uses of changed water rights include: Longmont Indoor Demand, Longmont Outdoor Demand, and storage in Button Rock and Union Reservoirs. Water is released to meet the Longmont Indoor and Outdoor demand via the Longmont North and South pipelines junior to the pipeline rights. The Lyons pipeline capacity is significantly smaller than the North and South Pipelines and is not used in StateMod to divert changed water rights. Water is released from the accounting plans to storage in Button Rock Reservoir by exchange junior to Button Rock's storage rights. Water is also released from the accounting plans to storage in Union Reservoir via Oligarchy Ditch junior to Union's absolute storage rights. Remaining plan supplies are released to the river.

Return flow obligations are tracked by the Longmont_TC accounting plan. Indoor reusable supplies are generated at the WWTP effluent and are tracked in the LinReuse PLN accounting plan. Outdoor reusable supplies are generated from outdoor return flows and are tracked in the LOutReusable accounting plan. For details, see Section 5.8 on Plan Files.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type

601_Pln1	1.00000	NA		601_Pln87DF	47
601_Pln2	5295.00000	601_Pln87	23%	0500601.01	26
601_Pln3	21702.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT NORTH PIPELINE (0500511)	601_Pln87	28
601_Pln4	18762.00001	Longmont Indoor Demand (05LONG_IN)	LONGMONT SOUTH PIPELINE (0500522)	601_Pln87	28
601_Pln6	21702.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT NORTH PIPELINE (0500511)	601_Pln87	28
601_Pln7	18762.00001	Longmont Outdoor Demand (05LONG_OUT)	LONGMONT SOUTH PIPELINE (0500522)	601_Pln87	28
601_Pln9	41785.00001	BUTTON ROCK RES (0504010)		601_Pln87	28
601_Pln10	46386.46001	UNION RES (0503905)	OLIGARCHY DITCH (0500547)	601_Pln87	28
601_Pln11	46386.46002	ZWECK TURNER DITCH (0500601)		601_Pln87	29

5.10.5.5.13 Longmont Changed Water Rights Reuse to Meet RFOs

To meet the return flow obligations generated by the use of changed water rights, Longmont can use their reusable supply from indoor or from outdoor use. The table below shows the rules sending reusable water to meet the terms and conditions obligations. Any water remaining in the reusable plan is then released to the river at the Longmont Waste Water Treatment Plant outfall.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
InReRFOs	49673.49498	Longmont_TC		LInReusable	48
OutReRFOs	49673.49499	Longmont_TC		LOutReusable	48
ResReRFOs	49673.49500	Longmont_TC		LResReusable	48
IReuseSpill	49673.49501	LAST CHANCE DITCH (0500589)		LInReusable	29
OReuseSpill	49673.49502	LAST CHANCE DITCH (0500589)		LOutReusable	29

5.10.5.6 Union Reservoir (0503905)

Union Reservoir is located off-channel, under the Oligarchy Ditch. However, it is not used to provide irrigation water. It is used by the City of Longmont to meet return flow obligation and by Central to meet well augmentation plan obligations. Water is stored under the reservoir's storage rights and under water rights changed by the City of Longmont (see sections above) Stored water is evenly divided between the two accounts. Account 1 releases for Longmont and account 2 releases for Central.

Storage water is released from reservoirs for municipal Longmont demand (junior to the most junior changed rights Union admin number 46386.0000) Note that these operating rules do not fire.

Longmont demand is satisfied from other sources and Union Reservoir is primarily used to meet return flow obligations and contract deliveries.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
0503905_C1	19271.00000	UNION RES (0503905), Accounts 1-2	OLIGARCHY DITCH (0500547)	0503905.01	45
0503905_C3	46386.45046	UNION RES (0503905), Accounts 1-2	OLIGARCHY DITCH (0500547)	0503905.02	45
Union_S_IN	46386.46001	0500522_C1	Account 1	UNION RESERVOIR (0503905)	7
Union_S_OUT	46386.46002	0500522_C4	Account 1	UNION RESERVOIR (0503905)	7
Union_N_IN	46386.46003	0500511_C1	Account 1	UNION RESERVOIR (0503905)	7
Union_N_OUT	46386.46004	0500511_C6	Account 1	UNION RESERVOIR (0503905)	7
Union_L_IN	46386.46005	0500512_C1	Account 1	UNION RESERVOIR (0503905)	7
Union_L_OUT	46386.46006	0500512_C6	Account 1	UNION RESERVOIR (0503905)	7
0503905_C6	46386.46013	BUTTON ROCK RES (0504010), Account 1	Account 1	UNION RES (0503905)	5
0503905_C7	46386.46014	Longmont_TC	Account 1	UNION RES (0503905)	48
0503905_C8	82000.00013	GMS Impact Reach A (9903334_A)	Account 2	UNION RES (0503905)	48
0503905_C9	82000.00013	GMS Impact Reach B (9903334_B)	Account 2	UNION RES (0503905)	48
0503905_C10	82000.00013	GMS Impact Reach C (9903334_C)	Account 2	UNION RES (0503905)	48
0503905_C11	82000.00013	WAS Impact Reach A (9903394_A)	Account 2	UNION RES (0503905)	48
0503905_C12	82000.00013	WAS Impact Reach B (9903394_B)	Account 2	UNION RES (0503905)	48
0503905_C13	82000.00013	WAS Impact Reach C (9903394_C)	Account 2	UNION RES (0503905)	48

5.10.5.7 Button Rock Reservoir (0504010)

Button Rock Reservoir (aka Ralph Price Reservoir) provides supplemental Longmont municipal water supply. The table below presents the operating rules associated with the reservoir.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Button_N_IN	46386.46007	Longmont Indoor Demand (05LONG_IN)	Account 1	BUTTON ROCK RES (0504010)	2
Button_N_OUT	46386.46008	Longmont Outdoor Demand (05LONG_OUT)	Account 1	BUTTON ROCK RES (0504010)	2
Button_L_IN	46386.46009	Longmont Indoor Demand	Account 1	BUTTON ROCK	2

		(05LONG_IN)		RES (0504010)	
Button_L_OUT	46386.46010	Longmont Outdoor Demand (05LONG_OUT)	Account 1	BUTTON ROCK RES (0504010)	2
Button_S_IN	46386.46011	0500522_C1	Account 1	BUTTON ROCK RES (0504010)	7
Button_S_OUT	46386.46012	0500522_C4	Account 1	BUTTON ROCK RES (0504010)	7
0504010_C1	46386.46016	Longmont_TC	Account 1	BUTTON ROCK RES (0504010)	48

5.10.5.8 Left Hand Ditch System (0500603)

Left Hand Ditch System diverts water from South St. Vrain Creek and delivers the water to Left Hand Creek and the diversion structures located on Left Hand Creek. These include Gold Lake (0504015), Left Hand Valley Reservoir (0504488), Allen Lake Reservoir (0504077), Lake Ditch (0500564), Lake Ditch Irrigation Demand (0500564_I), Haldi Ditch (0500565), Spurgeon WTP (0500619_a), Dodd WTP (0500619_b), Crocker Ditch (0500568), Table Mountain Ditch (0500569), Bader Ditch (0500570), Toll Gate (0500648), Johnson Ditch (0500571), Star Ditch (0500572), Hinman Ditch (0500573), Holland (0500574), and Williamson Ditch (0500575). The majority of the water rights on Left Hand Creek are owned by the Left Hand Ditch Company, which provides irrigation water to the shareholders. Left Hand Creek is managed as a ditch company delivering share water to the water users. The Left Hand Water District is a shareholder in the Left Hand Ditch Company and provides domestic water supply to the rural area. Water is treated at the Spurgeon Water Treatment Plant or the Water Dodd Treatment Plant. C-BT water is delivered to Left Hand Creek from the Boulder Feeder Canal.

The Left Hand Ditch Company and Left Hand Water District own several reservoirs. In StateMod, the following reservoirs are modeled: Left Hand Valley Reservoir (0504488), Gold Lake (0504015) and Allen Lake Reservoir (0504077).

Left Hand Valley Reservoir releases to Spurgeon and Dodd water treatment plants and to the Left Hand Ditches. These releases are junior to the C-BT delivery to the WTPs and the ditches' most junior direct flow water right. Gold Lake releases to Left Hand Ditches junior to the ditches' most junior direct flow water right.

Lake Ditch (0500564) serves as the feeder canal for Allen Lake and also delivers water for irrigation under Lake Ditch and Toll Gate Ditch (0500648). Allen Lake cannot physically supply Lake Ditch irrigation demand; releases feed Toll Gate Ditch (0500648).

The irrigation system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
0504488_C1	34833.00000	LEFT HAND VALLEY RESERVOIR (0504488), Account 1	Left Hand Valley Reservoir Intake (05_LHVRIN)	0504488.01	45

0504015_C1	11841.10836	GOLD LAKE (0504015), Account 1	Gold Lake Reservoir Intake (05_GLRIN)	0504015.01	45
0504015_C2	19861.00000	GOLD LAKE (0504015), Account 1	Gold Lake Reservoir Intake (05_GLRIN)	0504015.02	45
0504015_C3	29219.00000	GOLD LAKE (0504015), Account 1	Gold Lake Reservoir Intake (05_GLRIN)	0504015.03	45
LHV_Spurg	36799.00001	SPURGEON TREATMENT PLANT DEMAND (0500619_a)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
LHV_Dodd	36799.00002	DODD TREATMENT PLANT DEMAND (0500619_b)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	2
GL_0500564	29219.00001	LAKE DITCH (0500564)	Account 1	GOLD LAKE (0504015)	2
GL_0500565	10715.00001	HALDI DITCH (0500565)	Account 1	GOLD LAKE (0504015)	2
GL_0500619a	99999.99999	SPURGEON TREATMENT PLANT DEMAND (0500619_a)	Account 1	GOLD LAKE (0504015)	2
GL_0500568	8157.00001	CROCKER DITCH (0500568)	Account 1	GOLD LAKE (0504015)	2
GL_0500569	36798.00001	TABLE MOUNTAIN DITCH (0500569)	Account 1	GOLD LAKE (0504015)	2
GL_0500570	7379.00001	BADER DITCH 1 & 2 (0500570)	Account 1	GOLD LAKE (0504015)	2
GL_0500571	8492.00001	JOHNSON DITCH (0500571)	Account 1	GOLD LAKE (0504015)	2
GL_0500572	7761.00001	STAR DITCH (0500572)	Account 1	GOLD LAKE (0504015)	2
GL_0500573	99999.99999	HINMAN DITCH (0500573)	Account 1	GOLD LAKE (0504015)	2
GL_0500574	8695.00001	HOLLAND DITCH (0500574)	Account 1	GOLD LAKE (0504015)	2
GL_0500575	99999.99999	WILLIAMSON DITCH (0500575)	Account 1	GOLD LAKE (0504015)	2
LH_0500564	29219.00002	LAKE DITCH (0500564)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
LH_0500565	10715.00002	HALDI DITCH (0500565)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
LH_0500619a	99999.99999	SPURGEON TREATMENT PLANT DEMAND (0500619_a)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
LH_0500568	8157.00002	CROCKER DITCH (0500568)	Account 1	LEFT HAND VALLEY RESERVOIR	4

				(0504488)	
LH_0500569	36798.00002	TABLE MOUNTAIN DITCH (0500569)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
LH_0500570	7379.00002	BADER DITCH 1 & 2 (0500570)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
LH_0500571	8492.00002	JOHNSON DITCH (0500571)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
LH_0500572	7761.00002	STAR DITCH (0500572)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
LH_0500573	99999.99999	HINMAN DITCH (0500573)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
LH_0500574	8695.00002	HOLLAND DITCH (0500574)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
LH_0500575	99999.99999	WILLIAMSON DITCH (0500575)	Account 1	LEFT HAND VALLEY RESERVOIR (0504488)	4
0504077_C1	27910.25172	ALLEN LAKE (0504077)	LAKE DITCH (0500564)	0504077.01	45
0504077_C2	28260.00000	ALLEN LAKE (0504077)	LAKE DITCH (0500564)	0504077.02	45
0504077_C3	29219.00000	ALLEN LAKE (0504077)	LAKE DITCH (0500564)	0504077.03	45
0500564_C1	8871.00000	LAKE DITCH IRRIGATION (0500564_I)	LAKE DITCH (0500564)	0500564.01	45
0500564_C2	10697.00000	LAKE DITCH IRRIGATION (0500564_I)	LAKE DITCH (0500564)	0500564.02	45
0500564_C3	8871.00000	TOLL GATE (0500648)	LAKE DITCH (0500564)	0500564.01	45
0500564_C4	10697.00000	TOLL GATE (0500648)	LAKE DITCH (0500564)	0500564.02	45
0504077_i1	29219.00002	TOLL GATE (0500648)	Account 1	ALLEN LAKE (0504077)	2

5.10.5.9 South Branch St. Vrain Diversions

The South Branch St. Vrain is a bifurcation in the river with diversion structures located along the branch, including Goss Private Ditch (0500534), Clough Private Ditch (0500536), Clough & True Ditch (0500535), Webster & McCaslin Ditch (0500537), True & Webster Ditch (0500538), James Ditch (0500539), and Davis & Downing Ditch (0500542). These ditches operated off an internal priority system. To model this system, the South Branch diversion (05_SBRANCH) is used as a carrier to each diversion on the South Branch. Each operating rule refers to a direct flow right, essentially moving the location of the direct flow right to the carrier structure. The operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
0500534_01	5660.00000	Goss Private Ditch (0500534)	South Branch Diversion Structure (05_SBRANCH)	0500534.01	11
0500536_01	4853.00000	Clough Private Ditch (0500536)	South Branch Diversion Structure (05_SBRANCH)	0500536.01	11
0500535_01	4488.00000	Clough & True Ditch (0500535)	South Branch Diversion Structure (05_SBRANCH)	0500535.01	11
0500537_01	5665.00000	Webster & McCaslin Ditch (0500537)	South Branch Diversion Structure (05_SBRANCH)	0500537.01	11
0500538_01	4474.00000	True & Webster Ditch (0500538)	South Branch Diversion Structure (05_SBRANCH)	0500538.01	11
0500539_01	6756.00000	James Ditch (0500539)	South Branch Diversion Structure (05_SBRANCH)	0500539.01	11
0500539_02	8034.00000	James Ditch (0500539)	South Branch Diversion Structure (05_SBRANCH)	0500539.02	11
0500539_03	9953.00000	James Ditch (0500539)	South Branch Diversion Structure (05_SBRANCH)	0500539.03	11
0500539_04	22155.00000	James Ditch (0500539)	South Branch Diversion Structure (05_SBRANCH)	0500539.04	11
0500539_05	29219.00000	James Ditch (0500539)	South Branch Diversion Structure (05_SBRANCH)	0500539.05	11
0500542_01	6149.00000	Davis & Downing Ditch (0500542)	South Branch Diversion Structure (05_SBRANCH)	0500542.01	11
0500542_02	6330.00000	Davis & Downing Ditch (0500542)	South Branch Diversion Structure (05_SBRANCH)	0500542.02	11
0500542_03	7379.00000	Davis & Downing Ditch (0500542)	South Branch Diversion Structure (05_SBRANCH)	0500542.03	11
0500542_04	8887.00000	Davis & Downing Ditch (0500542)	South Branch Diversion Structure (05_SBRANCH)	0500542.04	11
0500542_05	9771.00000	Davis & Downing Ditch (0500542)	South Branch Diversion Structure	0500542.05	11

			(05_SBRANCH)		

5.10.6 Water District 6 (Boulder Creek) Operations

This section describes the operations for diversion structures located in the Boulder Creek Basin. The section first presents operations related to imports and exports of C-BT water into and out of the basin. A description of the City of Boulder, Lafayette, and Louisville then follows, with a description of relevant reservoir operations. Next is a description of the complex irrigation systems. Finally, a description of changed water rights organized by ditch is presented.

Where to find more information

- SPDSS Task Memorandum 3, "Identify Key Diversion Structures Notes from Water District 6 Meeting," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, City of Boulder," available on the CDSS website.

5.10.6.1 Colorado-Big Thompson Imports – Boulder Creek Supply Canal and Southern Water Supply Pipeline

Imports from the C-BT project enter Water District 6 either by the Boulder Creek Supply Canal (BCSC), by the Southern Water Supply Pipeline (SWSP) or by direct release from Boulder Reservoir to Boulder's municipal demands. Despite the name "Boulder Reservoir", the Boulder Reservoir is included in the St. Vrain Basin in the SPDSS StateMod model network. The BCSC carries water from Boulder Reservoir. It makes deliveries via turnout directly to the Boulder White Rock Ditch (0600516) and then discharges to Boulder Creek. SWSP delivers to Windy Gap Cities, represented by aggregated municipal structures, via direct connections from the pipeline to their water treatment plants.

The City of Boulder's direct diversions from Boulder Reservoir supply the Boulder Reservoir Water Treatment Plant. This is represented at diversion node 0600800. More details on this operation are described in the Boulder Municipal Operations section below. For the C-BT water delivered via the BCSC, a historical analysis was done to identify the volume of water typically sent to different users. Based on this analysis of demands, C-BT imports delivered by the BCSC were split into two demand categories, with 80 percent of imports used for Boulder municipal demands (stored in 06_CBT_SP1) and 20 percent used for other in-basin users and downstream demands (stored in 06_CBT_SP2). The 80 percent reserved for the City of Boulder is separate from the direct diversions from Boulder Reservoir. The use of this water is also detailed in the Boulder Municipal Operations section below. Use of the 20 percent is detailed in the BCSC section immediately below. C-BT water delivered via SWSP is detailed in the SWSP section below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06CBTPLN.01	1.00001	06_CBT_ACC		06_CBT_IMP	35
06CBTPLN.02	1.00002	06_CBT_SP1 06_CBT_SP2	20% 80%	06_CBT_ACC	46
06CBTLIM.01	1.00000			06_CBT_LIM	47
06CBTPLN.05	1.00003	Boulder Constant Winter RFO (06_BOU_RF)		06_CBT_SP1	27
06CBTPLN.35	38350.00034	06538_B_RF		06_CBT_SP1	48
06CBTPLN.36	38350.00035	06543_B_RF		06_CBT_SP1	48

5.10.6.1.1 Boulder Creek Supply Canal

C-BT water released from Boulder Reservoir is carried down the Boulder Creek Supply Canal and is delivered to its users by the river, either directly or by exchange. The City of Lafayette takes C-BT water into Baseline Reservoir by exchange. The only exception to this is that the Boulder White Rock Ditch diverts some water directly off the Boulder Creek Supply Canal via a turnout. Rules documented in the table below release water down the Boulder Creek Supply Canal to meet various municipal demands, generally return flow obligations generated by the use of changed water rights. Water is also released from the Accounting Plan to various irrigators directly, by exchange or by carrier. Final, C-BT water is exported from the Boulder Basin to the South Platte Demand via the South Platte Supply Canal, which is an extension of the Lower Boulder Ditch (0600538_D). The table below outlines the operating rules that deliver water to the various C-BT users.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06CBTPLN.37	49330.00011	Lower Boulder Irrigation (0600538_I)	Lower Boulder Ditch (0600538_D)	06_CBT_SP1	27
06CBTPLN.12	2.00020	CBT export to South Platte (SPDMSPSC)	Lower Boulder Ditch (0600538_D)	06_CBT_SP2	27
06CBTPLN.13	8706.00060	BOULDER WHITEROCK DITCH IRRIGATION (0600516_I)	C-BTBWR Turnout (06_BWRCBT)	06_CBT_SP2	27
06CBTPLN.14	35731.00010	BOULDER LEFT HAND DITCH (0600513)	C-BTBWR Turnout (06_BWRCBT)	06_CBT_SP2	27
06CBTPLN.15	7791.00010	Boulder and Weld Co Ditch (0600515_D)		06_CBT_SP2	27
06CBTPLN.16	5266.00010	CARR TYLER DITCH (0600520_D)	Idaho Creek Ditch(0600663)	06_CBT_SP2	27
06CBTPLN.17	5570.00010	Gooding Daily and Plumb Ditch (0600527)		06_CBT_SP2	27
06CBTPLN.18	5600.00010	DELEHANT DITCH (0600523)	Idaho Creek Ditch (0600663)	06_CBT_SP2	27
06CBTPLN.19	40740.40317	FARMERS DITCH (0600525)		06_CBT_SP2	28
06CBTPLN.20	4109.00010	HOUCK 2 DITCH (0600534)	Idaho Creek Ditch (0600663)	06_CBT_SP2	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06CBTPLN.24	20890.19884	LEGGETT DITCH IRRIGATION (0600537_I)	Leggett Carrier (0600537)	06_CBT_SP2	27
06CBTPLN.25	49330.00010	Lower Boulder Irrigation (0600538_I)	Lower Boulder Ditch (0600538_D)	06_CBT_SP2	27
06CBTPLN.26	22265.00010	N BOULD FARMER DITCH (0600543)		06_CBT_SP2	28
06CBTPLN.27	4817.00010	Rural Ditch (0600551)		06_CBT_SP2	28
06CBTPLN.28	4900.00010	SMITH EMMONS DITCH (0600553)	Idaho Creek Ditch(0600663)	06_CBT_SP2	27
06CBTPLN.29	49330.00020	Louisville Return Flow Obligation (06565_V_RF)		06_CBT_SP2	48
06CBTPLN.30	49330.00020	Louisville Return Flow Obligation (06650_V_RF)		06_CBT_SP2	48
06CBTPLN.31	49330.00020	Louisville Return Flow Obligation (06567_V_RF)		06_CBT_SP2	48
06CBTPLN.32	99999.99999	BCSC Outfall (06_ARP009)		06_CBT_ACC	29
06CBTPLN.33	99999.99999	BCSC Outfall (06_ARP009)		06_CBT_SP1	29
06CBTPLN.34	99999.99999	BCSC Outfall (06_ARP009)		06_CBT_SP2	29

5.10.6.1.2 Southern Water Supply Pipeline (SWSP)

The Southern Water Supply Pipeline (SWSP) delivers water to “Windy Gap” Cities is represented as a single node (06_SWSP_IMP) that imports water into the lower District 6 system. Water is carried from the import by SWSP_C carrier node to Louisville demands. The bulk of the imported water is released to the river upstream of aggregated municipal demands (06_AMP001 and 06_AUP001) representing the smaller Windy Gap cities, whereby they are diverted in priority. The rules that deliver water from the SWSP are below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06SWSPPL.01	1.00001	06_SWSP_PL		06_SWSP_IMP	35
06SWSPPL.02	8812.00050	Louisville Indoor Use (06LOUIS_I)	C-BTSWSP Carrier (SWSP_C)	06_SWSP_PL	27
06SWSPPL.03	8812.00060	Louisville Outdoor Use (06LOUIS_O)	C-BTSWSP Carrier (SWSP_C)	06_SWSP_PL	27
06SWSPPL.04	8812.00100	C-BTSWSP Carrier (SWSP_C)		06_SWSP_PL	29

5.10.6.2 City of Boulder

The City of Boulder has multiple supply sources and diversion locations that are supplied by both rights originally decreed to those locations as well as irrigation rights that were changed to municipal use with multiple allowable points of diversion.

Boulder owns Barker Reservoir and the North Boulder Creek Watershed Reservoirs (Watershed Reservoirs). It uses most of the capacity in each, as well as direct flow diversions and direct exchanges, to meet its municipal demands. Tables outlining the accounts in each of Barker and the Watershed Reservoirs are in Section 5.6.1. Boulder meets a portion of its demands by exchanging C-BT water and storage water from Baseline Reservoir up to it points of diversion on Middle and North Boulder Creeks including Barker and the Watershed Reservoirs. The details for Baseline Reservoir are covered in the Lafayette Municipal section below.

Boulder owns several storage rights, exchange rights and changed irrigation rights that are decreed for storage in Barker Reservoir for municipal, hydropower, augmentation, and instream flow uses. Boulder also has an irrigation delivery obligation to the Silver Lake Ditch that Boulder sometimes meets with releases from Barker Reservoir. In the model, Barker Reservoir has a municipal account used to help meet Boulder's municipal demands and irrigation delivery obligations and a hydroelectric account that is used for power generation.

In addition to Boulder's municipal use, Barker Reservoir water is delivered to the Silver Lake Ditch for irrigation use using operating rules in the table below.

The Watershed Reservoirs consist of 7 individual reservoirs: Silver Lake, Island Lake, Lake Albion, Goose Lake and Green Lakes 1, 2 and 3. These reservoirs are operated together and are treated as one in this model. Boulder owns several storage rights, exchange rights and changed irrigation rights that are decreed for storage in the Watershed Reservoirs for municipal, hydropower, augmentation and instream flow uses. Some of Boulder's storage rights for Silver Lake were changed to include minimum streamflow as an allowable use. The model's accounts in the Watershed Reservoirs are shown in Section 5.6.1.

The CWCB owns decreed instream flow rights on North Boulder Creek and Boulder Creek. The City of Boulder has entered into agreements with the CWCB to provide water rights that support the CWCB's decreed instream flow rights in three defined stream reaches on Middle and North Boulder Creek, which are referred to as Segments A, B and C. Case 90CW0193 changed several direct flow rights and storage rights in Barker and the Watershed Reservoirs to alternate municipal and instream flow uses. Some of the direct flow rights (the 90CW193 Anderson, Farmers, McCarty, Harden, Smith & Goss and Boulder City Pipeline rights) were conveyed or assigned to the CWCB for instream flow use as a first priority. To the degree that instream flow requirements are met or during extraordinary drought or system emergency, the City reserves the ability to use the rights for municipal supply or to lease the historically consumed portion of the instream flow water to downstream users after it has passed through the City. There are no return flow obligations except that Boulder must deliver a total of 36 AF of return flow during October-March of each year, which they usually do with reusable return flow. Details are described in the following section.

Generally, Boulder takes its water supply in this order:

1. All direct flow and changed irrigation rights for direct use according to their relative priorities and terms and conditions. These rights are generally taken at the Boulder City Pipeline on North Boulder Creek and the Pipeline at Barker Reservoir on Middle Boulder

Creek. Some rights have been changed to be available to meet minimum streamflows as well as municipal demands.
2. At their decreed priorities, fill Barker Reservoir and the Watershed Reservoirs.
3. Fill Barker Reservoir and the Watershed Reservoirs via exchanges on Middle and North Boulder Creeks.
4. Fill Barker Reservoir and the Watershed Reservoirs by exchange from Boulder's municipal account in Baseline Reservoir. This exchange is limited to 50cfs.
5. Use C-BT water supplied by the Water Treatment Plant at Boulder Reservoir. This is represented by an import at 0600800.
6. Use Minimum Stream Flow (MSF) accounts in Barker and Watershed storage to supply minimum streamflow demands on North/Middle Boulder Creek segments A, B and C. Many of the rights available for MSF usage are decreed for municipal use as well.
7. Use accounts in both Barker Reservoir and the Watershed Reservoirs to supply the remaining municipal demand.
8. Meet return Boulder's monthly 36 AF return flow obligation as required using direct C-BT water or releases from Barker Reservoir. Boulder leases water from its account in Baseline reservoir to Lower Boulder Ditch Irrigators. Pre-1990, Boulder leased its shares in Baseline Reservoir to a number of different irrigators; these operations are represented in operating rules as well.

As presented in the tables below and the changed water rights section below, the following operating rules were used to simulate City of Boulder municipal and minimum instream flow demands.

Boulder Reservoir deliveries to Boulder WTP

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06800PLN.01	1.00001	060800_ACC		060800_IMP	35
06800PLN.02	1.00002	Boulder Indoor Use (06BOULDER_I)	Boulder Res Intake (0600800)	060800_ACC	27
06800PLN.03	1.00003	Boulder Outdoor Use (06BOULDER_O)	Boulder Res Intake (0600800)	060800_ACC	27
06800PLN.04	06800PLN.04	Boulder Outdoor Use (06BOULDER_O)		060800_ACC	29
06CBTPLN.06	38350.00020	Watershed reservoir (06_WSHED), Accounts 1-2		06_CBT_SP1	28
06CBTPLN.07	38350.00028	Barker Reservoir (0604172), Accounts 1-2		06_CBT_SP1	28
06CBTPLN.08	38350.00030	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	06_CBT_SP1	28
06CBTPLN.09	38350.00031	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	06_CBT_SP1	28
06CBTPLN.10	38350.00032	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	06_CBT_SP1	28

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06800PLN.01	1.00001	060800_ACC		060800_IMP	35
06CBTPLN.11	38350.00033	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	06_CBT_SP1	28

City of Boulder Direct Right Deliveries - Boulder Pipeline and Barker Pipeline

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06005990.01	9299.00000	Boulder Indoor Use (06BOULDER_I)		0600599.05	11
06005990.02	9299.00000	Boulder Outdoor Use (06BOULDER_O)		0600599.05	11
06005990.03	35793.00000	Boulder Indoor Use (06BOULDER_I)		0600599.07	11
06005990.04	35793.00000	Boulder Outdoor Use (06BOULDER_O)		0600599.07	11
06009430.01	40740.38851	Boulder Indoor Use (06BOULDER_I)		0600943.01	11
06009430.02	40740.38851	Boulder Outdoor Use (06BOULDER_O)		0600943.01	11
06_WSHED.01	52597.00001	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	Watershed reservoir (06_WSHED), Account 1	27
06_WSHED.02	52597.00004	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	Watershed reservoir (06_WSHED), Account 1	27
06_WSHED.03	52597.00005	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	Watershed reservoir (06_WSHED), Account 2	27
06_WSHED.04	52597.00005	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	Watershed reservoir (06_WSHED), Account 2	27
06CBTPLN.05	1.00003	Boulder Constant Winter RFO (06_BOU_RF)	Account 1	Barker Reservoir (0604172)	27
06041720.01	52597.00002	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	Barker Res (0604172), Account 1	27
06041720.02	52597.00002	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	Barker Res (0604172), Account 1	27
06041720.03	52597.00003	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	Barker Res (0604172), Account 2	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06041720.04	52597.00003	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	Barker Res (0604172), Account 2	27
06041720.13	20188.13948	SILVER LAKE DITCH (0600603)		Barker Res (0604172), Account 1	2
06041720.14	20188.16054	SILVER LAKE DITCH (0600603)		Barker Res (0604172), Account 1	2
06041720.07	38350.00036	06538_B_RF		Barker Reservoir (0604172), Account 1	48
06041720.08	38350.00037	06543_B_RF		Barker Reservoir (0604172), Account 1	48

5.10.6.3 Instream Flow Rules (0602124_U, 0602124_L, and 0602100)

There are several minimum streamflow reaches from the headwaters of Boulder Creek to the 75th Avenue gage. Instream flows are typically met into July by several transfers and donations of senior rights (Farmers Ditch, Anderson, Harden Ditch, and Smith & Goss Ditch and McCarty). The rights usually fall out of priority by the end of July, reducing flows below minimum standards. The City of Boulder has agreements with CWCB to provide water rights that support the CWCB's decreed instream flow rights in three defined stream reaches on Middle and North Boulder Creek, which are referred to as Segments A, B and C. Case 90CW0193 changed several direct flow rights and storage rights in Barker and the Watershed Reservoirs to alternate municipal and instream flow uses. Some of the direct flow rights (the 90CW193 Anderson, Farmers, McCarty, Harden, Smith & Goss and Boulder City Pipeline rights) were conveyed or assigned to the CWCB for instream flow use as a first priority.

Although the City of Boulder uses Barker Reservoir primarily for municipal water supply, Boulder also uses its Barker hydropower account for power generation in a manner that does not diminish the reliability of its municipal water supply. The Barker Reservoir MSF reflects a minimum bypass for Barker Reservoir on Middle Boulder Creek. Hydropower operations were not explicitly modeled because a 3 cfs releases to the 0602100 ISF mimic the operation. Typically, Boulder stores water in Barker under its hydropower rights during the fall and winter under the following conditions: 1. There is storage in Barker Reservoir, 2. Boulder's municipal rights at Barker are out of priority but Boulder's hydropower storage rights are in priority, and 3. The inflow to Barker in excess of the 3 cfs bypass is insufficient to effectively spin the turbine at Boulder Canyon Hydroelectric Plant, or Boulder Canyon Plant is temporarily not operating. On these occasions, Boulder stores inflow in excess of 3 cfs in Barker and subsequently releases that stored water for hydropower production at Boulder Canyon Plant, typically in late winter. Operating rules benefiting instream flow segments are presented in the table below, in the City of Boulder section above, and the changed water rights section below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06BARKMSF.01	99999.99999	BARKER 3CFS BYPASS (06_BARKMSF)		Barker Res (0604172), Account 2	1
064172MSF.02	52597.00099	BOULDER CREEK MSF SEGMENT C UPPER (0602100)		Barker Res (0604172), Account 2	1

5.10.6.4 City of Lafayette

The City of Lafayette has multiple supply sources and diversion locations that are supplied by both rights originally decreed to those locations as well as irrigation rights that were changed with multiple allowable points of diversion. Due to the lack of operational data on the Lafayette system, operations have been simplified significantly.

Lafayette generally takes its water supply in this order:

1. Take all Direct Flow and Changed Rights according to their priorities and terms and conditions. Most of these rights are either diverted for direct use via the Lafayette Pipeline on South Boulder Creek, diverted for direct use at the Baseline Pipeline via the Dry Creek Headgate, diverted for storage at Baseline Reservoir via Dry Creek Carrier, diverted for direct use via Leyner Cottonwood Ditch on the Dry Creek Carrier or diverted for direct use via the Lower Boulder Ditch.
2. Fill Baseline Reservoir from South Boulder Creek and by Carrier from Boulder Creek via water carried along the Anderson Ditch.
3. Fill Baseline Reservoir with C-BT water exchanged from the Boulder Supply canal to the Dry Creek Carrier headgate.
4. Use Lafayette's municipal account in Baseline Reservoir to supply Lafayette directly by the Baseline Pipeline.
5. Release from Baseline reservoir to meet return flow obligations for changed water rights.
6. Exchange Lafayette's reusable municipal supply to Baseline Reservoir, Baseline Pipeline and Lafayette Boulder Creek Pipelines.

Per CA12111, Lafayette can also store water in Baseline Reservoir from Boulder Creek (via Anderson Ditch), Bear Creek (via Anderson Ext. Ditch), South Boulder Creek (via Dry Creek Carrier), and Dry Creek (on-channel). All storage diversions (with the exception of on-channel storage) are carried by Dry Creek Carrier (0600902_C). Though Lafayette has many points of diversion, most of its water is either diverted at the Dry Creek Carrier headgate to be delivered to Lafayette's demands directly or to be stored in Baseline Reservoir. The notable exception is when C-BT water is either diverted at the Lafayette Boulder Creek Pipeline or exchanged up to the Dry Creek Carrier headgate to be delivered to Baseline reservoir.

Lafayette owns a large portion of Baseline Reservoir. While some water is leased from Baseline Reservoir to irrigators in District 6, those leases are inconsistent and difficult to model. The only other major user of Baseline Reservoir is the City of Boulder. The accounts modeled in Baseline Reservoir are detailed in Section 5.6.1. As presented in the table below, Lafayette meets its municipal and reuse demands with the following operating rules.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06CBTPLN.21	8141.00010	Lafayette Indoor Use (06LAFFYT_I)	LAFAYETTE BOULDER CREEK PL 1 (0600878)	06_CBT_SP2	27
06CBTPLN.22	8141.00010	Lafayette Indoor Use (06LAFFYT_I)	LAFAYETTE BOULDER CREEK PL 1 (0600878)	06_CBT_SP2	27
06CBTPLN.23	31379.00050	Baseline Reservoir (0604173), Account 1	Dry Creek Carrier (0600902_C)	06_CBT_SP2	28
0604173_C.01	8553.00015	Lafayette Indoor Use (06LAFFYT_I)	Baseline Res C to Lafayette (0604173_C)	Barker Res (0604173), Account 1	27
0604173_C.02	8553.00015	Lafayette Outdoor Use (06LAFFYT_O)	Baseline Res C to Lafayette (0604173_C)	Barker Res (0604173), Account 1	27
06LAFLIM.01	1.00000			Lafayette Release Limit - 06LAF_RELIM	47
06LAF_RE.01	51269.00020	Lafayette Indoor Use (06LAFFYT_I)	Lafayette Boulder Creek (0600878)	06LAF_DIVRE	28
06LAF_RE.02	51269.00021	Lafayette Outdoor Use (06LAFFYT_O)	Lafayette Boulder Creek (0600878)	06LAF_DIVRE	28
06LAF_RE.03	51269.00022	Lafayette Indoor Use (06LAFFYT_I)	DRY CR CARRIER (0600902_C) Baseline Res to Lafayette (0604173_C)	06LAF_DIVRE	28
06LAF_RE.04	51269.00023	Lafayette Outdoor Use (06LAFFYT_O)	DRY CR CARRIER (0600902_C) Baseline Res to Lafayette (0604173_C)	06LAF_DIVRE	28
06LAF_RE.05	51269.00022	Baseline Res (0604173), Account 1	DRY CR CARRIER (0600902_C)	06LAF_DIVRE	28
06LAF_RE.11	51269.00030	06_AWP003		06LAF_DIVRE	29

5.10.6.5 Baseline Reservoir

Currently, Baseline Reservoir is primarily owned by the City of Lafayette and the City of Boulder. Historically, the reservoir was used for supplemental irrigation supply. The reservoir is located off-channel and is filled via the Dry Creek Carrier (0600902_C). Deliveries are made at the direction of the City of Lafayette or the City of Boulder, as documented in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06041730.01	20890.20031	Baseline Res (0604173), Accounts 1-2	Anderson Carrier (0600501) Dry Creek Carrier (0600902_C)	0604173.01	45
6041730.02	26630.00000	Baseline Res (0604173), Accounts 1-2	Anderson Carrier (0600501) Dry Creek Carrier (0600902_C)	0604173.02	45
06041730.03	29219.00000	Baseline Res (0604173), Accounts 1-2	Anderson Carrier (0600501) Dry Creek Carrier (0600902_C)	0604173.03	45
06041730.04	29219.00000	Baseline Res (0604173), Accounts 1-2	Anderson Carrier (0600501) Dry Creek Carrier (0600902_C)	0604173.04	45
06041730.05	20890.20031	Baseline Res (0604173), Accounts 1-2	Dry Creek Carrier (0600902_C)	0604173.01	45
06041730.06	26630.00000	Baseline Res (0604173), Accounts 1-2	Dry Creek Carrier (0600902_C)	0604173.02	45
06041730.07	29219.00000	Baseline Res (0604173), Accounts 1-2	Dry Creek Carrier (0600902_C)	0604173.03	45
06041730.08	31379.00000	Baseline Res (0604173), Accounts 1-2	Dry Creek Carrier (0600902_C)	0604173.04	45
06041730.09	20890.20031	Baseline Res (0604173), Accounts 1-2	ANDERSON EXTENSION DITCH (0600753) Dry Creek Carrier (0600902_C)	0604173.01	45
06041730.10	26630.00000	Baseline Res (0604173), Accounts 1-2	ANDERSON EXTENSION DITCH (0600753) Dry Creek Carrier (0600902_C)	0604173.02	45
06041730.11	29219.00000	Baseline Res (0604173), Accounts 1-2	ANDERSON EXTENSION DITCH (0600753) Dry Creek Carrier (0600902_C)	0604173.03	45
06041730.12	29219.00000	Baseline Res (0604173), Accounts 1-2	ANDERSON EXTENSION DITCH (0600753) Dry Creek Carrier (0600902_C)	0604173.04	45
0604173_X.01	1.00000			064173_CH	47
0604173_X.02	38350.00000	Watershed reservoir (06_WSHED), Accounts 1-2		Baseline Reservoir (0604173), Account 2	28
0604173_X.03	38350.00000	Barker Reservoir (0604172), Accounts 1-2		Baseline Reservoir (0604173), Account 2	28

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
0604173RF.01	38350.00050	06538_L_RF		Baseline Reservoir (0604173), Account 1	48
0604173RF.02	38350.00050	06565_L_RF		Baseline Reservoir (0604173), Account 1	48
0604173RF.03	38350.00050	06650_L_RF		Baseline Reservoir (0604173), Account 1	48
0604173RF.04	38350.00050	06576_L_RF		Baseline Reservoir (0604173), Account 1	48
0604173RF.05	38350.00050	06569_L_RF		Baseline Reservoir (0604173), Account 1	48
0604173RF.06	38350.00050	06567_L_RF		Baseline Reservoir (0604173), Account 1	48

5.10.6.5.3 Direct Deliveries from Baseline Reservoir via Pipeline

Boulder leases their shares back to Lower Boulder Ditch irrigators. Pre-1990 Baseline released to Lower Boulder Ditch and other Dry Creek Carrier Ditches (primarily 0600565, 0600566, and 0600569 as noted in HydroBase).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06041730.13	38350.00010	Lower Boulder Irrigation (0600538_I)		Baseline Reservoir (0604173), Account 2	27
06041730.14	38350.00020	Lower Boulder Irrigation (0600538_I)		Baseline Reservoir (0604173), Account 1	27
06041730.15	38350.00030	DRY CREEK DAVIDSON DITCH SYSTEM (0600569_D)		Baseline Reservoir (0604173), Account 1	27
06041730.16	38350.00040	COTTONWOOD DITCH 2 (0600566)		Baseline Reservoir	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
				(0604173), Account 1	
06041730.17	38350.00041	LEYNER COTTONWOOD DITCH IRRIGATION (0600565_I)	LEYNER COTTONWOOD DITCH (0600565)	Baseline Reservoir (0604173), Account 1	27

5.10.6.6 Dry Creek Carrier System

The Dry Creek Carrier headgate is the diversion point for Baseline Reservoir and the City of Lafayette, as well as several irrigation diversions. These irrigation diversions all account for use of their water rights at the Dry Creek Carrier headgate. These diversions include Leyner Cottonwood, Howard, Dry Creek Davidson, Enterprise, and Cottonwood Ditch (detailed in the Changed Water Rights sections) and Andrews Farwell Ditch as presented below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06005600.01	5266.00000	ANDREWS FARWELL DITCH (0600560)	Dry Creek Carrier (0600902_C)	0600560.01	45
06005600.02	7761.00000	ANDREWS FARWELL DITCH (0600560)	Dry Creek Carrier (0600902_C)	0600560.02	45

5.10.6.7 City of Louisville

The City of Louisville's municipal supply is maintained by a number of changed water rights (see the Changed Water Rights Section 5.10.6.12 below), one major point of diversion, and supply from a single reservoir system, Marshall Reservoir. In general, the order Louisville uses its supply:

1. Take all Direct Flow and Changed Rights according to their priorities and terms and conditions. Most of these rights are diverted for direct use via the Louisville Pipeline on South Boulder Creek. Some rights are changed for storage in Marshall Lake, diverted via the Community Ditch.
2. Release water from Marshall Reservoir to meet Louisville's Municipal Demands.
3. Use imported C-BT water from the Southern Water Supply Pipeline.

The table below outlines the rules used to deliver water to the City of Louisville:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06042120.05	8812.00010	Louisville Indoor Demand (06LOUIS_I)	Marshall Res to Louisville (0604212_C)	Marshall Lake (0604212), Account 1	3
06042120.06	8812.00011	Louisville Outdoor Demand (06LOUIS_O)	Marshall Res to Louisville (0604212_C)	Marshall Lake (0604212),	3

				Account1	
06SWSPPL.02	8812.00050	Louisville Indoor Use (06LOUIS_I)	C-BTSWSP Carrier (SWSP_C)	06_SWSP_PL	27
06SWSPPL.03	8812.00060	Louisville Outdoor Use (06LOUIS_O)	C-BTSWSP Carrier (SWSP_C)	06_SWSP_PL	27

5.10.6.8 Marshall Reservoir (0604212), McKay Lake (0604214), and Community Ditch (0600564_D)

Marshall Reservoir is modeled as a single account used to supply both Louisville Municipal Demands and irrigators on the Community Ditch system. McKay Lake uses the same headgate, but is only modeled as irrigation supply. As presented in the tables below, the operations of Community Ditch, Marshall Reservoir and McKay Lake are modeled with the following operating rules.

Direct deliveries to Community Ditch Irrigation Demands (0600564_I)

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060564_D.01	3744.00000	Community Ditch Irrigation Demands (0600564_I)	Community Ditch (0600564_D)	0600564_D.01	45
060564_D.02	4853.00000	Community Ditch Irrigation Demands (0600564_I)	Community Ditch (0600564_D)	0600564_D.02	45
060564_D.03	4869.00000	Community Ditch Irrigation Demands (0600564_I)	Community Ditch (0600564_D)	0600564_D.03	45
060564_D.04	5235.00000	Community Ditch Irrigation Demands (0600564_I)	Community Ditch (0600564_D)	0600564_D.04	45
060564_D.06	12941.00000	Community Ditch Irrigation Demands (0600564_I)	Community Ditch (0600564_D)	0600564_D.06	45
060564_D.12	18699.00000	Community Ditch Irrigation Demands (0600564_I)	Community Ditch (0600564_D)	0600564_D.12	45
060564_D.18	20890.19595	Community Ditch Irrigation Demands (0600564_I)	Community Ditch (0600564_D)	0600564_D.18	45

Marshall and McKay Reservoirs

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06042120.01	12941.00000	Marshall Lake (0604212), Accounts 1-2	Community Ditch (0600564_D)	0604212.01	45

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06042120.02	20890.19055	Marshall Lake (0604212), Accounts 1-2	Community Ditch (0600564_D)	0604212.02	45
06042120.03	22561.00000	Marshall Lake (0604212), Accounts 1-2	Community Ditch (0600564_D)	0604212.03	45
06042120.04	29219.00000	Marshall Lake (0604212), Accounts 1-2	Community Ditch (0600564_D)	0604212.04	45
06042140.01	14001.00000	McKay Lake (0604214), Account 1	Community Ditch (0600564_D)	0604214.01	45
06042140.02	18615.18319	McKay Lake (0604214), Account 1	Community Ditch (0600564_D)	0604214.02	45
06042140.03	99999.00000	McKay Lake (0604214), Account 1	Community Ditch (0600564_D)	0604214.03	45
06042120.07	20890.19695	Community Ditch Irrigation Demands (0600564_I)		Marshall Lake (0604212), Account1	2
06042140.04	20890.19695	Community Ditch Irrigation Demands (0600564_I)		McKay Lake (0604214), Account 1	2

5.10.6.9 Boulder White Rock Ditch System (0600516) - Six Mile (0604187) and Panama (0604185) Reservoirs

The Boulder White Rock Ditch system supplies irrigated land by several sources. Boulder White Rock owns an 1873 priority direct flow right and an exchange right supplied by Panama Reservoir releases. Boulder White Rock is a majority shareholder in the storage rights for Six Mile and Panama Reservoir. Boulder White Rock Ditch is modeled with a headgate diverting off Boulder Creek, a turnout headgate on the Boulder Creek Supply Canal, and storage in Panama and Six Mile Reservoirs. Some of the irrigated lands for the Boulder White Rock Ditch are upstream of both reservoirs. Panama Reservoir releases can be delivered by exchange to the Boulder White Rock headgate. Other source structures have been used infrequently in the past. The inconsistency is no modeled. Six Mile Reservoir can be filled with diversions from Boulder White Rock Ditch. Panama Reservoir can be filled with diversion from Boulder White Rock Ditch and from Leggett Ditch. Leggett Ditch also deliveries to irrigation demand. As presented in the table below, the Boulder White Rock System is modeled with the following operating rules.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06041870.01	16303.00000	SIX MILE RES (0604187), Account 1	Boulder White Rock Carrier (0600516)	0604187.01	45
06041870.02	29219.00000	SIX MILE RES (0604187), Account 1	Boulder White Rock Carrier (0600516)	0604187.02	45
06041850.01	20890.19874	Panama Reservoir (0604185), Account 1	Boulder White Rock Carrier (0600516)	0604185.01	45

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06041850.02	29219.00000	Panama Reservoir (0604185), Account 1	Boulder White Rock Carrier (0600516)	0604185.02	45
06041850.09	20890.19874	Panama Reservoir (0604185), Account 1	LEGGETT DITCH (0600537)	0604185.01	45
06041850.10	29219.00000	Panama Reservoir (0604185), Account 1	LEGGETT DITCH (0600537)	0604185.02	45
06CBTPLN.13	8706.00060	BOULDER WHITEROCK DITCH IRRIGATION (0600516_I)	C-BTBWR Turnout (06_BWRCBT)	06_CBT_SP2	27
06516_XL.01	1.00000			06_BWR_XLIM	47
06005160.02	20890.19884	BOULDER WHITEROCK DITCH IRRIGATION (0600516_I)	Boulder White Rock Ditch (0600516)	Panama Reservoir (0604185), Account 1	28
06005160.03	20890.19894	BOULDER WHITEROCK DITCH IRRIGATION (0600516_I)		SIX MILE RES (0604187), Account 1	2
06005370.01	6696.00000	LEGGETT DITCH - IRRIGATION (0600537_I)	Leggett Ditch (0600537)	0600537.01	45
06005370.02	20890.19894	LEGGETT DITCH - IRRIGATION (0600537_I)		Panama Reservoir (0604185), Account 1	3

5.10.6.10 Idaho Creek Ditches (0600663)

Idaho Creek Ditches (also known as Idaho Slough) diverts from Boulder Creek and is the common supply for Idaho Creek. The complex includes several irrigation ditches - Houck #2 Ditch (0600534), Carr Tyler Ditch (0600520_D), Smith Emmons (0600553), Delehant Ditch (0600523), and Highland South Side Ditch (0600532) - that divert from Idaho Creek. Some of these ditches also receive C-BT water from the Boulder Creek Supply Canal (as documented in the Boulder Creek Supply Canal Section) and from Panama Reservoir (not captured in the model). The operating rules that deliver water to irrigation diversions off Idaho Creek are below:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06005340.01	4109.00000	Houck No. 2 Ditch (0600534)	IDAHO CREEK (0600663)	0600534.01	45
0600520_D.01	4170.00000	Carr Tyler Ditch (0600520_D)	IDAHO CREEK (0600663)	0600520_D.01	45
0600520_D.02	5266.00000	Carr Tyler Ditch (0600520_D)	IDAHO CREEK (0600663)	0600520_D.02	45
06005530.01	4900.00000	Smith Emmons (0600553)	IDAHO CREEK (0600663)	0600553.01	45
06005230.01	5600.00000	Delehant (0600523)	IDAHO CREEK (0600663)	0600523.01	45

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06005320.01	5631.00000	Highland South Side Ditch (0600532)	IDAHO CREEK (0600663)	0600532.01	45
06005320.02	6727.00000	Highland South Side Ditch (0600532)	IDAHO CREEK (0600663)	0600532.02	45
06CBTPLN.28	4900.00010	SMITH EMMONS DITCH (0600553)	Idaho Creek Ditch(0600663)	06_CBT_SP2	27

5.10.6.11 Valmont Reservoir Complex

The Valmont Reservoir Complex is owned by Xcel Energy, formerly known as Public Service Company of Colorado (PSCO) and consists of three hydraulically interconnected reservoirs, Valmont, Leggett and Hillcrest. These reservoirs share a common water surface elevation and are treated as one reservoir. The Valmont system diverts its storage rights and some changed rights primarily from South Boulder Creek. Operating rules deliver water from the reservoir system to the cooling demands of the power plant. While there have been intermittent historical releases from the reservoir system to irrigators in District 6, those operations are infrequent and were not modeled. Until 2000, releases were regularly made from the Valmont Reservoir complex to the Leggett Ditch to satisfy PSCO's contractual delivery obligations related to their acquisition of Leggett Reservoir. Starting in 2001, those delivery obligations were met via C-BT deliveries. As presented in the table below, components of the Valmont Reservoir System were modeled with the following operating rules.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06_VALMT_D.2	20890.05113	Valmont Combined Reservoir (06_VALMT), Account 1	Combined Valmont Res Inlet (06_VALMT_C)	06_VALMT.02	45
06_VALMT_D.3	22302.00000	Valmont Combined Reservoir (06_VALMT), Account 1	Combined Valmont Res Inlet (06_VALMT_C)	06_VALMT.03	45
06_VALMT_D.4	24538.00000	Valmont Combined Reservoir (06_VALMT), Account 1	Combined Valmont Res Inlet (06_VALMT_C)	06_VALMT.04	45
06_VALMT_D.5	27930.26611	Valmont Combined Reservoir (06_VALMT), Account 1	Combined Valmont Res Inlet (06_VALMT_C)	06_VALMT.05	45
06_VALMT_D.6	29219.00000	Valmont Combined Reservoir (06_VALMT), Account 1	Combined Valmont Res Inlet (06_VALMT_C)	06_VALMT.06	45
06_VALMT_D.7	40740.38101	Valmont Combined Reservoir (06_VALMT), Account 1	Combined Valmont Res Inlet (06_VALMT_C)	06_VALMT.07	45
06_VALMPP.01	1.00000	Valmont Power Plant (06_VALMPP)		06_VALMT	2

5.10.6.12 Changed Water Rights

Numerous changed water rights in the Boulder Creek drainage are included in the following section. Because of the prevalence of shared interest by the Boulder county municipalities, these changed irrigation rights as listed below by ditch. Many of the changed rights were left with a remaining irrigation component and rules exist to release water to those irrigation demands.

5.10.6.12.1 Lower Boulder Ditch (0600538_D) Changed Rights

There are multiple changes for each of the rights that sit on the Lower Boulder Ditch. They are laid out by water right ID below.

The 0600538_D.01 water right is stored in the (060538_CHT1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. The sum of monthly limits is greater than to the annual limit, so the users can take what they need until they hit their limit. Lower Boulder Ditch 0600538_D.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (90CW108 and 97CW195) and the City of Boulder (94CW284).

Water right yield is split between City of Boulder Exchange (0.875 cfs, 3.3%) and City of Lafayette Direct Use (1.624 cfs, 6.5%). By decree, new uses are required to leave a portion of the water right at the ditch. This water is modeled as not being moved to the split plans for new users, but remaining in the ditch plan.

Uses of the changed water rights include:

- City of Boulder exchange to the Barker Pipeline
    - Available April 15th to Oct 31st, subject to limits, Sept 56.9 AF, Oct 51.2 AF, Annual 419.7 AF
- City of Lafayette direct use, carried by 0600538_D
    - Available April 15th to Oct 31st, subject to limits, Sept 105.6 AF, Oct 95 AF, Annual 778.8 AF

The 0600538_D.02, 0600538_D.03, and 0600538_D.04 water rights are stored in the (060538_CH2) accounting plan, limited to April through October. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (90CW108).

Water right yield is used by the City of Lafayette Direct Use (0.043 cfs, 0.064 cfs, and 0.044 cfs, for a total of 1.6% of the water rights).

Uses of the changed water rights include:

- City of Lafayette direct use, carried by 0600538_D with 20% carrier loss.

The **0600538_D.05** water right is stored in the (060538_CH7) accounting plan, available from May 1st, through Sept 15th. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (90CW108).

Water right yield is used by the City of Lafayette through storage in Baseline Reservoir (0.044 cfs, 11.5%).

Uses of the changed water rights include:

- City of Lafayette through storage in Baseline Reservoir, carried by 0600902 and 06_BASE_C with 0% carrier loss.

The **0600538_D.06** water right is stored in the (060538_CH5) accounting plan, available from May 1st, through Sept 15th. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (90CW108)

Water right yield is used by the City of Lafayette Direct Use (0.017 cfs, 0.6%).

Uses of the changed water rights include:

- City of Lafayette direct use, carried by 0600538_D with 20% carrier loss.

The 0600538_D.08 water right priority is stored in the (060538_CHT8). Monthly and annual limits are set based on changes for individual users, see below. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (90CW108 and 97CW195) and the City of Boulder (94CW284).

Water right yield is split between three City of Boulder Exchanges, each with a different monthly/annual limit (1.26 cfs, 1.3%; 1.22 cfs, 1.2%; 1.83 cfs, 1.9%) and City of Lafayette Direct Use (2.96 cfs, 3.0%).

Uses of the changed water rights include:

- City of Boulder Exchange 2
  - Available April 15th to Oct 31st, subject to limits, Sept 56.9 AF, Oct 51.2 AF, Annual 419.7 AF
- City of Boulder Exchange 3
  - Available April 15th to Oct 31st, subject to limits, Annual 198 AF
- City of Boulder Exchange 4
  - Available May 1st to July 31st, subject to limits, Annual 198 AF
- City of Lafayette direct use, carried by 0600538_D
  - Available April 15th to Oct 31st, subject to limits, Sept 105.6 AF, Oct 95 AF, Annual 778.8 AF

Remaining plan supplies are released to Lower Boulder Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060538_CH.11	3561.00000	060538_CHT1	100%	0600538_D.01	26
060538_CL.01	1.00000			Release Limit 1 - 060538_CHL1	47
060538_XL.01	1.00000			Release Limit 2 - 060538_CXL1	47
060538_CH.12	3561.00001	060538_CHI1 060538_CX1 060538_CH1	90.2% 3.3% 6.5%	060538_CHT1	46
060538_CH.13	3561.00002	Lower Boulder Irrigation (0600538_I)	Lower Boulder Ditch (0600538_D)	060538_CHI1	27
060538_CX.01	3561.00003	Barker Reservoir (0604172), Account 1		060538_CX1	28
060538_CX.02	3561.00004	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	060538_CX1	28
060538_CX.03	3561.00004	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	060538_CX1	28
060538_CH.14	3561.00004	Lafayette Indoor Demand (06LAFFYT_I)	Lower Boulder Ditch (0600538_D)	060538_CH1	27
060538_CH.15	3561.00005	Lafayette Outdoor Demand (06LAFFYT_O)	Lower Boulder Ditch (0600538_D)	060538_CH1	27
060538_C.100	3561.00020	Lower Boulder Ditch (0600538_D)		060538_CHT1	29
060538_C.101	3561.00020	Lower Boulder Ditch (0600538_D)		060538_CHI1	29
060538_C.102	3561.00020	Lower Boulder Ditch (0600538_D)		060538_CH1	29
060538_C.103	3561.00020	Lower Boulder Ditch (0600538_D)		060538_CX1	29
060538_CH.21	4869.00000	060538_CHT2	100%	0600538_D.02	26
060538_CH.22	5511.00000	060538_CHT2	100%	0600538_D.03	26
060538_CH.23	5979.00000	060538_CHT2	100%	0600538_D.04	26
060538_CH.24	5979.00001	060538_CHI2 060538_CH2	98.4% 1.6%	060538_CHT2	46
060538_CH.25	5979.00002	Lower Boulder Irrigation (0600538_I)	Lower Boulder Ditch (0600538_D)	060538_CHI2	27
060538_CH.26	5979.00003	Lafayette Indoor Demand (06LAFFYT_I)	Lower Boulder Ditch (0600538_D)	060538_CHI2	27
060538_CH.27	5979.00004	Lafayette Outdoor Demand (06LAFFYT_O)	Lower Boulder Ditch (0600538_D)	060538_CHI2	27
060538_C.104	5979.00020	Lower Boulder Ditch (0600538_D)		060538_CHT2	29
060538_C.105	5979.00020	Lower Boulder Ditch (0600538_D)		060538_CHI2	29
060538_C.106	5979.00020	Lower Boulder Ditch (0600538_D)		060538_CH2	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060538_CH.51	5979.00000	060538_CHT5	100%	0600538_D.05	26
060538_CH.52	5979.00001	060538_CHI5 060538_CH5	88.5% 11.5%	060538_CHT5	46
060538_CH.53	5979.00002	Lower Boulder Irrigation (0600538_I)	Lower Boulder Ditch (0600538_D)	060538_CHI5	27
060538_CH.54	5979.00003	Baseline Reservoir (0604173), Account 1	Dry Creek Carrier (0600902_C)	060538_CH5	28
060538_C.107	5979.00020	Lower Boulder Ditch (0600538_D)		060538_CHT5	29
060538_C.108	5979.00020	Lower Boulder Ditch (0600538_D)		060538_CHI5	29
060538_C.109	5979.00020	Lower Boulder Ditch (0600538_D)		060538_CH5	29
060538_CH.61	5996.00000	060538_CHT6	100%	0600538_D.06	26
060538_CH.62	5996.00001	060538_CHI6 060538_CH6	99.4% 0.6%	060538_CHT6	46
060538_CH.63	5996.00002	Lower Boulder Irrigation (0600538_I)	Lower Boulder Ditch (0600538_D)	060538_CHI6	27
060538_CH.64	5996.00003	Lafayette Indoor Demand (06LAFFYT_I)	Lower Boulder Ditch (0600538_D)	060538_CH6	27
060538_CH.65	5996.00004	Lafayette Outdoor Demand (06LAFFYT_O)	Lower Boulder Ditch (0600538_D)	060538_CH6	27
060538_C.110	5996.00020	Lower Boulder Ditch (0600538_D)		060538_CHT6	29
060538_C.111	5996.00020	Lower Boulder Ditch (0600538_D)		060538_CHI6	29
060538_C.112	5996.00020	Lower Boulder Ditch (0600538_D)		060538_CH6	29
060538_D.71	5996.00000	Lower Boulder Irrigation (0600538_I)	Lower Boulder Ditch (0600538_D)	0600538_D.07	45
060538_CH.81	7457.00000	060538_CHT8	100%	0600538_D.08	26
060538_CL.82	1.00000			Release Limit 1 - 060538_CHL8	47
060538_CL.83	1.00000			Release Limit 2 060538_CXL2	47
060538_XL.84	1.00000			Release Limit 3 060538_CXL3	47
060538_XL.85	1.00000			Release Limit 4 060538_CXL4	47
060538_CH.86	7457.00001	060538_CX2 060538_CX3 060538_CX4 060538_CH8 060538_CHI8	1.3% 1.2% 1.9% 3.0% 92.6%	060538_CHT8	46
060538_CH.87	7457.00002	Lower Boulder Irrigation (0600538_I)	Lower Boulder Ditch (0600538_D)	060538_CHI8	27
060538_CX.71	7457.00003	Baseline Res (0604172), Accounts 1-2		060538_CX2	28

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060538_CX.72	7457.00002	Watershed Res (06_WSHED), Accounts 1-2		060538_CX2	28
060538_CX.73	7457.00004	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	060538_CX2	28
060538_CX.74	7457.00004	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	060538_CX2	28
060538_CX.75	7457.00005	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060538_CX2	28
060538_CX.76	7457.00005	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060538_CX2	28
060538_CX.77	7457.00003	Baseline Res (0604172), Accounts 1-2		060538_CX3	3
060538_CX.78	7457.00002	Watershed Res (06_WSHED), Accounts 1-2		060538_CX3	3
060538_CX.79	7457.00004	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	060538_CX3	3
060538_CX.80	7457.00004	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	060538_CX3	3
060538_CX.81	7457.00005	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060538_CX3	3
060538_CX.82	7457.00005	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060538_CX3	3
060538_CX.83	7457.00003	Baseline Res (0604172), Accounts 1-2		060538_CX4	28
060538_CX.84	7457.00002	Watershed Res (06_WSHED), Accounts 1-2		060538_CX4	28
060538_CX.85	7457.00004	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	060538_CX4	28
060538_CX.86	7457.00004	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	060538_CX4	28
060538_CX.87	7457.00005	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060538_CX4	28
060538_CX.88	7457.00005	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060538_CX4	28

Lower Boulder Ditch Split Changed Water delivered to Lafayette demands

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060538_CH.89	7457.00005	Lafayette Indoor Demand (06LAFFYT_I)	LAFAYETTE BOULDER CREEK PL 1 (0600878)	060538_CH8	28
060538_CH.90	7457.00006	Lafayette Outdoor Demand (06LAFFYT_O)	LAFAYETTE BOULDER CREEK PL 1 (0600878)	060538_CH8	28
060538_CH.91	7457.00007	Lafayette Indoor Demand (06LAFFYT_I)	Lower Boulder Ditch (0600538_D)	060538_CH8	28

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060538_CH.92	7457.00008	Lafayette Outdoor Demand (06LAFFYT_O)	Lower Boulder Ditch (0600538_D)	060538_CH8	28
060538_C.113	7457.00020	Lower Boulder Ditch (0600538_D)		060538_CHT8	29
060538_C.114	7457.00020	Lower Boulder Ditch (0600538_D)		060538_CH8	29
060538_C.115	7457.00020	Lower Boulder Ditch (0600538_D)		060538_CX2	29
060538_C.116	7457.00020	Lower Boulder Ditch (0600538_D)		060538_CX3	29
060538_C.117	7457.00020	Lower Boulder Ditch (0600538_D)		060538_CX4	29
060538_C.118	7457.00020	Lower Boulder Ditch (0600538_D)		060538_CHI8	29

5.10.6.12.2 Leyner Cottonwood Ditch (0600565) Changed Rights

The 0600565.01 water right priority is stored in the (060565_CHT1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. All Leyner Cottonwood Ditch 0600565.01 operations are represented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (80CW468 and 85CW119) and the City of Louisville (87CW327).

Water right yield is split between City of Lafayette (3.76 cfs, 11.7%) and City of Louisville Direct Use (2.26 cfs, 7.1%). Both cities are required to leave a portion of the water right at the ditch. Therefore, some of their water right yield is put into plans which be released back to the ditch. All water for this water right is diverted into the changed water rights plan since the water not changed to municipalities needs to be delivered to off-channel irrigation at 0600565_I.

Uses of the changed water rights include:

- City of Lafayette deliveries to Baseline reservoir or direct use via Leyner Cottonwood Carrier Ditch
    - Available April 15th to Sep 15st, subject to limits, Annual 656 AF
- City of Louisville direct use, exchanged to Louisville Pipeline
    - Available April 15th to Sep 15st, subject to limits, Annual 430 AF

Remaining plan supplies are released to the Leyner Cottonwood Ditch headgate.

The junior water rights have not been changed and are available to the irrigation demand.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060565_CH.01	5570.00000	060565_CHT1	100%	0600565.01	26

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060565_CL.01	1.00000			Release Limit 1 - 060565_CHL1	47
060565_CL.02	1.00000			Release Limit 2 - 060565_CHL2	47
060565_CH.02	5570.00001	060565_CHI1 060565_CH1 060565_CS1 060565_CH2 060565_CS2	81.2% 10.5% 1.2% 5.7% 1.4%	060565_CHT1	46
060565_CH.03	5570.00002	LEYNER COTTONWOOD DITCH IRRIGATION (0600565_I)	Dry Creek Carrier (0600902_C) Leyner Cottonwood Ditch (0600565)	060565_CHI1	27
060565_CH.04	5570.00002	Baseline Reservoir (0604173), Account 1	Dry Creek Carrier (0600902_C)	060565_CH1	27
060565_CH.05	5570.00002	Lafayette Indoor Demand (06LAFFYT_I)	Dry Creek Carrier (0600902_C) Leyner Cottonwood Ditch (0600565) Leyner Cottonwood Carrier (0600565_C)	060565_CH1	27
060565_CH.06	5570.00003	Lafayette Outdoor Demand (06LAFFYT_O)	Dry Creek Carrier (0600902_C) Leyner Cottonwood Ditch (0600565) Leyner Cottonwood Carrier (0600565_C)	060565_CH1	27
060565_CH.07	5570.00002	Louisville Indoor Demand (06LOUIS_I)	Louisville PL (0600598)	060565_CH2	28
060565_CH.08	5570.00003	Louisville Outdoor Demand (06LOUIS_O)	Louisville PL (0600598)	060565_CH2	28
060565_CH.10	5570.00020	Leyner Cottonwood Ditch (0600565)		060565_CHT1	29
060565_CH.11	5570.00020	Leyner Cottonwood Ditch (0600565)		060565_CHI1	29
060565_CH.12	5570.00020	Leyner Cottonwood Ditch (0600565)		060565_CH1	29
060565_CH.13	5570.00020	Leyner Cottonwood Ditch (0600565)		060565_CS1	29
060565_CH.14	5570.00020	Leyner Cottonwood Ditch (0600565)		060565_CH2	29
060565_CH.15	5570.00020	Leyner Cottonwood Ditch (0600565)		060565_CS2	29
06005650.02	5935.00000	LEYNER COTTONWOOD DITCH IRRIGATION (0600565_I)	Dry Creek Carrier (0600902_C) Leyner Cottonwood Ditch (0600565)	0600565.02	45
06005650.03	7579.00000	LEYNER COTTONWOOD DITCH IRRIGATION	Dry Creek Carrier (0600902_C)	0600565.03	45

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		(0600565_I)	Leyner Cottonwood Ditch (0600565)		
06005650.04	49330.00000	LEYNER COTTONWOOD DITCH IRRIGATION (0600565_I)	Dry Creek Carrier (0600902_C) Leyner Cottonwood Ditch (0600565)	0600565.04	45
06005650.05	53691.53631	LEYNER COTTONWOOD DITCH IRRIGATION (0600565_I)	Dry Creek Carrier (0600902_C) Leyner Cottonwood Ditch (0600565)	0600565.05	45

5.10.6.12.3 Howard Ditch (0600580) Changed Rights

The pro rata portion of 0600580.01 water right priority is stored in the (060580_CHT1) accounting plan. Monthly and annual limits are set based on multiple changes for each individual user, see below. All Howard Ditch 0600580.01 operations are represented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (CA8960, W8346 and W8348), the City of Louisville (99CW0230, CA12698, CA21299 and W8500) and Eldora Ski Resort (W7786, 02CW400 and 07CW02).

Water right yield is split between City of Lafayette (3.76 cfs, 17.5% and 3.28 cfs, 24.6%), City of Louisville (0.36 cfs, 2.7%; 4.5 cfs, 33.8%; 0.841 cfs, 6.3%; 1.55 cfs, 11.6%) and Eldora Ski Resort (0.4914 cfs, 3.7%). Under the decrees, new uses are required to leave a portion of the water right at the ditch. Therefore, some of their water right yields are put into plans which release back to the ditch.

Uses of the changed water rights include:

- City of Lafayette exchange to the Lafayette Pipeline on South Boulder Creek
  - Change of 3.76 cfs available April 15th to Oct 31st, subject to limits, Annual 260 AF
  - Change of 3.28 cfs available April 15th to Oct 31st, subject to limits, Apr 19.6 AF, May 36.3 AF, Jun 73.3 AF, Jul 95.3 AF, Aug 86.2 AF, Sep 42.2 AF, Oct 25.1 AF, Annual 290.8 AF
- City of Louisville direct use, exchanged to Louisville Pipeline
  - Change of 0.36 cfs available April 1st to Oct 31st, subject to limits, Apr 0.68 AF, May 2.04 AF, Jun 3.66 AF, Jul 4.92 AF, Aug 4.24 AF, Sep 2.09 AF, Oct 1.1 AF, Ann 18.74 AF
  - Change of 4.5 cfs available April 1st to Oct 31st, subject to limits, Jun 123 AF, Jul 123 AF, Ann 500 AF
  - Change of 0.841cfs available April 1st to Oct 31st, subject to limits, Ann 133 AF
  - Change of 1.55 cfs available April 1st to Oct 31st, subject to limits, Apr 13 AF, May 39 AF, Jun 70 AF, Jul 94 AF, Aug 81 AF, Sep 40 AF, Oct 21 AF, Annual 358 AF
- Eldora Ski Resort direct use

- Change of 0.4914 cfs available April 1st to Oct 31st, subject to limits, Apr 24.5 AF, May 25.3 AF, Jun 29.2 AF, Jul 30.2 AF, Aug 30.2 AF, Sep 24.5 AF, Oct 24.5 AF, Annual 60.41 AF

Remaining plan supplies are released back to the river at the Howard Ditch headgate. 100% of this ditch has been changed, so there is no irrigation structure to receive the remaining water.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060580_CH.01	3744.00000	060580_CHT1	52.1%	0600580.01	26
060580_CL.01	1.00000			Release Limit 1 - 060580_CHL1	47
060580_CL.02	1.00000			Release Limit 2 - 060580_CHL1	47
060580_CL.03	1.00000			Release Limit 3 - 060580_CHL1	47
060580_CL.04	1.00000			Release Limit 4 - 060580_CHL1	47
060580_CL.05	1.00000			Release Limit 5 - 060580_CHL1	47
060580_CL.06	1.00000			Release Limit 6 - 060580_CHL1	47
060580_CL.07	1.00000			Release Limit 7 - 060580_CHL1	47
060580_CH.02	3744.00001	060580_CH1 060580_CS1 060580_CH2 060580_CS2 060580_CH3 060580_CS3 060580_CH4 060580_CS4 060580_CH5 060580_CS5 060580_CH6 060580_CS6 060580_CH7 060580_CS7	14.0% 3.5% 19.7% 4.9% 2.4% 0.3% 30.4% 3.4% 5.0% 1.2% 9.9% 1.7% 3.4% 0.2%	060580_CHT1	46
060580_CH.04	3744.00002	Lafayette Indoor Demand (06LAFFYT_I)	Dry Creek Carrier (0600902_C) Baseline Res to Lafayette (0604173_C)	060580_CH1	28
060580_CH.05	3744.00003	Lafayette Outdoor Demand (06LAFFYT_O)	Dry Creek Carrier (0600902_C) Baseline Res to Lafayette (0604173_C)	060580_CH1	28
060580_CH.06	3744.00002	Lafayette Indoor Demand (06LAFFYT_I)	Dry Creek Carrier (0600902_C) Baseline Res to Lafayette (0604173_C)	060580_CH2	28

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060580_CH.07	3744.00003	Lafayette Outdoor Demand (06LAFFYT_O)	Dry Creek Carrier (0600902_C) Baseline Res to Lafayette (0604173_C)	060580_CH2	28
060580_CH.08	3744.00002	Lafayette Indoor Demand (06LAFFYT_I)	LOUISVILLE PL (0600598)	060580_CH3	28
060580_CH.09	3744.00003	Lafayette Outdoor Demand (06LAFFYT_O)	LOUISVILLE PL (0600598)	060580_CH3	28
060580_CH.10	3744.00002	Lafayette Indoor Demand (06LAFFYT_I)	LOUISVILLE PL (0600598)	060580_CH4	28
060580_CH.11	3744.00003	Lafayette Outdoor Demand (06LAFFYT_O)	LOUISVILLE PL (0600598)	060580_CH4	28
060580_CH.12	3744.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060580_CH5	28
060580_CH.13	3744.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060580_CH5	28
060580_CH.14	3744.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060580_CH6	28
060580_CH.15	3744.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060580_CH6	28
060580_CH.16	3744.00002	Eldora Ski Resort (06_ELDORA)		060580_CH7	28
060580_CH.21	3744.00020	HOWARD DITCH (0600580)		060580_CHT1	29
060580_CH.23	3744.00020	HOWARD DITCH (0600580)		060580_CH1	29
060580_CH.24	3744.00020	HOWARD DITCH (0600580)		060580_CH2	29
060580_CH.25	3744.00020	HOWARD DITCH (0600580)		060580_CH3	29
060580_CH.26	3744.00020	HOWARD DITCH (0600580)		060580_CH4	29
060580_CH.27	3744.00020	HOWARD DITCH (0600580)		060580_CH5	29
060580_CH.28	3744.00020	HOWARD DITCH (0600580)		060580_CH6	29
060580_CH.29	3744.00020	HOWARD DITCH (0600580)		060580_CH7	29
060580_CS.30	3744.00020	HOWARD DITCH (0600580)		060580_CS1	29
060580_CS.31	3744.00020	HOWARD DITCH (0600580)		060580_CS2	29
060580_CS.32	3744.00020	HOWARD DITCH (0600580)		060580_CS3	29
060580_CS.33	3744.00020	HOWARD DITCH (0600580)		060580_CS4	29
060580_CS.34	3744.00020	HOWARD DITCH (0600580)		060580_CS5	29
060580_CS.35	3744.00020	HOWARD DITCH (0600580)		060580_CS6	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060580_CS.36	3744.00020	HOWARD DITCH (0600580)		060580_CS7	29

5.10.6.12.4 Dry Creek No 2 Ditch (0600570) Changed Rights

The pro rata portion of 0600570.01 water right priority is stored in the (060570_CHT1) accounting plan. Monthly and annual limits are set based on multiple changes for each individual user, see below. All Dry Creek No 2 Ditch 0600570.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (W8346 and W8348) and the City of Louisville (CA12698, CA21299 and W8500).

Water right yield is split between City of Lafayette (0.9cfs, 11.5%, 3.0 cfs, 38.3% and 1.34 cfs, 17.1%) and the City of Louisville (0.38 cfs, 4.9%; 1.19 cfs, 15.2% and 1.02 cfs, 13%). The 1.34cfs for Lafayette is also known as their Winter Season Rights since it can be diverted during the non-irrigation season. Under the decrees, new uses are required to leave a portion of the water right at the ditch. Therefore, some of their water right yields are put into plans which release back to the ditch.

Uses of the changed water rights include:

- City of Lafayette exchange to the Lafayette Pipeline or Baseline Reservoir on South Boulder Creek
    - Change of 0.9 cfs available April 15th to Oct 1st, not subject to limits
    - Change of 3.0 cfs available April 15th to Oct 31st, subject to annual 263AF limit.
- City of Lafayette exchange to the Lafayette Pipeline only on South Boulder Creek
    - Change of 1.34 cfs available November 1st to April 30th, subject to annual 514.9AF limit.
- City of Louisville direct use, exchanged to Louisville Pipeline
    - Change of 0.36 cfs available April 1st to Oct 31st, subject to limits, Apr 0.68 AF, May 2.04 AF, Jun 3.66 AF, Jul 4.92 AF, Aug 4.24 AF, Sep 2.09 AF, Oct 1.1 AF, Ann 18.74 AF
    - Change of 4.5 cfs available April 1st to Oct 31st, subject to limits, Jun 123 AF, Jul 123 AF, Ann 500 AF
    - Change of 0.841cfs available April 1st to Oct 31st, subject to limits, Ann 133 AF
    - Change of 1.55 cfs available April 1st to Oct 31st, subject to limits, Apr 13 AF, May 39 AF, Jun 70 AF, Jul 94 AF, Aug 81 AF, Sep 40 AF, Oct 21 AF, Annual 358 AF

Remaining plan supplies are released back to the river at the Dry Creek No. 2 headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060570_CH.01	5235.00000	060570_CHT1	28.6%	0600570.01	26
060570_CL.01-06	1.00000			Release Limit 1-6 (060570_CHL1-	47

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
				6)	
060570_CH.02	5235.00001	060570_CH1 060570_CH2 060570_CH3 060570_CH4 060570_CS4 060570_CH5 060570_CS5 060570_CH6 060570_CS6	11.5% 38.3% 17.1% 4.4% 0.5% 12.6% 2.6% 6.5% 6.5%	060570_CHT1	46
060570_CH.03	5235.00002	Baseline Reservoir (0604173), Account 1	Dry Creek Carrier (0600902_C)	060570_CH1	27
060570_CH.04	5235.00003	Lafayette Indoor Demand (06LAFFYT_I)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060570_CH1	27
060570_CH.05	5235.00004	Lafayette Outdoor Demand (06LAFFYT_O)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060570_CH1	27
060570_CH.06	5235.00002	Baseline Reservoir (0604173), Account 1	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060570_CH2	27
060570_CH.07	5235.00003	Lafayette Indoor Demand (06LAFFYT_I)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060570_CH2	27
060570_CH.08	5235.00004	Lafayette Outdoor Demand (06LAFFYT_O)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060570_CH2	27
060570_CH.09	5235.00002	Lafayette Indoor Demand (06LAFFYT_I)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060570_CH3	27
060570_CH.10	5235.00003	Lafayette Outdoor Demand (06LAFFYT_O)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060570_CH3	27
060570_CH.11	5235.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060570_CH4	27
060570_CH.12	5235.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060570_CH4	27
060570_CH.13	5235.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060570_CH5	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060570_CH.14	5235.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060570_CH5	27
060570_CH.15	5235.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060570_CH6	27
060570_CH.16	5235.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060570_CH6	27
060570_CH.21	5235.00020	DRY CREEK NO 2 DITCH (0600570)		060570_CHT1	29
060570_CH.23	5235.00020	DRY CREEK NO 2 DITCH (0600570)		060570_CH1	29
060570_CH.24	5235.00020	DRY CREEK NO 2 DITCH (0600570)		060570_CH2	29
060570_CH.25	5235.00020	DRY CREEK NO 2 DITCH (0600570)		060570_CH3	29
060570_CH.26	5235.00020	DRY CREEK NO 2 DITCH (0600570)		060570_CH4	29
060570_CH.27	5235.00020	DRY CREEK NO 2 DITCH (0600570)		060570_CH5	29
060570_CH.28	5235.00020	DRY CREEK NO 2 DITCH (0600570)		060570_CH6	29
060570_CH.29	5235.00020	DRY CREEK NO 2 DITCH (0600570)		060570_CS4	29
060570_CH.30	5235.00020	DRY CREEK NO 2 DITCH (0600570)		060570_CS5	29
060570_CH.31	5235.00020	DRY CREEK NO 2 DITCH (0600570)		060570_CS6	29

5.10.6.12.5 Goodhue Ditch (0600650) Changed Rights

The pro rata portion of 0600650.01 water right priority is stored in the (060650_CHT1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. Goodhue Ditch 0600650.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (W8348, 80CW469, 85CW119) and the City of Louisville (83CW319).

Water right yield is split between City of Lafayette (4.5 cfs, 14.9%; 0.86 cfs, 2.8%; 5.37 cfs, 17.8%) and City of Louisville Direct Use (19.46 cfs, 64.5%). Under the decrees, new uses are required to leave a portion of the water right at the ditch. Therefore, some of their water right yields are put into plans which release back to the ditch.

Uses of the changed water rights include:

- City of Lafayette deliveries to Baseline reservoir or direct use via the Lafayette Pipeline
    - 4.5 cfs, Available April 25th to August 31st, not subject to limits

- City of Louisville direct use, exchanged to Louisville Pipeline
  - Available April 15th to Sep 15st, subject to limits, Annual 430 AF

Remaining plan supplies are released to the Goodhue Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060650_CH.01	8553.00000	060650_CHT1	31.4%	0600650.01	26
060650_CL.01-04	1.00000			Release Limit 1-4 (060650_CHL1-4)	47
060650_CH.02	8553.00001	060650_CH1 060650_CH2 060650_CH3 060650_CH4 060650_CS4	14.9% 2.8% 17.8% 58.1% 6.4%	060650_CHT1	46
060650_CH.04	8553.00002	Baseline Res (0604173), Account 1	Dry Creek Carrier (0600902_C)	060650_CH1	27
060650_CH.05	8553.00002	Baseline Res (0604173), Account 1	Dry Creek Carrier (0600902_C)	060650_CH2	27
060650_CH.06	8553.00002	Baseline Res (0604173), Account 1	Dry Creek Carrier (0600902_C)	060650_CH3	27
060650_CH.07	8553.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060650_CH4	28
060650_CH.08	8553.00002	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060650_CH4	28
060650_CH.21	8553.00020	GOODHUE DITCH (0600650)		060650_CHT1	29
060650_CH.23	8553.00020	GOODHUE DITCH (0600650)		060650_CH1	29
060650_CH.24	8553.00020	GOODHUE DITCH (0600650)		060650_CH2	29
060650_CH.25	8553.00020	GOODHUE DITCH (0600650)		060650_CH3	29
060650_CH.26	8553.00020	GOODHUE DITCH (0600650)		060650_CH4	29
060650_CH.27	8553.00020	GOODHUE DITCH (0600650)		060650_CS4	29

5.10.6.12.6 Davidson Ditch (0600567) Changed Rights

The pro rata portion of 0600567.01 water right priority is stored in the (060567_CHT1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. Davidson Ditch 0600567.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (W8348, 80CW469, 85CW119) and the City of Louisville (83CW319).

Water right yield for the 20.1% changed is split between the City of Lafayette (3.3 cfs, 14.1%; 0.86cfs, 3.7%; 1.23, 5.3%) and the City of Louisville (18.03 cfs, 77%). Under the decrees, new uses are required to leave a portion of the water right at the ditch. Therefore, some of their water right yields are put into plans which release back to the ditch. The 79.9% remaining of the water right is available to the Davidson Ditch headgate on South Boulder Creek.

Uses of the changed water rights include:

- City of Lafayette deliveries to Baseline reservoir or direct use via the Lafayette Pipeline
    - 3.3 + 0.86 cfs, Available April 25th to August 31st, 263 AF annual limit
- City of Lafayette deliveries to direct use via the Lafayette Pipeline
    - 0.317 cfs, Available April 25th to August 31st, limited to Apr 3AF, May 33AF, June 46AF, July 42AF, Aug 3AF, Annual 79 AF
- City of Louisville direct use, exchanged to Louisville Pipeline
    - 5.208 cfs, Available April 25th to August 31st, limits of Apr 45, May 437 AF, Jun 598 AF, July 547, Aug 36, Annual 1039 AF

Remaining plan supplies are released to the Davidson Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060567_CH.01	8141.00000	060567_CHT1	20.1%	0600567.01	26
060567_CL.01-03	1.00000			060567_CHL1-3	47
060567_CH.02	8141.00001	060567_CH1 060567_CH2 060567_CS2 060567_CH3 060567_CS3	17.7% 4.8% 0.5% 69.3% 7.7%	060567_CHT1	46
060567_CH.04	8141.00002	Baseline Res (0604173), Account 1	Dry Creek Carrier (0600902_C)	060567_CH1	27
060567_CH.05	8141.00003	Lafayette Indoor Demand (06LAFFYT_I)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060567_CH1	27
060567_CH.06	8141.00004	Lafayette Outdoor Demand (06LAFFYT_O)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060567_CH1	27
060567_CH.10	8141.00002	Baseline Res (0604173), Account 1	Dry Creek Carrier (0600902_C)	060567_CH2	27
060567_CH.11	8141.00003	Lafayette Indoor Demand (06LAFFYT_I)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060567_CH2	27
060567_CH.12	8141.00004	Lafayette Outdoor Demand (06LAFFYT_O)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060567_CH2	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060567_CH.13	8141.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060567_CH3	28
060567_CH.14	8141.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060567_CH3	28
060567_CH.21	8141.00020	DAVIDSON DITCH (0600567)		060567_CHT1	29
060567_CH.23	8141.00020	DAVIDSON DITCH (0600567)		060567_CH1	29
060567_CH.24	8141.00020	DAVIDSON DITCH (0600567)		060567_CH2	29
060567_CH.25	8141.00020	DAVIDSON DITCH (0600567)		060567_CS2	29
060567_CH.26	8141.00020	DAVIDSON DITCH (0600567)		060567_CH3	29
060567_CH.27	8141.00020	DAVIDSON DITCH (0600567)		060567_CS3	29

5.10.6.12.7 South Boulder Bear Creek Ditch (0600588) Changed Rights

The pro rata portion of 0600588.01 water right priority is stored in the (060588_CH1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. South Boulder Bear Creek Ditch 0600588.01 operations are presented in the table below. The changed water right represented with these rules is decreed in cases for the City of Lafayette (W8347).

Water right yield is available for diversion by the City of Lafayette. 7.09 cfs is allowable for diversion equal to the 8.75 cfs total change minus a 1.66 cfs flow to remain on the ditch. All remaining water is released to the South Boulder Bear Creek Ditch.

Uses of the changed water rights include:

- City of Lafayette deliveries to Baseline reservoir or direct use via the Lafayette Pipeline
  - 8.75 cfs, Available April 1st to October 31st, subject to the following limits:
  - April 136 AF, May 387 AF, June 525 AF, July 543 AF, August 416 AF, September 216 AF, October 151 AF, and 954 AF annually.

Remaining plan supplies are released to South Boulder Bear Creek headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060588_CH.01	4528.00000	060588_CH1	61.0%	0600588.01	26
060588_CH.04	4528.00002	Baseline Res (0604173), Account 1	Dry Creek Carrier (0600902_C)	060588_CH1	27
060588_CH.05	4528.00003	Lafayette Indoor Demand (06LAFFYT_I)	Dry Creek Carrier (0600902_C) Baseline Res C to	060588_CH1	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
			Lafayette (0604173_C)		
060588_CH.06	4528.00004	Lafayette Outdoor Demand (06LAFFYT_O)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060588_CH1	27
060588_CH.23	4528.00020	S BOULDER BEAR CR DITCH (0600588)		060588_CH1	29

5.10.6.12.8 Dry Creek Davidson Ditch (0600569_D) Changed Rights

The 0600569_D.01 water right priority is stored in the (060569_CHT1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. Dry Creek Davidson Ditch 0600569.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (90CW108, 80CW468), the City of Louisville (CA6517) and the Coal Ridge Ditch Company (CA10000)

Water right yield is split between the City of Lafayette (0.317 cfs, 1.2%), the City of Louisville (5.208 cfs, 20.9%) and the Coal Ridge Ditch Company (2.64 cfs, 10.6%). Under the decrees, new uses are required to leave a portion of the water right at the ditch. Therefore, some of their water right yields are put into plans which release back to the ditch. The remaining 67.3% is used for Dry Creek Davidson Ditch irrigation demand.

Uses of the changed water rights include:

- City of Lafayette deliveries to Baseline reservoir or direct use via the Lafayette Pipeline
  - 0.317 cfs, Available May 1st to September 15th, limited to 65.9AF annually
- City of Louisville direct use, exchanged to Louisville Pipeline
  - 5.208 cfs, Available April 1st to September 15th, limited to 57.0 AF annually
- Coal Ridge Ditch Company Diversion At the Lower Boulder Ditch Headgate
  - 3.872 cfs, Available May 1st to September 15th, no limits

Remaining plan supplies are released to South Boulder Creek at the Dry Creek Headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060569_CH.01	4869.00000	060569_CHT1	100%	0600569_D.01	26
060569_CL.01-03	1.00000			060569_CHL1-3	47
060569_CH.02	4869.00001	060569_CHI1 060569_CH1 060569_CS1 060569_CH2 060569_CS2 060569_CH3	67.3% 1.1% 0.1% 17.2% 3.7% 10.6%	060569_CHT1	46
060569_CH.03	4869.00002	DRY CREEK DAVIDSON DITCH SYSTEM	Dry Creek Carrier (0600902_C)	060569_CHI1	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		(0600569_D)			
060569_CH.04	4869.00002	Baseline Res (0604173), Account 1	Dry Creek Carrier (0600902_C)	060569_CH1	27
060569_CH.05	4869.00002	Lafayette Indoor Demand (06LAFFYT_I)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060569_CH1	27
060569_CH.06	4869.00003	Lafayette Outdoor Demand (06LAFFYT_O)	Dry Creek Carrier (0600902_C) Baseline Res C to Lafayette (0604173_C)	060569_CH1	27
060569_CH.07	4869.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060569_CH1	27
060569_CH.08	4869.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060569_CH1	27
060569_CH.09	4869.00002	Lower Boulder Ditch (0600538_D)		060569_CH3	27
060569_CH.21	4869.00020	Dry Creek Carrier (0600902_C)		060569_CHT1	29
060569_CH.22	4869.00020	Dry Creek Carrier (0600902_C)		060569_CHI1	29
060569_CH.23	4869.00020	Dry Creek Carrier (0600902_C)		060569_CH1	29
060569_CH.24	4869.00020	Dry Creek Carrier (0600902_C)		060569_CS1	29
060569_CH.25	4869.00020	Dry Creek Carrier (0600902_C)		060569_CH2	29
060569_CH.26	4869.00020	Dry Creek Carrier (0600902_C)		060569_CS2	29
060569_CH.27	4869.00020	Dry Creek Carrier (0600902_C)		060569_CH3	29

5.10.6.12.9 Enterprise Ditch (0600576) Changed Rights

The 0600576.01 water right priority is stored in the (060576_CHT1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. Enterprise Ditch 0600576.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Lafayette (80CW468, 90CW108), the City of Louisville (CA21299, 82CW305) and the Coal Ridge Ditch Company (CA10000)

Water right yield is split between City of Lafayette (0.41 cfs, 1.6%; 0.064 cfs, 0.3%), the City of Louisville (1.19 cfs, 4.7%; 1.294 cfs, 5.2%) and the Coal Ridge Ditch Company (3.872 cfs, 15.5%). Under the decrees, new uses are required to leave a portion of the water right at the ditch. Therefore, some of their water right yields are put into plans which release back to the ditch. All remaining water is released to the Enterprise Ditch off-channel irrigation system.

Uses of the changed water rights include:

- City of Lafayette deliveries to Baseline reservoir or direct use via the Lafayette Pipeline
  - 0.41 cfs, Available May 1st to September 15th, limited to 84AF annually
  - 0.064 cfs, Available May 1st to September 15th, limited to 13.2AF annually
- City of Louisville direct use, exchanged to Louisville Pipeline
  - 1.19 cfs, Available April 1st to October 31st, limited to 56AF annually
  - 1.294 cfs, Available April 1st to September 15th, limited to Apr 3AF, May 14AF, June 18AF, July 26AF, Aug 4AF, Sep 2AF, Annual: 45 AF
- Coal Ridge Ditch Company Diversion At the Lower Boulder Ditch Headgate
  - 3.872 cfs, Available May 1st to September 15th, no limits

Remaining plan supplies are released to South Boulder Creek at the Dry Creek headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060576_CH.01	5511.00000	060576_CHT1	100%	0600576.01	26
060576_CL.01-05	1.00000			060576_CHL1-5	47
060576_CH.02	5511.00001	060576_CHI1 060576_CH1 060576_CH2 060576_CH3 060576_CS3 060576_CH4 060576_CS4 060576_CH5	72.7% 1.6% 0.3% 3.9% 0.8% 4.3% 0.9% 15.5%	060576_CHT1	46
060576_CH.03	5511.00002	ENTERPRISE DITCH (0600576)	Dry Creek Carrier (0600902_C)	060576_CHI1	27
060576_CH.04	5511.00002	Baseline Res (0604173), Account 1	Dry Creek Carrier (0600902_C)	060576_CHI1	27
060576_CH.05	5511.00002	Baseline Res (0604173), Account 1	Dry Creek Carrier (0600902_C)	060576_CHI2	27
060576_CH.06	5511.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060576_CH3	28
060576_CH.07	5511.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060576_CH3	28
060576_CH.08	5511.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060576_CH4	28
060576_CH.09	5511.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060576_CH4	28
060576_CH.10	5511.00002	Lower Boulder Ditch (0600538_D)		060576_CH5	27
060576_CH.21	5511.00020	Dry Creek Carrier (0600902_C)		060576_CHT1	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060576_CH.22	5511.00020	Dry Creek Carrier (0600902_C)		060576_CHI1	29
060576_CH.23	5511.00020	Dry Creek Carrier (0600902_C)		060576_CH1	29
060576_CH.24	5511.00020	Dry Creek Carrier (0600902_C)		060576_CH2	29
060576_CH.26	5511.00020	Dry Creek Carrier (0600902_C)		060576_CH3	29
060576_CH.27	5511.00020	Dry Creek Carrier (0600902_C)		060576_CS3	29
060576_CH.28	5511.00020	Dry Creek Carrier (0600902_C)		060576_CH4	29
060576_CH.29	5511.00020	Dry Creek Carrier (0600902_C)		060576_CS4	29
060576_CH.30	5511.00020	Dry Creek Carrier (0600902_C)		060576_CH5	29

5.10.6.12.10 Cottonwood No 2 Ditch (0600566) Changed Rights

The 0600566.01 water right priority is stored in the (060566_CH1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. Cottonwood No. 2 Ditch 0600566.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Louisville (W9193, 99CW230).

Water right yield for the 4.8% changed is delivered to the City of Louisville. Under the decrees, new uses are required to leave a portion of the water right at the ditch. Therefore, some of their water right yields are put into plans which release back to the ditch. The 95.2% remaining water is released to the Cottonwood No. 2 Ditch headgate on South Boulder Creek.

Uses of the changed water rights include:

- City of Louisville direct use, exchanged to Louisville Pipeline
  - 1.163 cfs, Available May 1st to October 31st, subject to annual limit of 43.4AF
  - 0.4 cfs, Available May 1st to October 31st, subject to annual limit of 36.9 AF

Remaining plan supplies are released to South Boulder Creek at the Dry Creek headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060566_CH.01	4853.00000	060566_CHT1	100%	0600566.01	26
060566_CL.01-02	1.00000			Release Limit 1-2 (060566_CHL1-2)	47
060566_CH.02	4853.00001	060566_CHI1 060566_CH1 060566_CS1 060566_CH2	95.2% 2.9% 0.7% 1.0%	060566_CHT1	46

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		060566_CS2	0.2%		
060566_CH.03	4853.00002	COTTONWOOD DITCH 2 (0600566)	Dry Creek Carrier (0600902_C)	060566_CHI1	27
060566_CH.04	4853.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060566_CH1	28
060566_CH.05	4853.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060566_CH1	28
060566_CH.06	4853.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060566_CH2	28
060566_CH.07	4853.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060566_CH2	28
060566_CH.21	4853.00020	Dry Creek Carrier (0600902_C)		060566_CHT1	29
060566_CH.22	4853.00020	Dry Creek Carrier (0600902_C)		060566_CHI1	29
060566_CH.23	4853.00020	Dry Creek Carrier (0600902_C)		060566_CH1	29
060566_CH.24	4853.00020	Dry Creek Carrier (0600902_C)		060566_CS1	29
060566_CH.25	4853.00020	Dry Creek Carrier (0600902_C)		060566_CH2	29
060566_CH.26	4853.00020	Dry Creek Carrier (0600902_C)		060566_CS2	29

5.10.6.12.11 McGinn Ditch (0600586) Changed Rights

The pro rata portion of 0600586.01 water right priority is stored in the (060586_CH1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. McGinn Ditch 0600586.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Louisville (87CW327).

Water right yield is delivered to the City of Louisville.

Uses of the changed water rights include:

- City of Louisville direct use, exchanged to Louisville Pipeline
    - 1.163 cfs, Available April 1st to October 31st, subject to annual limit of 199.4AF

Remaining plan supplies released to the McGinn Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060586_CH.01	3774.00000	060586_CH1	13.4%	0600586.01	26
060586_CH.02	3774.00001	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060586_CH1	28

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060586_CH.03	3774.00002	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060586_CH1	28
060586_CH.06	3774.00020	MCGINN DITCH (0600586)		060586_CH1	29

5.10.6.12.12 Marshalville Ditch (0600585) Changed Rights

The pro rata portion of 0600585.01 water right priority is stored in the (060585_CH1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. Marshalville Ditch 0600585.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Louisville (87CW327).

Water right yield is delivered to the City of Louisville.

Uses of the changed water rights include:

- City of Louisville direct use, exchanged to Louisville Pipeline
  - 1.163 cfs, Available April 1st to October 31st, subject to annual limit of 91.4 AF

Remaining plan supplies are released to the Marshalville Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060585_CH.01	5631.00000	060585_CH1	6.4%	0600585.01	26
060585_CH.02	5631.00001	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060585_CH1	28
060585_CH.03	5631.00002	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060585_CH1	28
060585_CH.04	5631.00020	MARSHALVILLE DITCH (0600585)		060585_CH1	29

5.10.6.12.13 East Boulder Ditch (0600575) Changed Rights

The pro rata portion of 0600575.01 water right priority is stored in the (060575_CH1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. East Boulder Ditch 0600575.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Louisville (82CW305).

Water right yield for the 1.7% changed is delivered to the City of Louisville. Under the decree, new uses are required to leave a portion of the water right at the ditch. Therefore, some of the water right yield is put into a plan which release back to the ditch.

Uses of the changed water rights include:

- City of Louisville direct use, exchanged to Louisville Pipeline

- o 1.163 cfs, Available April 1st to October 31st, subject to limits of Apr 2 AF, May 8AF, June 11AF, July 11AF, Aug 8AF, Sep 3AF, Oct 1, Annual 41 AF

Remaining plan supplies released to the East Boulder Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060575_CH.01	4474.00000	060575_CHT1	89.7%	0600575.01	26
060575_CL.01-02	1.00000			Release Limit 1-2 (060575_CHL1-2)	47
060575_CH.02	4474.00001	060575_CH1 060575_CS1 060575_CH2	1.6% 0.3% 98.1%	060575_CHT1	46
060575_CH.03	4474.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060575_CH1	28
060575_CH.04	4474.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060575_CH1	28
060575_CH.05	4474.00002	Valmont Combined Reservoir (06_VALMT), Account 1	COMBINED VALMONT RESERVOIR DIVERSION (06_VALMT_C)	060575_CH2	27
060575_CH.06	4474.00020	EAST BOULDER DITCH (0600575)		060575_CHT1	29
060575_CH.07	4474.00020	EAST BOULDER DITCH (0600575)		060575_CH1	29
060575_CH.08	4474.00020	EAST BOULDER DITCH (0600575)		060575_CS1	29
060575_CH.09	40740.38103	EAST BOULDER DITCH (0600575)		060575_CH2	29

5.10.6.12.14 Community Ditch (0600564_D) Changed Rights

The 0600564_D.01 water right priority is stored in the (060564_CHT1) accounting plan. This right is for South Boulder Coal Creek Ditch, though it is part of the Community Ditch diversion system. Monthly and annual limits are set based on changes for individual users, see below. South Boulder Coal Creek Ditch 0600564_D.05 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Louisville (CA21299, CA10232).

Water right yield for this ditch is changed for the City of Louisville (6.78 cfs, 12.6%). Under the decree, new uses are required to leave a portion of the water right at the ditch. Therefore, some of the water right yield is put into a plan which release back to the ditch. All remaining water is released to the Community Ditch irrigation demands.

Uses of the changed water rights include:

- City of Louisville direct use, exchanged to Louisville Pipeline
    - o 6.78 cfs, Available April 1st to October 31st, subject to 283 AF annually

Remaining plan supplies are released to the Community Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060564_CH.01	8188.00000	060564_CHT1	100%	0600564_D.05	26
060564_CL.01	1.00000			060564_CHL1	47
060564_CH.02	8188.00001	060564_CHI1 060564_CH1 060564_CS1	87.4% 10.5% 2.1%	060564_CHT1	46
060564_CH.03	8188.00002	Community Ditch Irrigation Demands (0600564_I)	Community Ditch Headgate (0600564_D)	060564_CHI1	27
060564_CH.04	8188.00002	Louisville Indoor Demand (06LOUIS_I)	LOUISVILLE PL (0600598)	060564_CH1	28
060564_CH.05	8188.00003	Louisville Outdoor Demand (06LOUIS_O)	LOUISVILLE PL (0600598)	060564_CH1	28
060564_CH.21	8188.00020	South Boulder Coal Creek Ditch (0600564)		060564_CHT1	29
060564_CH.22	8188.00020	South Boulder Coal Creek Ditch (0600564)		060564_CHI1	29
060564_CH.23	8188.00020	South Boulder Coal Creek Ditch (0600564)		060564_CH1	29
060564_CH.24	8188.00020	South Boulder Coal Creek Ditch (0600564)		060564_CS1	29

5.10.6.12.15 Anderson Ditch (0600501) Changed Rights

The 0600501.01 water right priority is stored in the (060501_CHT1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. Anderson Ditch 0600501.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Boulder and Middle Boulder Creek Instream Flows (Case Nos. CA8407, 10518, 15012, 90CW0193).

Water right yield for the 59% changed is delivered to the City of Boulder and the minimum streamflow segments A, B and C. Under the decree, new uses are required to leave a portion of the water right at the ditch. Therefore, some of the water right yield is put into a plan which release back to the ditch. 44% of the water right is released to irrigation demand.

Uses of the changed water rights include:

- City of Boulder direct use, exchanged to Boulder City Pipeline or Barker Pipeline
    - 1.81 cfs, available May 1 to Sep 30th, subject to volumetric limits of May 49.8 AF, June 100 AF, July 100.2 AF, Aug 75 AF, Sep 55.3 AF, Annual 380 AF.
    - 12.328 cfs, available May 1 to Sep 30th, not subject to volumetric limits
- City of Boulder direct use, exchanged to Boulder City Pipeline or Barker Pipeline but available at minimum streamflow segments A, B and C on Middle Boulder Creek

- 0.62 cfs, available May 1 to Sep 30th, subject to volumetric limits of May 16 AF, Jun 32.7 AF, Jul 32.6 AF, Aug 24.6 AF, Sep 17.9 AF, Ann 124 AF

Remaining plan supplies are released to the Anderson Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060501_CH.01	3927.00000	060501_CHT1	100%	0600501.01	26
060501_CL.01-03	1.00000			Release Limit 1-3 (060501_CHL1-3)	47
060501_CH.02	3927.00001	060501_CHI1 060501_CH1 060501_CH2 060501_CH3	44.0% 6.8% 46.8% 2.4%	060501_CHT1	46
060501_CH.03	3927.00002	ANDERSON DITCH – IRR (0600501_I)	ANDERSON DITCH (0600501)	060501_CHI1	27
060501_CH.04	3927.00002	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060501_CH1	28
060501_CH.05	3927.00002	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060501_CH1	28
060501_CH.06	3927.00002	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060501_CH2	28
060501_CH.07	3927.00002	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060501_CH2	28
060501_CH.08	3927.00003	ISF North Boulder Creek (0602125)		060501_CH3	28
060501_CH.09	3927.00004	BOULDER CREEK MSF SEGMENT B UP (0602124_U)		060501_CH3	28
060501_CH.10	3927.00005	BOULDER CREEK MSF SEGMENT B LOW (0602124_L)		060501_CH3	28
060501_CH.11	3927.00006	BOULDER CREEK MSF SEGMENT C UPPER (0602100)		060501_CH3	28
060501_CH.12	3927.00010	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	060501_CH3	28
060501_CH.13	3927.00010	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	060501_CH3	28
060501_CH.14	3927.00011	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060501_CH3	28
060501_CH.15	3927.00011	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060501_CH3	28
060501_CH.21	3927.00020	ANDERSON DITCH (0600501)		060501_CHT1	29
060501_CH.22	3927.00020	ANDERSON DITCH (0600501)		060501_CHI1	29
060501_CH.23	3927.00020	ANDERSON DITCH (0600501)		060501_CH1	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060501_CH.24	3927.00020	ANDERSON DITCH (0600501)		060501_CH2	29
060501_CH.25	3927.00020	ANDERSON DITCH (0600501)		060501_CH3	29
060501_CH.21	3927.00020	ANDERSON DITCH (0600501)		060501_CHT1	29

5.10.6.12.16 Farmers Ditch (0600525) Changed Rights

The pro rata portion of 0600525.01 water right priority is stored in the (060525_CHT1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. All Farmers Ditch 0600525.01 operations are represented using 17 operating rules. The changed water rights represented with these rules are decreed in cases for the City of Boulder, the Middle Boulder Creek Minimum Streamflow (MSF) Segment C and the City of Nederland (Case Nos. W7569, W7570, W8520-77, CA10518, W8407, W8485, CA15012, and 90CW0193).

Water right yield is split between the Middle Boulder Creek minimum streamflow segment C (13.52, 46.8%), the City of Boulder (15.13, 52.4%), and the City of Nederland (0.229 cfs, 0.8%). The water available to the MSF Segment C is also available for diversion by the City of Boulder in the cases where there is a minimum flow of 15cfs in MSF Segment C. Under the decrees, new uses are required to leave a portion of the water right at the ditch. Therefore, some of the water right yields are put into a plan which release back to the ditch.

Uses of the changed water rights include:

- MSF Segment C on Middle Boulder Creek but also available for City of Boulder direct use, exchanged to Boulder City Pipeline or Barker Pipeline.
  - 13.52cfs, available May 1st to September 30th, subject to limits of: May 396 AF, June 725 AF, July 748 AF, Aug 655 AF, Sep 284 AF, Annual 2165 AF.
- City of Boulder direct use, exchanged to Boulder City Pipeline or Barker Pipeline
  - 15.13cfs, available May 1st to September 30th, not subject to any volumetric limits.
- City of Nederland direct use, exchanged to Nederland's Municipal Diversion.
  - 0.229cfs, available April 10th to Oct 31st, subject to limits of: Apr 3.51 AF, May 6.94 AF, June 12.25, July 14.09, Aug 13.22, Sep 9.74, Oct 2.54, Annual 39.6 AF

Remaining plan supplies are released to the Farmers Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060525_CH.01	4657.00000	060525_CHT1	42.5%	0600525.01	26
060525_CL.01-02	1.00000			Release Limit 1-2 (060525_CL.01-02)	47
060525_CH.02	4657.00001	060525_CH1 060525_CS1	42.1% 4.7%	060525_CHT1	46

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		060525_CH2 060525_CS2	50.5% 2.7%		
060525_CH.04	4657.00002	BOULDER CREEK MSF SEGMENT C UPPER (0602100)		060525_CH1	28
060525_CH.05	4657.00004	Boulder Indoor Use (06BOULDER_I)	FARMERS DITCH (0600525)	060525_CH1	27
060525_CH.06	4657.00004	Boulder Outdoor Use (06BOULDER_O)	FARMERS DITCH (0600525)	060525_CH1	27
060525_CH.07	4657.00002	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	060525_CH2	28
060525_CH.08	4657.00002	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	060525_CH2	28
060525_CH.09	4657.00003	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060525_CH2	28
060525_CH.10	4657.00003	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060525_CH2	28
060525_CH.21	4657.00020	FARMERS DITCH (0600525)		060525_CHT1	29
060525_CH.22	4657.00020	FARMERS DITCH (0600525)		060525_CH1	29
060525_CH.23	4657.00020	FARMERS DITCH (0600525)		060525_CS1	29
060525_CH.24	4657.00020	FARMERS DITCH (0600525)		060525_CH2	29
060525_CH.25	4657.00020	FARMERS DITCH (0600525)		060525_CS2	29

5.10.6.12.17 Smith Goss Ditch (0600554) Changed Rights

The pro rata portion of 0600554.01 water right priority is stored in the (060554_CHT1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. All Smith Goss Ditch 0600554.01 operations are represented using 18 operating rules. The changed water rights represented with these rules are decreed in cases for the City of Boulder and the Middle Boulder Creek Minimum Streamflow (MSF) Segments A, B and C (Cases: W7569, W7570, W8520-77, 90CW193.).

Water right yield is available to the Middle Boulder Creek minimum streamflow segments A, B and C and the City of Boulder. The water available to the MSF Segments is also available for diversion by the City of Boulder in the cases where the streamflow requirements for each MSF are met. Under the decrees, new uses are required to leave a portion of the water right at the ditch. Therefore, some of the water right yields are put into a plan which release back to the ditch.

Uses of the changed water rights include:

- MSF Segments A, B and C on Middle Boulder Creek but also available for City of Boulder direct use, exchanged to Boulder City Pipeline or Barker Pipeline.

- 0.45 cfs available May 1 to Oct 15th, not subject to additional volumetric limits.

Remaining plan supplies are released to the Smith Goss Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060554_CH.01	3606.00000	060554_CHT1	1.5%	0600554.01	26
060554_CL.01	1.00000			Release Limit (060554_CHL1)	47
060554_CH.02	3606.00001	060554_CH1 060554_CS1 060554_CH2 060554_CS2	80% 8.9% 10.5% 0.6%	060554_CHT1	46
060554_CH.04	3606.00004	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	060554_CH1	28
060554_CH.05	3606.00004	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	060554_CH1	28
060554_CH.06	3606.00005	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060554_CH1	28
060554_CH.07	3606.00005	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060554_CH1	28
060554_CH.08	3606.00005	North Boulder Creek ISF (0602125)		060554_CH2	28
060554_CH.09	3606.00004	BOULDER CREEK MSF SEGMENT B UP (0602124_U)		060554_CH2	28
060554_CH.10	3606.00003	BOULDER CREEK MSF SEGMENT B LOWER MID (0602124_L)		060554_CH2	28
060554_CH.11	3606.00002	BOULDER CREEK MSF SEGMENT C UPPER (0602100)		060554_CH2	28
060554_CH.12	3606.00004	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	060554_CH2	28
060554_CH.13	3606.00004	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	060554_CH2	28
060554_CH.14	3606.00005	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060554_CH2	28
060554_CH.15	3606.00005	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060554_CH2	28
060554_CH.21	3606.00020	SMITH GOSS DITCH (0600554)		060554_CHT1	29
060554_CH.23	3606.00020	SMITH GOSS DITCH (0600554)		060554_CH1	29
060554_CH.24	3606.00020	SMITH GOSS DITCH (0600554)		060554_CS1	29
060554_CH.25	3606.00020	SMITH GOSS DITCH (0600554)		060554_CH2	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060554_CH.26	3606.00020	SMITH GOSS DITCH (0600554)		060554_CS2	29

5.10.6.12.18 McCarty Ditch (0600542) Changed Rights

The pro rata portion of 0600542.01 water right priority is stored in the (060542_CH1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. McCarty Ditch 0600542.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Boulder and the Middle Boulder Creek Minimum Streamflow (MSF) Segments A, B and C (Cases: W7569, W7570, W8520-77, 90CW193.).

Water right yield is available to the Middle Boulder Creek minimum streamflow segments A, B and C and the City of Boulder. The water available to the MSF Segments is also available for diversion by the City of Boulder in the cases where the streamflow requirements for each MSF are met.

Uses of the changed water rights include:

- MSF Segments A, B and C on Middle Boulder Creek but also available for City of Boulder direct use, exchanged to Boulder City Pipeline or Barker Pipeline.
    - 0.64 cfs available May 1 to Sep 30th, subject to 194.2 AF annual limits

Remaining plan supplies are released to the McCarty Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060542_CH.01	4535.00000	060542_CH1	39.2%	0600542.01	26
060542_CH.06	4535.00005	North Boulder Creek ISF (0602125)		060542_CH1	28
060542_CH.07	4535.00004	BOULDER CREEK MSF SEGMENT B UP (0602124_U)		060542_CH1	28
060542_CH.08	4535.00003	BOULDER CREEK MSF SEGMENT B LOWER MID (0602124_L)		060542_CH1	28
060542_CH.09	4535.00002	BOULDER CREEK MSF SEGMENT C UPPER (0602100)		060542_CH1	28
060542_CH.10	4535.00004	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	060542_CH1	28
060542_CH.11	4535.00004	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	060542_CH1	28
060542_CH.12	4535.00005	Boulder Indoor Use	BOULDER CITY PL	060542_CH1	28

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		(06BOULDER_I)	(0600599)		
060542_CH.13	4535.00005	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060542_CH1	28
060542_CH.23	4535.00020	MC CARTY DITCH (0600542)		060542_CH1	29

5.10.6.12.19 Harden Ditch (0600530_D) Changed Rights

The 0600599.03 water right is entirely water from the Harden Ditch (0600530) that is not being modeled and has been fully moved to the Boulder City Pipeline. The pro rata portion of 0600599.03 water right priority is stored in the (060530_CH1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. Harden Ditch 0600599.03 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Boulder and the Middle Boulder Creek Minimum Streamflow (MSF) Segments A, B and C (Case No. 90CW0193).

Water right yield is available to the Middle Boulder Creek minimum streamflow segments A, B and C and the City of Boulder. The water available to the MSF Segments is also available for diversion by the City of Boulder in the cases where the streamflow requirements for each MSF are met.

Uses of the changed water rights include:

- MSF Segments A, B and C on Middle Boulder Creek but also available for City of Boulder direct use at the Boulder City Pipeline.
  - 1.8 cfs available May 1 to Sep 30th, not subject to additional volumetric limits.

Remaining plan supplies are released to the Dry Creek Carrier headgate.

The 0600599.06 water right is stored in the (060599_CHT1) accounting plan. Monthly and annual limits are set based on changes for individual users, see below. Harden Ditch 0600599.06 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Boulder and the Middle Boulder Creek Minimum Streamflow (MSF) Segments B and C (Case No. 90CW0193).

Water right yield is available to the Middle Boulder Creek minimum streamflow segments B and C and the City of Boulder. The water available to the MSF Segments is also available for diversion by the City of Boulder in the cases where the streamflow requirements for each MSF are met.

Uses of the changed water rights include:

- MSF Segments B and C on Middle Boulder Creek but also available for City of Boulder direct use at the Boulder City Pipeline.
  - 1.5 cfs available November 1 to April 30th, not subject to additional volumetric limits.

Plan supplies are delivered to the Boulder City Indoor and Outdoor demands by the Boulder City Pipeline.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060530_CH.01	4535.00000	060530_CH1	95%	0600599.03	26
060530_CH.06	4535.00005	North Boulder Creek ISF (0602125)		060530_CH1	28
060530_CH.07	4535.00004	BOULDER CREEK MSF SEGMENT B UP (0602124_U)		060530_CH1	27
060530_CH.08	4535.00003	BOULDER CREEK MSF SEGMENT B LOWER MID (0602124_L)		060530_CH1	27
060530_CH.09	4535.00002	BOULDER CREEK MSF SEGMENT C UPPER (0602100)		060530_CH1	27
060530_CH.10	4535.00004	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060530_CH1	27
060530_CH.11	4535.00004	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060530_CH1	27
060530_CH.23	4535.00020	Dry Creek Carrier (0600902_C)		060530_CH1	29
060599_CH.01	19762.00000	060599_CHT1	100%	0600599.06	26
060599_CL.01	1.00000			060599_CHL1	47
060599_CH.02	19762.00001	060599_CH1 060599_CH2	92.5% 7.5%	060599_CHT1	46
060599_CH.03	19762.00007	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060599_CH1	27
060599_CH.04	19762.00008	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060599_CH1	27
060599_CH.05	19762.00004	BOULDER CREEK MSF SEGMENT B UP (0602124_U)		060599_CH2	27
060599_CH.06	19762.00005	BOULDER CREEK MSF SEGMENT B LOWER MID (0602124_L)		060599_CH2	27
060599_CH.07	19762.00006	BOULDER CREEK MSF SEGMENT C UPPER (0602100)		060599_CH2	27
060599_CH.08	19762.00009	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060599_CH2	27
060599_CH.09	19762.00010	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060599_CH2	27
060599_CH.21	19762.00020	BOULDER CITY PL (0600599)		060599_CHT1	29
060599_CH.22	19762.00020	BOULDER CITY PL (0600599)		060599_CH1	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060599_CH.23	19762.00020	BOULDER CITY PL (0600599)		060599_CH2	29

5.10.6.12.20 North Boulder Farmer Ditch (0600543) Changed Rights

There are multiple changes for each of the rights that sit on the North Boulder Farmers Ditch. They are laid out by water right ID below.

The pro rata portion of 0600543.01 water right priority is stored in the (060538_CHT1) accounting plan. Monthly and annual limits as follows; April 21AF, May 76AF, June 73AF, July 75AF, August 75AF, Sep 73AF, Annual 390 AF. North Boulder Farmers Ditch 0600543.01 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Boulder (94CW285).

Water right yield is entirely available for the City of Boulder at these methods and locations at a rate of 1.23 cfs:

- Exchange to the Watershed Reservoirs
- Exchange to Barker Reservoir
- Exchange to the Barker Pipeline for Direct Use by the City of Boulder
- Exchange to the North Boulder Creek Pipeline (0600599) for Direct Use by the City of Boulder

The pro rata portion of 0600543.02 water right priority is stored in the (060543_CH2) accounting plan. Monthly and annual limits as follows; April 8AF, May 123AF, June 146AF, July 148AF, August 73AF, Sep 25AF, Annual 353 AF. North Boulder Farmers Ditch 0600543.02 operations are presented in the table below. The changed water rights represented with these rules are decreed in cases for the City of Boulder (94CW285).

Water right yield is entirely available for the City of Boulder at these methods and locations at a rate of 4.26 cfs:

- Exchange to the Watershed Reservoirs
- Exchange to Barker Reservoir
- Exchange to the Barker Pipeline for Direct Use by the City of Boulder
- Exchange to the North Boulder Creek Pipeline (0600599) for Direct Use by the City of Boulder

Remaining plan supplies are released to the North Boulder Farmers Ditch headgate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
060543_CH.01	4535.00000	060530_CH1	9.2%	0600543.01	26
060543_CH.07	4535.00004	Watershed reservoir (06_WSHED),		060543_CH1	28

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		Accounts 1-2			
060543_CH.08	4535.00004	Barker Reservoir (0604172)		060543_CH1	28
060543_CH.09	4535.00005	Boulder Indoor Use (06BOULDER_I)	BOULDER PL 3 AT BARKER R (0600943)	060543_CH1	28
060543_CH.10	4535.00005	Boulder Outdoor Use (06BOULDER_O)	BOULDER PL 3 AT BARKER R (0600943)	060543_CH1	28
060543_CH.11	4535.00006	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060543_CH1	28
060543_CH.12	4535.00006	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060543_CH1	28
060543_CH.25	4535.00020	N BOULD FARMER DITCH (0600543)		060543_CH1	29
060543_CH.02	4900.00000	060543_CH2	3.9%	0600543.02	26
060543_CH.13	4900.00004	Watershed reservoir (06_WSHED), Accounts 1-2		060543_CH2	28
060543_CH.14	4900.00004	Barker Reservoir (0604172), Account 1		060543_CH2	28
060543_CH.15	4900.00005	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060543_CH2	28
060543_CH.16	4900.00005	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060543_CH2	28
060543_CH.17	4900.00006	Boulder Indoor Use (06BOULDER_I)	BOULDER CITY PL (0600599)	060543_CH2	28
060543_CH.18	4900.00006	Boulder Outdoor Use (06BOULDER_O)	BOULDER CITY PL (0600599)	060543_CH2	28
060543_CH.26	4900.00020	N BOULD FARMER DITCH (0600543)		060543_CH2	29

5.10.7 Moffat Tunnel Project

Water is brought into District 6 via the Moffat Tunnel and is released to South Boulder Creek at the East Portal. The transmountain water released into District 6 is measured at the East Portal USGS Gage (09022500). As discussed in Section 6.1.2.1, Moffat Tunnel operations were originally developed based on sub-basin demands and revised during model calibration to reflect end-user demands. Under this representation, Moffat Tunnel imports transmountain water into South Boulder Creek where they are stored in Gross Reservoir and/or carried directly to Ralston Reservoir and downstream demands via the South Boulder Diversion Conduit. The transmountain imports are ultimately used at Denver Water's Moffat Water Treatment Plant and delivered to other municipal contracts, including Arvada and Consolidated Mutual. Any unused supplies are released to the Moffat Treatment Plant, located on a small tributary in the Clear Creek basin.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Xbasin.08	0.99997	06_MOF_ACC		06_MOF_IMP	35

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Xbasin.08	0.99997	06_MOF_ACC		06_MOF_IMP	35
06MOFPLN.01	1.00001	060800_ACC		060800_IMP	35
06MOFPLN.02	1.00003	Arvada Inside Use (07_Arvada_I)	S BOULDER DIVR CONDUIT (0600590)	06_MOF_ACC	27
06MOFPLN.03	1.00004	Arvada Outside Use (07_Arvada_O)	S BOULDER DIVR CONDUIT (0600590)	06_MOF_ACC	27
06MOFPLN.04	1.00005	Ralston Reservoir (0703324), Account 1	S BOULDER DIVR CONDUIT (0600590)	06_MOF_ACC	27
06MOFPLN.05	1.00006	Gross Reservoir (0604199), Account 1	S BOULDER DIVR CONDUIT (0600590)	06_MOF_ACC	27
GrossRes.01	1.00009	Ralston Reservoir (0703324), Account 1	S BOULDER DIVR CONDUIT (0600590)	Gross Reservoir (0604199), Account 1	2
PlnSpill.78	1.00009	MoffatWTP		06_MOF_ACC	29

5.10.8 Upper South Platte System (Water Districts 80, 23, 9, 8, and 2)

The Upper South Platte system is dominated by reservoir operations and irrigation return flows.

Where to find more information

- General
    - SPDSS Task Memorandum 3, “Identify Key Diversion Structures Notes from Water District 8 Meeting,” available on the CDSS website.
    - SPDSS Task Memorandum 3, “Identify Key Diversion Structures Notes from Water District 9 Meeting,” available on the CDSS website.
    - SPDSS Task Memorandum 3, “Identify Key Diversion Structures Notes from Water District 23 Meeting,” available on the CDSS website.
    - SPDSS Task Memorandum 3, “Identify Key Diversion Structures Notes from Water District 80 Meeting,” available on the CDSS website.
    - SPDSS Task Memorandum 3, “Identify Key Diversion Structures Notes from Water District 2 Meeting,” available on the CDSS website.
- Denver Water
    - SPDSS Task Memorandum 5, “Key Structure, Moffat Tunnel,” available on the CDSS website.
    - SPDSS Task Memorandum 5, “Key Structure, Roberts Tunnel,” available on the CDSS website.
    - SPDSS Task Memorandum 5, “Key Municipal User, Denver Water Board,” available on the CDSS website.
- Aurora
    - SPDSS Task Memorandum 5, “Key Structure, Homestake Tunnel,” available on the CDSS website.
    - SPDSS Task Memorandum 5, “Key Municipal User, City of Aurora,” available on the CDSS website.
- Other Operations/Municipalities
    - SPDSS Task Memorandum 5, “Key Structure, Boreas Pass Ditch,” available on the CDSS website.
    - SPDSS Task Memorandum 5, “Key Structure, Straight Creek Tunnel,” available on the CDSS website.
    - SPDSS Task Memorandum 5, “Key Structure, FRICO-Marshall Lake Division,” available on the CDSS website.
    - SPDSS Task Memorandum 5, “Key Structure, FRICO-Milton Lake Division,” available on the CDSS website.
    - SPDSS Task Memorandum 5, “Key Structure, FRICO-Standley Lake Cities,” available on the CDSS website.
    - SPDSS Task Memorandum 5, “Key Structure, Burlington, FRICO-Barr and Henrylyn Systems,” available on the CDSS website.

5.10.8.1 Denver Water Board

Denver Water is the largest municipal water provider in Colorado. Denver Water has established an extensive water rights portfolio and related infrastructure on the South Platte River main stem and various tributaries to the South Platte River Basin and Colorado River Basin, as shown in Figure 5-2 below. Denver Water supplies municipal water through its North and South System. Some of the major features of the associated infrastructure and water supplies are presented in the operations below.

The North System is focused in the Boulder Creek and Ralston Creek basins. The Boulder Creek supplies include Moffat Tunnel (06_MOF_IMP) deliveries from the Fraser River Basin that are stored in Gross Reservoir (0604199). The reservoir regulates the Moffat Tunnel water and stores native flows. Storage deliveries are released to the South Boulder Conduit (0600590), which conveys water to Ralston Creek, tributary to Clear Creek. Ralston Reservoir (0703324) is the terminal storage for the Conduit, from which Denver Water supplies its potable system via the Moffat Water Treatment Plant (MoffatWTP). Contract water is also supplied to multiple entities from the South Boulder Conduit – Ralston Reservoir system, with the City of Arvada the largest contractee (approximately 17,000 acre-feet per year).

The South system consists of upper South Platte River Basin storage units (Antero Reservoir – 2303904 and Eleven Mile Canyon Reservoir - 2303965), and reservoirs located near and within the Denver metropolitan area (Strontia Springs Reservoir - 0803983, Cheesman Reservoir - 8003550, and Marston Reservoir - 0903501). Denver Water has storage space in Chatfield Reservoir (0803514), which also serves as a flood control reservoir operated by the Army Corps of Engineers. Strontia Springs Reservoir feeds the Foothills Water Treatment Plant (FoothillsWTP) via Conduit 26 (0801002_D). Conduit 20 (0801017) conveys water to the Marston Water Treatment Plant (0901700).

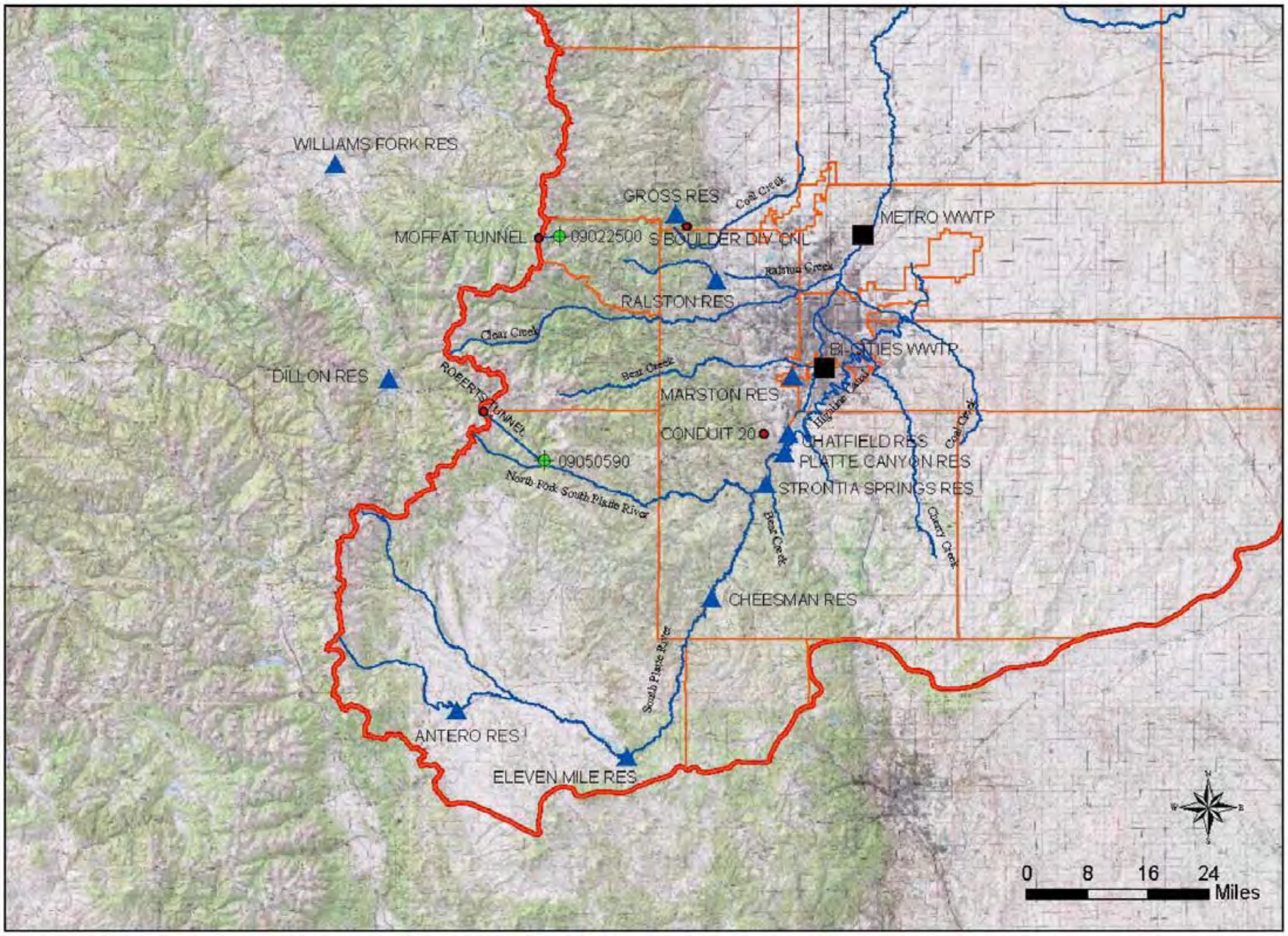


Figure 5-2: Denver Water South Platte River Water Supply System

5.10.8.1.1 Transmountain Supplies

The Denver Water system is complex and its operations vary annually based on the available water in storage and water supply forecasts for the Front Range and the western slope. Representation of the Denver Water system has been simplified in the SPDSS model since it operates independently of the Colorado DSS model and StateMod is a deterministic (not optimization) model.

Until the SPDSS model and western slope models are integrated, the transmountain supplies are set equal to historical deliveries. These supplies are operated in the model as the primary supply, which results in the use of all the imports to meet the Denver Water demand or stored in reservoirs. The following six rules are used to supply Roberts Tunnel imports directly to Denver Water demands (4) and storage (2):

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Roberts.01	1.00010	Denver Water Inside Use (08_Denver_I)	Robt Tun Aug Stn (8000653_A) NF SPR at Grant (PLAGRACO, R) Denver Conduit 26 (0801017) Denver Foothills WTP (FoothillsWTP)	Roberts Tunnel Carrier (RobTun_C)	27
Roberts.02	1.00010	Denver Water Outside Use (08_Denver_O)	Robt Tun Aug Stn (8000653_A) NF SPR at Grant (PLAGRACO, R) Denver Conduit 26 (0801017) Denver Foothills WTP (FoothillsWTP)	Roberts Tunnel Carrier (RobTun_C)	27
Roberts.03	1.00010	Denver Water Inside Use (08_Denver_I)	Robt Tun Aug Stn (8000653_A) NF SPR at Grant (PLAGRACO, R) Denver Conduit 20 (0801002_D) Marston WTP (0901700)	Roberts Tunnel Carrier (RobTun_C)	27
Roberts.04	1.00010	Denver Water Outside Use (08_Denver_O)	Robt Tun Aug Stn (8000653_A) NF SPR at Grant (PLAGRACO, R) Denver Conduit 20 (0801002_D) Marston WTP (0901700)	Roberts Tunnel Carrier (RobTun_C)	27
Roberts.05	26000.00004	Marston Reservoir (0903501), Accounts 1-2	Robt Tun Aug Stn (8000653_A) NF SPR at Grant (PLAGRACO, R) Denver Conduit 20 (0801002_D) Marston WTP (0901700)	Roberts Tunnel Carrier (RobTun_C)	27
Roberts.06	26000.00005	Strontia Springs Reservoir (0803983), Account 1	Robt Tun Aug Stn (8000653_A) NF SPR at Grant (PLAGRACO, R)	Roberts Tunnel Carrier (RobTun_C)	27

Denver Water has rights to water from Bear Creek but these supplies are rarely used due to concerns with water quality in Bear Creek. The following three rules are used in order to mimic the historical deliveries of Bear Creek water to the Marston Reservoir and Marston water treatment plant:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cond15.01	1.00000	Denver Conduit 15 (Conduit15)		Conduit15.01	31
Cond15.02	1.00001	Marston Reservoir (0903501), Accounts 1-2		BearCkPln	27
Cond15.03	1.00002	Denver Water Inside Use (08_Denver_I)	Marston WTP (0901700)	BearCkPln	27
Cond15.04	1.00003	Denver Water Outside Use (08_Denver_O)	Marston WTP (0901700)	BearCkPln	27

Just as its operations change between years based on variability of supply, Denver Water's operations in the South Platte River Basin vary based on the amount of water in storage and relative supply between tributary basins. Simulation of the Northern system deliveries are focused on meeting historical Moffat Water Treatment Plant deliveries. The following rules are used to supply the Moffat WTP demand:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06800PLN.01	1.00001	060800_ACC		060800_IMP	35
06MOFPLN.02	1.00003	Arvada Inside Use (07_Arvada_I)	S BOULDER DIVR CONDUIT (0600590)	06_MOF_ACC	27
06MOFPLN.03	1.00004	Arvada Outside Use (07_Arvada_O)	S BOULDER DIVR CONDUIT (0600590)	06_MOF_ACC	27
06MOFPLN.04	1.00005	Ralston Reservoir (0703324), Account 1	S BOULDER DIVR CONDUIT (0600590)	06_MOF_ACC	27
06MOFPLN.05	1.00006	Gross Reservoir (0604199), Account 1	S BOULDER DIVR CONDUIT (0600590)	06_MOF_ACC	27
Moffat.01	1.00003	MoffatWTP	S BOULDER DIVR CONDUIT (0600590)	Gross Reservoir (0604199), Account 1	2
Moffat.02	1.0004	MoffatWTP		Ralston Res (0703324), Account 1	3

5.10.8.1.2 In-basin Supplies

Denver Water's remaining municipal demand is satisfied by river diversions and storage diversions via Conduit 20 and Conduit 26 to the Foothills and Marston treatment plants, respectively. Direct flow rights are first stored in Changed Water Rights Plan structures (Cond20Pln and Cond20DirPln) based on the standard approach used to represent Changed Water Rights, as outlined in Section 4.9. Monthly limits on use of these rights are based on decretal terms and conditions. Some of the water rights can be used both directly and for storage.

Changed Water Rights

The first five rules listed below are used to store those rights in the Cond20Pln structure; the following four rules are used to meet the Denver Water demand; and the last five rules are used for storage:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cond20Sto.01	4260.00000	Cond20Pln	100%	0801002_D.02	26
Cond20Sto.02	4717.00000	Cond20Pln	100%	0801002_D.25	26
Cond20Sto.03	5112.00000	Cond20Pln	100%	0801002_D.03	26
Cond20Sto.04	5478.00000	Cond20Pln	100%	0801002_D.05	26
Cond20Sto.06	5843.00000	Cond20Pln	100%	0801002_D.07	26
Cond20Sto.08	22254.00002	Denver Water Inside Use (08_Denver_I)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Cnd20Pln	27
Cond20Sto.09	22254.00003	Denver Water Outside Use (08_Denver_O)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Cnd20Pln	27
Cond20Sto.10	22254.00002	Denver Water Inside Use (08_Denver_I)	Denver Conduit 26 (0801017) FoothillsWTP	Cnd20Pln	27
Cond20Sto.11	22254.00003	Denver Water Outside Use (08_Denver_O)	Denver Conduit 26 (0801017) FoothillsWTP	Cond20Pln	27
Cond20Sto.12	22254.00003	Marston Reservoir (0903501), Account 2	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Cond20Pln	27
Cond20Sto.13	57000.00000	Strontia Springs Reservoir (0803983), Account 1		Cond20Pln	28
Cond20Sto.14	57000.00001	Eleven Mile Reservoir (2303965), Account 1		Cond20Pln	28
Cond20Sto.15	57000.00002	Antero Reservoir (2303904), Account 2		Cond20Pln	28
Cond20Sto.16	57000.00003	Cheesman Lake (8003550), Account 1		Cond20Pln	28

Operations with these rights are differentiated from other Denver Water rights that can only be used directly (Borden, City, Island, Little Channel, Love and Raynor, and Weed Ditches). The first fifteen rules listed below are used to store the water rights in the Cond20DirPln structure; the subsequent four rules are used to meet the Denver Water demand:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cond20Dir.01	4229.00000	Cnd20DirPln	100%	0801002_D.01	26
Cond20Dir.02	5112.00000	Cnd20DirPln	100%	0801002_D.04	26
Cond20Dir.04	7659.00000	Cnd20DirPln	100%	0801002_D.10	26
Cond20Dir.05	9131.00000	Cnd20DirPln	100%	0801002_D.11	26
Cond20Dir.06	9252.00000	Cnd20DirPln	100%	0801002_D.12	26
Cond20Dir.07	10480.00000	Cnd20DirPln	100%	0801002_D.13	26
Cond20Dir.08	10744.00000	Cnd20DirPln	100%	0801002_D.14	26
Cond20Dir.09	11139.00000	Cnd20DirPln	100%	0801002_D.15	26
Cond20Dir.10	11451.00000	Cnd20DirPln	100%	0801002_D.16	26
Cond20Dir.11	11809.00000	Cnd20DirPln	100%	0801002_D.17	26
Cond20Dir.12	12924.00000	Cnd20DirPln	100%	0801002_D.18	26
Cond20Dir.13	14519.00000	Cnd20DirPln	100%	0801002_D.19	26
Cond20Dir.14	15585.00000	Cnd20DirPln	100%	0801002_D.20	26
Cond20Dir.15	18018.00000	Cnd20DirPln	100%	0801002_D.21	26
Cond20Dir.16	22254.00000	Cnd20DirPln	100%	0801002_D.23	26
Cond20Dir.17	22254.00002	Denver Water Inside Use (08_Denver_I)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Cnd20DirPln	27
Cond20Dir.18	22254.00003	Denver Water Outside Use (08_Denver_O)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Cnd20DirPln	27
Cond20Dir.19	22254.00002	Denver Water Inside Use (08_Denver_I)	Denver Conduit 26 (0801017) FoothillsWTP	Cnd20DirPln	27
Cond20Dir.20	22254.00003	Denver Water Outside Use (08_Denver_O)	Denver Conduit 26 (0801017) FoothillsWTP	Cnd20DirPln	27

One other Plan release rule is included for the Cond20Pln to meet demands at the Arapahoe Power Plant:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
ArapahPP.01	22254.00001	Arapahoe Power Plant (0801014),		Cnd20DirPln	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		Account 1			

The Upper South Platte (Dist 23) Four Mile changed rights to Antero Reservoir includes Beery Ditch to indoor, outdoor upper basin storage (by water right priority). The majority of Beery D DivClass appears to have this water being stored in Eleven Mile Reservoir so we are including that as the sole use for this water, as shown in the operating rules below.

Beery.01	4184.00000	Beery D Transfer Gage (2302201)	100%	2302905.01	26
Beery.02	4184.00001	Eleven Mile Reservoir (2303965), Account 1		Beery D Transfer Gage (2302201)	27

Reusable Effluent

Effluent exchanges and storage releases provide supplemental supplies to meet the Denver Water demand. The following six rules exchange reusable effluent to supply the Denver Water demands (4) and storage (2):

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
MetroDW.01	29386.26137	Denver Water Inside Use (08_Denver_I)	Denver Conduit 26 (0801017) FoothillsWTP	MetroDW	28
MetroDW.02	29386.26137	Denver Water Inside Use (08_Denver_I)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	MetroDW	28
MetroDW.03	29386.26138	Denver Water Outside Use (08_Denver_O)	Denver Conduit 26 (0801017) FoothillsWTP	MetroDW	28
MetroDW.04	29386.26138	Denver Water Outside Use (08_Denver_O)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	MetroDW	28
MetroDW.05	29386.26139	Cheesman Lake (8003550), Account 1		MetroDW	28
MetroDW.06	29386.26140	Chatfield Reservoir (0803514), Account 2		MetroDW	28

One other Plan release rule is included for the MetroDW to meet demands at the Cherokee Power Plant, starting in 2004:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cherokee.01	1.00001	Cherokee Power Plant (02_ChrkPP)	Reuse PL to Cherokee (DW_ReusePL)	DWB Metro Reuse Plan (MetroDW)	27

Storage Releases

The following 22 rules are used to supply the Denver Water demand with releases from storage. Note Chatfield Res has an operating rule to release for flood control.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cheesman.01	29999.00001	Denver Water Inside Use (08_Denver_I)	Denver Conduit 26 (0801017) Foothills WTP	Cheesman Lake (8003550), Account 1	2
Cheesman.02	29999.00002	Denver Water Inside Use (08_Denver_I)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Cheesman Lake (8003550), Account 1	2
Chatfield.01	30000.00000	Denver Water Inside Use (08_Denver_I)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Chatfield Reservoir (0803514), Account 2	4
Chatfield.02	30000.00001	Denver Water Inside Use (08_Denver_I)	Denver Conduit 26 (0801017) FoothillsWTP	Chatfield Reservoir (0803514), Account 2	4
Chatfield.03	30000.00002	Denver Water Inside Use (08_Denver_I)	Martson WTP (0901700)	Chatfield Reservoir (0803514), Account 2	3
Chatfield.04	30000.00003	Denver Water Outside Use (08_Denver_O)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Chatfield Reservoir (0803514), Account 2	4
Chatfield.05	30000.00004	Denver Water Outside Use (08_Denver_O)	Denver Conduit 26 (0801017) FoothillsWTP	Chatfield Reservoir (0803514), Account 2	4
Chatfield.06	30000.00005	Denver Water Outside Use (08_Denver_O)	Martson WTP (0901700)	Chatfield Reservoir (0803514), Account 2	3
ChatFld.01	46748.00001	NA		Chatfield Reservoir (0803514), Acct	3

				3	
Marston.01	31000.00003	Denver Water Inside Use (08_Denver_I)	Martson WTP (0901700)	Marston Reservoir (0903501), Account 2	3
Strontia.01	31000.00004	Denver Water Inside Use (08_Denver_I)	FoothillsWTP	Strontia Springs Reservoir (0803983), Account 1	3
Antero.01	31000.00005	Denver Water Inside Use (08_Denver_I)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Antero Reservoir (2303904), Account 2	2
Antero.02	31000.00006	Denver Water Inside Use (08_Denver_I)	Denver Conduit 26 (0801017) Foothills WTP	Antero Reservoir (2303904), Account 2	2
11_Mile.01	31000.00007	Denver Water Inside Use (08_Denver_I)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Eleven Mile Reservoir (2303965), Account 1	2
11_Mile.02	31000.00008	Denver Water Inside Use (08_Denver_I)	Denver Conduit 26 (0801017) Foothills WTP	Eleven Mile Reservoir (2303965), Account 1	2
Cheesman.03	31000.00009	Denver Water Outside Use (08_Denver_O)	Foothills WTP	Cheesman Lake (8003550), Account 1	2
Cheesman.04	31000.00010	Denver Water Outside Use (08_Denver_O)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Cheesman Lake (8003550), Account 1	2
Marston.02	31000.00011	Denver Water Outside Use (08_Denver_O)	Martson WTP (0901700)	Marston Reservoir (0903501), Account 2	3
Strontia.02	31000.00012	Denver Water Outside Use (08_Denver_O)	FoothillsWTP	Strontia Springs Reservoir (0803983), Account 1	3
Antero.03	31000.00013	Denver Water Outside Use (08_Denver_O)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Antero Reservoir (2303904), Account 2	2
Antero.04	31000.00014	Denver Water Outside Use (08_Denver_O)	Denver Conduit 26 (0801017) Foothills WTP	Antero Reservoir (2303904), Account 2	2
11_Mile.03	31000.00015	Denver Water Outside Use (08_Denver_O)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Eleven Mile Reservoir (2303965), Account 1	2

11_Mile.04	31000.00016	Denver Water Outside Use (08_Denver_O)	Denver Conduit 26 (0801017) Foothills WTP	Eleven Mile Reservoir (2303965), Account 1	2

Antero Reservoir and Eleven Mile Canyon Reservoir are typically used as drought supply. Simulated use of these storage units for only infrequent releases was difficult. Therefore, the following rules are used to supply the Denver Water demand with storage releases from the reservoirs in South Park:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
AnterDry.1a-6b, 7a-9b, 10a-b, 11a-b	0.99996-0.99997	Denver Water Inside Use (08_Denver_I)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Antero Reservoir (2303904), Account 2	2
AnterDry.6c-d and 9c-d, 10c-d, 11c-d	0.99996-0.99997	Denver Water Inside Use (08_Denver_I)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Antero Reservoir (2303904), Account 3	2
11MilDry.1a-7b	0.99998-0.99999	Denver Water Inside Use (08_Denver_I)	Denver Conduit 20 (0801002_D) Martson WTP (0901700)	Eleven Mile Reservoir (2303965), Account 1	2

5.10.8.2 City of Aurora

The City of Aurora is the second largest municipal water provider in Colorado. Aurora relied on ground water from the Cherry Creek Basin and contract deliveries from Denver Water until the 1960s. The city started purchasing ranches in South Park during that period and completed the development of the transmountain Homestake Project in 1967. Completion of Spinney Mountain Reservoir (2304013) in 1981 provided Aurora with high basin storage to manage the transmountain supplies. Aurora continued its ranch purchases in the upper South Platte River and Tarryall Creek basins. The city expanded its acquisition of transmountain supplies through purchases of water rights in the Arkansas River Basin, starting in the mid-1980s. Note that Aurora also diverts reusable effluent at the Prairie Waters Project, however this operation is more recent (post-2012) and was not included in the model.

The components of Aurora's water supply system in the South Platte River Basin are shown in Figure 5-3 below. Other major infrastructure associated with Aurora's system in the South Platte River Basin includes the Aurora Intake (0801001), located at Strontia Springs Reservoir (0203893), and terminal storage in Aurora Reservoir (0203379). The Aurora Intake node is used as a carrier for all municipal water supplies, except for storage releases of water from Aurora Reservoir.

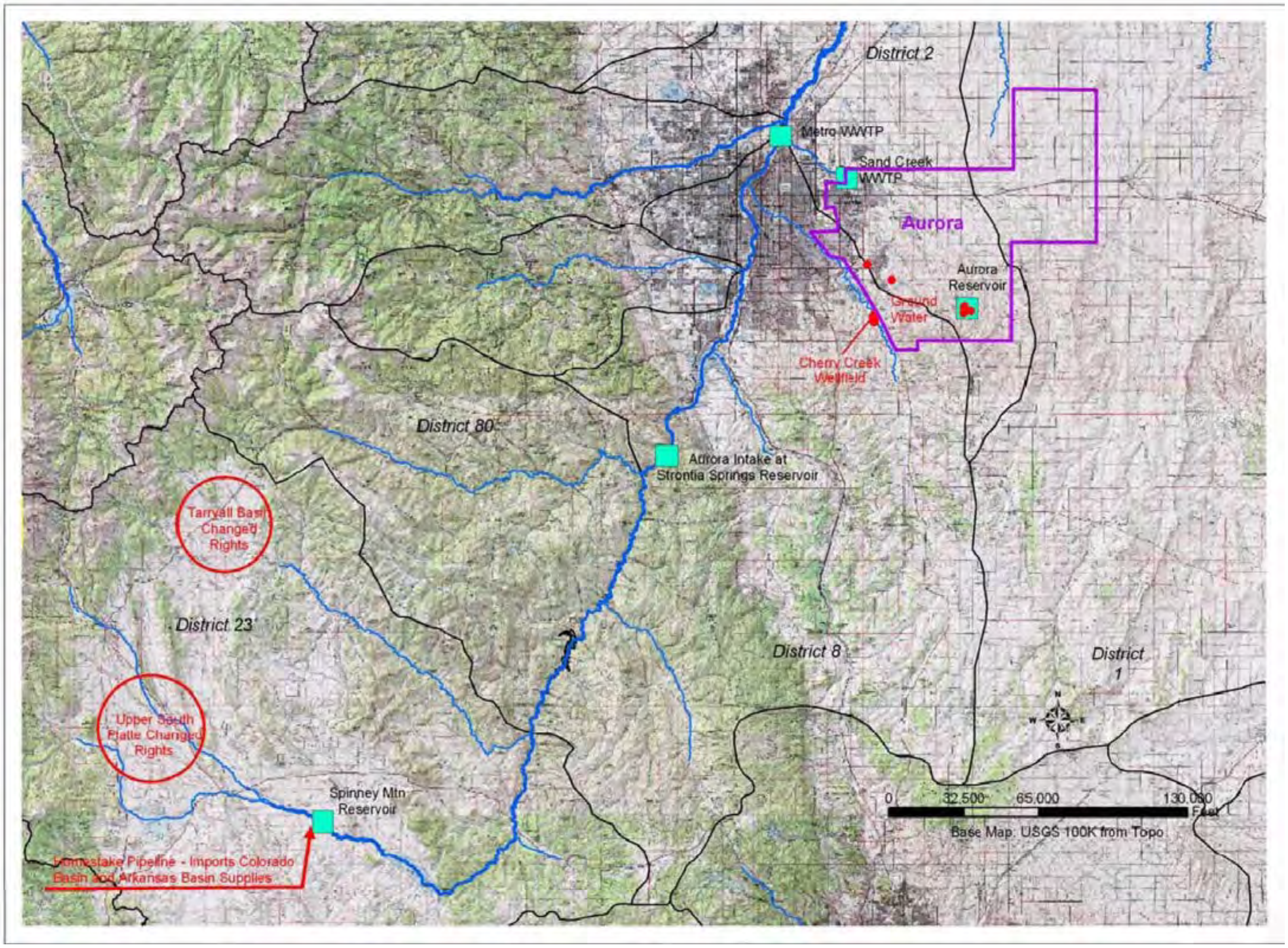


Figure 5-3: City of Aurora South Platte Water Supply Systems

5.10.8.2.1 Transmountain Supplies

Until the SPDSS model, the Colorado model, and the future ArkDSS model are integrated, the transmountain supplies are set equal to historical deliveries. These supplies are operated in the model as the primary supply so the use of all the supplies is simulated to meet the Aurora demand or stored in reservoirs. The following rules are used to supply Homestake Tunnel (HOMSPICO) directly to Aurora demands (2) and storage (1).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Homestk.01	1.00004	Aurora Inside Use (08_Aurora_I)	AURORA INTAKE (0801001)	Homestk_C	27
Homestk.02	1.00005	Aurora Outdoor Use (08_Aurora_O)	AURORA INTAKE (0801001)	Homestk_C	27
Homestk.03	1.00006	Spinney Mountain		Homestk_C	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		Reservoir (2304013), Account 3			

5.10.8.2.2 In-basin Supplies

Aurora's remaining municipal demand is satisfied by river diversions and storage releases. Direct flow rights include the senior changed water rights in the Last Chance Ditch (0801007), the South Park rights, and the 1964 direct flow right at Strontia Springs Reservoir.

Groundwater Supplies

Aurora has rights to ground water in Cherry Creek and operates these wells (0805065) on an inconsistent basis. Well demands are set equal to historical pumping records in order to mimic the historical deliveries of groundwater to meet Aurora's demands. Note that these operations are not simulated by operating rules. Rather the wells pump and return to the Aurora municipal demands where they "divert" the pumped supplies in-priority. Lagged depletions from use of the wells is accounted for in an Aurora Aug Plan (0802593).

Changed Water Rights

The Last Chance Ditch rights were changed in Case Nos. W2083 and 91CW1117. The use of the changed rights are simulated based on the year the change cases were signed (1970 and 1995 for the Last Chance Ditch). The former rights is not reusable and cannot be stored. The latter rights are reusable but are typically not used as the city is required to make one-to-one replacements at the Metro WWTP for the use of the 91CW1117 water. The Last Chance Ditch rights are stored in Changed Water Rights Plan structures coincident with the water court case (AurIntPln1 – W2083 and AurIntPln2 – 91CW1117) based on the approach used to represent Changed Water Rights, as outlined in Section 4.9. Note however that due to replacement requirements, the 91CW1117 Last Chance operations with AurIntPln2 (operating rule IDs – AurIntk.02 and AurIntk.05) and associated Plan releases (operating rule IDs – AurIntk.08 and AurIntk.10) are turned off and included in the operating rules file as placeholders for future modeling efforts. Monthly limits on use of these rights are based on decretal terms and conditions. Although not a changed water right, the 1964 priority water right is located at the Aurora Intake and stored in a Changed Water Right Plan (AurIntPln3) so that the water can be released to multiple demands. The following rules are used to store the water rights into the three Plan nodes.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
AurIntk.98	1.00000			Release Limit - AurInt_RL1	47
AurIntk.99	1.00000			Release Limit - AurInt_RL2	47
AurIntk.01	5112.00000	AurIntPln1		0801001.01	26

AurIntk.03	5843.00000	AurIntPln1		0801001.03	26
AurIntk.04	6637.00000	AurIntPln1		0801001.04	26
AurIntk.06	41776.00000	AurIntPln3		0801001.06	26

The following two rules release water from the W2083 Plan node to Aurora's demand:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
AurIntk.07	6637.00001	Aurora Inside Use (08_Aurora_I)	AURORA INTAKE (0801001)	AurIntPln1	26
AurIntk.09	6637.00003	Aurora Outdoor Use (08_Aurora_O)	AURORA INTAKE (0801001)	AurIntPln1	26

The following three rules release water from the 1964 Plan (AurIntPln3) to the Aurora demand (2) and to storage (1).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
AurIntk.11	50029.00002	Aurora Inside Use (08_Aurora_I)	AURORA INTAKE (0801001)	AurIntPln3	27
AurIntk.12	50029.00003	Aurora Outdoor Use (08_Aurora_O)	AURORA INTAKE (0801001)	AurIntPln3	27
AurIntk.13	50029.00004	Strontia Springs Reservoir (0803983)		AurIntPln3	28

5.10.8.2.3 Representation of South Park Water Rights

The South Park rights are administered in aggregate at 18 administrative stream gages (IDs 2302900, 2302901, 2302902, 2302903, 2302904, 2302906, 2302907, 2302908, 2302909, 2302910, 2302911, 2302912, 2302913, 2302914, 2302915, 2302916, 2302917, and 2302918) on the South Platte River and Tarryall Creek. Note the water commissioner computes flows at the Hartsel gage (2302922) and it is not represented in the model. The Diversion Classes in HydroBase for the changed uses of the water rights typically begin in the late-1980s/early-1990s time frame; therefore, a start date of 1990 was chosen for simulation with the changed rights.

South Platte River Water Rights

The consumptive use amounts for the 69 water rights on the Upper South Platte River Basin are stored, in priority, in the following Changed Water Rights Plan structures.

Plan ID	Abbreviation	Gage Name	# Rights
2302900_Pln	SFKANTCO	SOUTH FORK GAGE	22
2302901_Pln	FOUHIGCO	BADGER BASIN GAGE	5
2302902_Pln	MFKSTMCO	SANTA MARIA GAGE	8

2302903_Pln	PLASPICO	SPINNEY GAGE	13
2302904_Pln	FOUHARCO	HIGH CREEK GAGE	2
2302911_Pln	TROGARCO	TROUT CREEK GAGE	1
2302912_Pln	SPRBRNCO	SPRING BRANCH GAGE	1
2302913_Pln	MFKPRICO	PRINCE GAGE	17

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SFKANTCO.01	8577.00000	2302900_Pln		2302900.01	26
SFKANTCO.02	8645.00000	2302900_Pln		2302900.02	26
SFKANTCO.03	8918.00000	2302900_Pln		2302900.03	26
SFKANTCO.04	9271.00000	2302900_Pln		2302900.04	26
SFKANTCO.05	9639.00000	2302900_Pln		2302900.05	26
SFKANTCO.06	9663.00000	2302900_Pln		2302900.06	26
SFKANTCO.07	9678.00000	2302900_Pln		2302900.07	26
SFKANTCO.08	9679.00000	2302900_Pln		2302900.08	26
SFKANTCO.09	10014.00000	2302900_Pln		2302900.09	26
SFKANTCO.10	10028.00000	2302900_Pln		2302900.10	26
SFKANTCO.11	10440.00000	2302900_Pln		2302900.11	26
SFKANTCO.12	10449.00000	2302900_Pln		2302900.12	26
SFKANTCO.13	10836.00000	2302900_Pln		2302900.13	26
SFKANTCO.14	11088.00000	2302900_Pln		2302900.14	26
SFKANTCO.15	13635.00000	2302900_Pln		2302900.15	26
SFKANTCO.16	13659.00000	2302900_Pln		2302900.16	26
SFKANTCO.17	13707.00000	2302900_Pln		2302900.17	26
SFKANTCO.18	14041.00000	2302900_Pln		2302900.18	26
SFKANTCO.19	14536.10744	2302900_Pln		2302900.19	26
SFKANTCO.20	14536.12571	2302900_Pln		2302900.20	26
SFKANTCO.21	14536.12936	2302900_Pln		2302900.22	26
SFKANTCO.22	18774.00000	2302900_Pln		2302900.23	26
FOUHARCO.01	8918.00000	2302901_Pln		2302901.01	26
FOUHARCO.02	10362.00000	2302901_Pln		2302901.02	26
FOUHARCO.03	11444.00000	2302901_Pln		2302901.03	26
FOUHARCO.04	12943.00000	2302901_Pln		2302901.04	26
FOUHARCO.05	14536.11110	2302901_Pln		2302901.05	26
MFKSTMCO.01	6391.00000	2302902_Pln		2302902.01	26

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
MFKSTMCO.02	6405.00000	2302902_Pln		2302902.02	26
MFKSTMCO.03	9241.00000	2302902_Pln		2302902.03	26
MFKSTMCO.04	10337.00000	2302902_Pln		2302902.04	26
MFKSTMCO.05	11415.00000	2302902_Pln		2302902.05	26
MFKSTMCO.06	23152.15493	2302902_Pln		2302902.06	26
MFKSTMCO.07	23152.15585	2302902_Pln		2302902.07	26
MFKSTMCO.08	23152.15645	2302902_Pln		2302902.08	26
PLASPICO.01	8932.00000	2302903_Pln		2302903.01	26
PLASPICO.02	9282.00000	2302903_Pln		302903.02	26
PLASPICO.03	9693.00000	2302903_Pln		2302903.03	26
PLASPICO.04	9709.00000	2302903_Pln		2302903.04	26
PLASPICO.05	9997.00000	2302903_Pln		2302903.05	26
PLASPICO.06	10014.00000	2302903_Pln		2302903.06	26
PLASPICO.07	10044.00000	2302903_Pln		2302903.07	26
PLASPICO.08	10727.00000	2302903_Pln		2302903.08	26
PLASPICO.09	11110.00000	2302903_Pln		2302903.09	26
PLASPICO.10	11597.00000	2302903_Pln		2302903.10	26
PLASPICO.11	11839.00000	2302903_Pln		2302903.11	26
PLASPICO.12	11946.00000	2302903_Pln		2302903.12	26
PLASPICO.13	12707.00000	2302903_Pln		2302903.13	26
FOUHIGCO.01	8644.00000	2302904_Pln		2302904.01	26
FOUHIGCO.02	9983.00000	2302904_Pln		2302904.02	26
TROGARCO.01	4565.00000	2302911_Pln		2302911.01	26
SPRBRNCO.01	10774.00000	2302912_Pln		2302912.01	26
MFKPRICO.01	6788.00000	2302913_Pln		2302913.01	26
MFKPRICO.02	8544.00000	2302913_Pln		2302913.02	26
MFKPRICO.03	8546.00000	2302913_Pln		2302913.03	26
MFKPRICO.04	8583.00000	2302913_Pln		2302913.04	26
MFKPRICO.05	9252.00000	2302913_Pln		2302913.05	26
MFKPRICO.06	9276.00000	2302913_Pln		2302913.06	26
MFKPRICO.07	9627.00000	2302913_Pln		2302913.07	26
MFKPRICO.08	10398.00000	2302913_Pln		2302913.08	26
MFKPRICO.09	10733.00000	2302913_Pln		2302913.09	26

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
MFKPRICO.10	10788.00000	2302913_Pln		2302913.10	26
MFKPRICO.11	11433.00000	2302913_Pln		2302913.11	26
MFKPRICO.12	11453.00000	2302913_Pln		2302913.12	26
MFKPRICO.13	11816.00000	2302913_Pln		2302913.13	26
MFKPRICO.14	11849.00000	2302913_Pln		2302913.14	26
MFKPRICO.15	11853.00000	2302913_Pln		2302913.15	26
MFKPRICO.16	11854.00000	2302913_Pln		2302913.16	26
MFKPRICO.17	11867.00000	2302913_Pln		2302913.17	26

The South Platte water rights are typically stored in Spinney Mountain Reservoir before water is released from Spinney to meet Aurora's demands. The water stored in Spinney Mountain is reusable and creates return flow obligations that represent a demand for the stored water below Spinney Mountain Reservoir.

In addition to the decreed Consumptive Use factors, the South Platte water rights have Delayed Return Factors (DRF). Limits on the use of these rights in the model are based on monthly CU cfs amounts plus DRF cfs amounts, which may be less than the total amount of a particular water right assigned to the gage. The total amount of water available, subject to the monthly limits, can be used to simulate releases to demands and/or storage. The DRFs generated by these uses vary by ditch and by month, so a simplified approach was used for simulating DRFs. First, monthly average DRF values were developed for all of the ditches represented at each gage. The DRF values, by gage, were then averaged amongst all the gages to get the following monthly DRF percentages that are used for all of the South Park water rights.

The DRF is assigned to a Term and Conditions Plan and distributed monthly based on a generalized return flow pattern used by the Aurora’s water rights engineers. (Section 5.8.6.10)

As noted above, the South Platte water rights are typically stored before being used to meet demands. The rules for the South Platte rights tabulated below are first stored in Spinney Mountain Reservoir with any excess supply being released directly to the Aurora demand.

Note these rules are represented by a suite of rules (e.g., SFKANTCO.23a, SFKANTCO.23b, SFKANTCO.23c, SFKANTCO.23d, SFKANTCO.23e) – one for each month so as to represent the variable monthly CU factors).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SFKANTCO.23a-e	18774.00001	Spinney Mountain Reservoir (2304013), Account 3	SF SPR abv Antero ADMIN GAGE (2302900) SF SPR Aug Station (2302900_A, R)	2302900_Pln	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SFKANTCO.24a-e	18774.00002	Aurora Inside Use (08_Aurora_I)	SF SPR abv Antero ADMIN GAGE (2302900) SF SPR Aug Station (2302900_A, R) AURORA INTAKE (0801001)	2302900_Pln	27
SFKANTCO.25a-e	18774.00003	Aurora Outside Use (08_Aurora_O)	SF SPR abv Antero ADMIN GAGE (2302900) SF SPR Aug Station (2302900_A, R) AURORA INTAKE (0801001)	2302900_Pln	27
FOUHARCO.06a-e	14536.11111	Spinney Mountain Reservoir (2304013), Account 3	Fourmile Ck nr Harstel ADMIN GAGE (2302901) Fourmile nr Harstel Aug Station (2302901_A, R)	2302901_Pln	27
FOUHARCO.07a-e	14536.11112	Aurora Inside Use (08_Aurora_I)	Fourmile Ck nr Harstel ADMIN GAGE (2302901) Fourmile nr Harstel Aug Station (2302901_A, R) AURORA INTAKE (0801001)	2302901_Pln	27
FOUHARCO.08a-e	14536.11113	Aurora Outside Use (08_Aurora_O)	Fourmile Ck nr Harstel ADMIN GAGE (2302901) Fourmile nr Harstel Aug Station (2302901_A, R) AURORA INTAKE (0801001)	2302901_Pln	27
MFKSTMCO.09a-e	23152.15646	Spinney Mountain Reservoir (2304013), Account 3	Mid Fk SPR at SantaMaria ADMIN GAGE (2302902) Mid Fk SPR Aug Station (2302902_A, R)	2302902_Pln	27
MFKSTMCO.10a-e	23152.15647	Aurora Inside Use (08_Aurora_I)	Mid Fk SPR at SantaMaria ADMIN GAGE (2302902) Mid Fk SPR Aug Station (2302902_A, R) AURORA INTAKE (0801001)	2302902_Pln	27
MFKSTMCO.11a-e	23152.15648	Aurora Outside Use (08_Aurora_O)	Mid Fk SPR at SantaMaria ADMIN GAGE (2302902) Mid Fk SPR Aug Station (2302902_A, R) AURORA INTAKE (0801001)	2302902_Pln	27
PLASPICO.14a-e	12707.00001	Spinney Mountain Reservoir (2304013), Account	SPR abv Spinney Mtn ADMIN GAGE (2302903) SPR abv Spinney Aug	2302903_Pln	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		3	Station (2302903_A)		
PLASPICO.15a-e	12707.00002	Aurora Inside Use (08_Aurora_I)	SPR abv Spinney Mtn ADMIN GAGE (2302903) SPR abv Spinney Aug Station (2302903_A) AURORA INTAKE (0801001)	2302903_Pln	27
PLASPICO.16a-e	12707.00003	Aurora Outside Use (08_Aurora_O)	SPR abv Spinney Mtn ADMIN GAGE (2302903) SPR abv Spinney Aug Station (2302903_A) AURORA INTAKE (0801001)	2302903_Pln	27
FOUHIGCO.03a-e	9983.00001	Spinney Mountain Reservoir (2304013), Account 3	Fourmile Ck at High Ck ADMIN GAGE (2302904) Fourmile at High Ck Aug Station (2302904_A)	2302904_Pln	27
FOUHIGCO.04a-e	9983.00002	Aurora Inside Use (08_Aurora_I)	Fourmile Ck at High Ck ADMIN GAGE (2302904) Fourmile at High Ck Aug Station (2302904_A) AURORA INTAKE (0801001)	2302904_Pln	27
FOUHIGCO.05a	9983.00003	Aurora Outside Use (08_Aurora_O)	Fourmile Ck at High Ck ADMIN GAGE (2302904) Fourmile at High Ck Aug Station (2302904_A) AURORA INTAKE (0801001)	2302904_Pln	27
TROGARCO.02a-e	4565.00001	Spinney Mountain Reservoir (2304013), Account 3	Trout Ck nr Garo ADMIN GAGE (2302911) Trout nr Garo Aug Station (2302911_A)	2302911_Pln	27
TROGARCO.03a-e	4565.00002	Aurora Inside Use (08_Aurora_I)	Trout Ck nr Garo ADMIN GAGE (2302911) Trout nr Garo Aug Station (2302911_A) AURORA INTAKE (0801001)	2302911_Pln	27
TROGARCO.04a-e	4565.00003	Aurora Outside Use (08_Aurora_O)	Trout Ck nr Garo ADMIN GAGE (2302911) Trout nr Garo Aug Station (2302911_A) AURORA INTAKE (0801001)	2302911_Pln	27
SPRBRNCO.02a-e	10774.00001	Spinney Mountain Reservoir (2304013), Account 3	Spring Branch abv MF SPR ADMIN GAGE (2302912) Spring Branch Aug Station (2302912_A)	2302912_Pln	26

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SPRBRNCO.03a-e	10774.00002	Aurora Inside Use (08_Aurora_I)	Spring Branch abv MF SPR ADMIN GAGE (2302912) Spring Branch Aug Station (2302912_A) AURORA INTAKE (0801001)	2302912_Pln	27
SPRBRNCO.04a-e	10774.00003	Aurora Outside Use (08_Aurora_O)	Spring Branch abv MF SPR ADMIN GAGE (2302912) Spring Branch Aug Station (2302912_A) AURORA INTAKE (0801001)	2302912_Pln	27
MFKPRICO.13a-e	11867.00001	Spinney Mountain Reservoir (2304013), Account 3	Mid Fk SPR Prince ADMIN GAGE (2302913) Mid Fk SPR Prince Aug Station (2302913_A)	2302913_Pln	27
MFKPRICO.14a-e	11867.00002	Aurora Inside Use (08_Aurora_I)	Mid Fk SPR Prince ADMIN GAGE (2302913) Mid Fk SPR Prince Aug Station (2302913_A) AURORA INTAKE (0801001)	2302913_Pln	27
MFKPRICO.15a-e	11867.00003	Aurora Outside Use (08_Aurora_O)	Mid Fk SPR Prince ADMIN GAGE (2302913) Mid Fk SPR Prince Aug Station (2302913_A) AURORA INTAKE (0801001)	2302913_Pln	27

5.10.8.2.4 Representation of Terryall Creek Water Rights

The consumptive use amounts for the 57 water rights in the Tarryall Creek Basin are stored, in priority, in the following Changed Water Rights Plan structures.

Plan ID	Abbreviation	Gage Name	# Rights
2302906_Pln	TARCOMCO	UPPER TARRYALL GAGE	10
2302907_Pln	MCHJEFCO	MICHIGAN CREEK GAGE	9
2302908_Pln	JEFJEFCO	JEFFERSON CREEK GAGE	9
2302909_Pln	TARBORCO	LOWER TARRYALL GAGE	7
2302910_Pln	OHGJEFCO	OHLER GULCH GAGE	1
2302914_Pln	FRNCRKCO	FRENCH CREEK GAGE	1
2302915_Pln	RCKTARCO	ROCK CREEK GAGE	13
2302916_Pln	SCHFLMCO	SCHATTINGER GAGE	3
2302917_Pln	JEFSNYCO	ROCKER 7 GAGE	3

2302918_Pln DIXCOMCO JOHNSTON GAGE 2

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
TARCOMCO.01	9592.00000	2302906_Pln		2302906.01	26
TARCOMCO.02	10367.00000	2302906_Pln		2302906.02	26
TARCOMCO.03	10722.00000	2302906_Pln		2302906.03	26
TARCOMCO.04	11068.00000	2302906_Pln		2302906.04	26
TARCOMCO.05	11098.00000	2302906_Pln		2302906.05	26
TARCOMCO.06	11129.00000	2302906_Pln		2302906.06	26
TARCOMCO.07	11453.00000	2302906_Pln		2302906.07	26
TARCOMCO.08	11550.00000	2302906_Pln		2302906.08	26
TARCOMCO.09	12924.00000	2302906_Pln		2302906.09	26
TARCOMCO.10	14536.14427	2302906_Pln		2302906.10	26
MCHJEFCO.01	9053.00000	2302907_Pln		2302907.01	26
MCHJEFCO.02	9233.00000	2302907_Pln		2302907.02	26
MCHJEFCO.03	11032.00000	2302907_Pln		2302907.03	26
MCHJEFCO.04	11170.00000	2302907_Pln		2302907.04	26
MCHJEFCO.05	11263.00000	2302907_Pln		2302907.05	26
MCHJEFCO.06	11748.00000	2302907_Pln		2302907.06	26
MCHJEFCO.07	11809.00000	2302907_Pln		2302907.07	26
MCHJEFCO.08	12205.00000	2302907_Pln		2302907.08	26
JEFJEFCO.01	9040.00000	2302908_Pln		2302908.01	26
JEFJEFCO.02	9266.00000	2302908_Pln		2302908.02	26
JEFJEFCO.03	9612.00000	2302908_Pln		2302908.03	26
JEFJEFCO.04	10732.00000	2302908_Pln		2302908.04	26
JEFJEFCO.05	10836.00000	2302908_Pln		2302908.05	26
JEFJEFCO.06	11453.00000	2302908_Pln		2302908.06	26
JEFJEFCO.07	11813.00000	2302908_Pln		2302908.07	26
JEFJEFCO.08	11854.00000	2302908_Pln		2302908.08	26
TARBORCO.01	7805.00000	2302909_Pln		2302909.01	26
TARBORCO.02	9071.00000	2302909_Pln		2302909.02	26
TARBORCO.03	9100.00000	2302909_Pln		2302909.03	26
TARBORCO.04	9618.00000	2302909_Pln		2302909.04	26
TARBORCO.05	10957.00000	2302909_Pln		2302909.05	26
TARBORCO.06	11108.00000	2302909_Pln		2302909.06	26

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
TARBORCO.07	11171.00000	2302909_Pln		2302909.07	26
OHGJEFCO.01	10318.00000	2302910_Pln		2302910.01	26
FRNCRKCO.01	10763.00000	2302914_Pln		2302914.01	26
RCKTARCO.01	8157.00000	2302915_Pln		2302915.01	26
RCKTARCO.02	8202.00000	2302915_Pln		2302915.02	26
RCKTARCO.03	8541.00000	2302915_Pln		2302915.03	26
RCKTARCO.04	9252.00000	2302915_Pln		2302915.04	26
RCKTARCO.05	9649.00000	2302915_Pln		2302915.05	26
RCKTARCO.06	9983.00000	2302915_Pln		2302915.06	26
RCKTARCO.07	10043.00000	2302915_Pln		2302915.07	26
RCKTARCO.08	11110.00000	2302915_Pln		2302915.08	26
RCKTARCO.09	11118.00000	2302915_Pln		2302915.09	26
RCKTARCO.10	11809.00000	2302915_Pln		2302915.10	26
RCKTARCO.11	11829.00000	2302915_Pln		2302915.11	26
RCKTARCO.12	12554.00000	2302915_Pln		2302915.12	26
RCKTARCO.13	12560.00000	2302915_Pln		2302915.13	26
SCHFLMCO.01	10044.00000	2302916_Pln		2302916.02	26
SCHFLMCO.02	10798.00000	2302916_Pln		2302916.04	26
SCHFLMCO.03	16718.00000	2302916_Pln		2302916.05	26
JEFSNYCO.01	9246.00000	2302917_Pln		2302917.01	26
JEFSNYCO.02	11458.00000	2302917_Pln		2302917.02	26
JEFSNYCO.03	23152.12608	2302917_Pln		2302917.03	26
DIXCOMCO.01	8171.00000	2302918_Pln		2302918.01	26
DIXCOMCO.02	9313.00000	2302918_Pln		2302918.02	26

The Tarryall rights are typically released first to meet Aurora's demands and excess supplies can then be exchanged to Spinney Mountain Reservoir. The Tarryall Creek changed water rights have Delayed (winter) Return Factors (DRF) and Instantaneous Return Factors (IRF). Limits on the use of these rights are based on the monthly CU cfs amounts plus DRF cfs plus IRF cfs amounts. The average monthly DRF values were developed using the same approach as described above for the South Platte water rights (see Section 5.8.6.10). The monthly DRF is distributed based on the same monthly pattern used for the South Platte water rights.

As noted above, the decretal limitations on a changed water right may be less than the water right assigned to the administrative gage. In addition, the CU factors, DRFs, and IRFs as percentages of each water right at an administrative gage are not consistent among the water rights assigned to that gage. Detailed analysis of the different moving parts with the administrative gages is fairly complex. The IRF values essentially represent the portion of the changed water right that must be bypassed and cannot be used by the owner. Therefore, the IRF values developed for the model are based on the cfs-weighted average monthly CU factor as a percentage of the total amount of changed water rights at a particular gage. The average monthly IRF values used in the model for the Tarryall rights are summarized in the Plan Section.

The rules for the Tarryall rights tabulated below are first used to meet Aurora demands with any excess supply stored in Spinney Mountain Reservoir, Aurora Reservoir, or Strontia Springs Reservoir.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
TARCOMCO.11a-f	23152.15646	Aurora Inside Use (08_Aurora_I)	Tarryall at Como Aug Station (2302906_A) Petrie Ditch (2300902, R) Aurora Intake (0801001)	2302906_Pl	27
TARCOMCO.12a-f	23152.15647	Aurora Outside Use (08_Aurora_O)	Tarryall at Como Aug Station (2302906_A) Petrie Ditch (2300902, R) Aurora Intake (0801001)	2302906_Pl	27
TARCOMCO.13a-f	23152.15648	Spinney Mountain Reservoir (2304013), Account 3	Tarryall at Como Aug Station (2302906_A) Petrie Ditch (2300902, R) Aurora Intake (0801001)	2302906_Pln	27
TARCOMCO.14a-f	23152.15649	Aurora Reservoir System (0203379), Account 1	Tarryall at Como Aug Station (2302906_A) Petrie Ditch (2300902, R) Aurora Intake (0801001)	2302906_Pln	27
TARCOMCO.15a-f	23152.15649	Strontia Springs Reservoir (0803983), Account 2	Tarryall at Como Aug Station (2302906_A) Petrie Ditch (2300902, R) Aurora Intake (0801001)	2302906_Pln	27
MCHJEFCO.09a-f	23152.15646	Aurora Inside Use (08_Aurora_I)	Michigan abv Jefferson Aug Station (2302907_A) Taylor Ditch (2300991, R) Aurora Intake (0801001)	2302907_Pln	27
MCHJEFCO.10a-f	23152.15647	Aurora Outside Use (08_Aurora_O)	Michigan abv Jefferson Aug Station (2302907_A) Taylor Ditch (2300991, R) Aurora Intake (0801001)	2302907_Pln	27
MCHJEFCO.11a-f	23152.15648	Spinney Mountain Reservoir (2304013), Account 3	Michigan abv Jefferson Aug Station (2302907_A) Taylor Ditch (2300991, R) Aurora Intake (0801001)	2302907_Pln	27
MCHJEFCO.12a-f	23152.15649	Aurora Reservoir System (0203379),	Michigan abv Jefferson Aug Station (2302907_A)	2302907_Pln	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		Account 1	Taylor Ditch (2300991, R) Aurora Intake (0801001)		
MCHJEFCO.13a-f	23152.15649	Strontia Springs Reservoir (0803983), Account 2	Michigan abv Jefferson Aug Station (2302907_A) Taylor Ditch (2300991, R) Aurora Intake (0801001)	2302907_Pln	27
JEFJEFCO.10a-f	23152.15646	Aurora Inside Use (08_Aurora_I)	Jefferson Ck nr Jefferson (2302908_A) Jefferson Ck blw Snyder ADMIN GAGE (2302917, R) AURORA INTAKE (0801001)	2302908_Pln	27
JEFJEFCO.11a-f	23152.15647	Aurora Outside Use (08_Aurora_O)	Jefferson Ck nr Jefferson (2302908_A) Jefferson Ck blw Snyder ADMIN GAGE (2302917, R) AURORA INTAKE (0801001)	2302908_Pln	27
JEFJEFCO.12a-f	23152.15648	Spinney Mountain Reservoir (2304013), Account 3	Jefferson Ck nr Jefferson (2302908_A) Jefferson Ck blw Snyder ADMIN GAGE (2302917, R) AURORA INTAKE (0801001)	2302908_Pln	27
JEFJEFCO.13a-f	23152.15649	Aurora Reservoir System (0203379), Account 1	Jefferson Ck nr Jefferson (2302908_A) Jefferson Ck blw Snyder ADMIN GAGE (2302917, R) AURORA INTAKE (0801001)	2302908_Pln	27
JEFJEFCO.14a-f	23152.15649	Strontia Springs Reservoir (0803983), Account 2	Jefferson Ck nr Jefferson (2302908_A) Jefferson Ck blw Snyder ADMIN GAGE (2302917, R) AURORA INTAKE (0801001)	2302908_Pln	27
TARBORCO.08a-c	23152.15646	Aurora Inside Use (08_Aurora_I)	Tarryall at Bordon Ditch Aug Station (2302909_A) Holst Ditch 2 (2300922, R) AURORA INTAKE (0801001)	2302909_Pln	27
TARBORCO.09a-c	23152.15647	Aurora Outside Use	Tarryall at Bordon Ditch	2302909_Pln	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		(08_Aurora_O)	Aug Station (2302909_A) Holst Ditch 2 (2300922, R) AURORA INTAKE (0801001)		
TARBORCO.10a-c	23152.15648	Spinney Mountain Reservoir (2304013), Account 3	Tarryall at Bordon Ditch Aug Station (2302909_A) Holst Ditch 2 (2300922, R) AURORA INTAKE (0801001)	2302909_Pln	27
TARBORCO.14a-c	23152.15649	Aurora Reservoir System (0203379), Account 1	Tarryall at Bordon Ditch Aug Station (2302909_A) Holst Ditch 2 (2300922, R) AURORA INTAKE (0801001)	2302909_Pln	27
TARBORCO.12a-c	23152.15649	Strontia Springs Reservoir (0803983), Account 2	Tarryall at Bordon Ditch Aug Station (2302909_A) Holst Ditch 2 (2300922, R) AURORA INTAKE (0801001)	2302909_Pln	27
OHGJEFCO.02a-e	23152.15646	Aurora Inside Use (08_Aurora_I)	Ohler Aug Stn (2302910_A) Jefferson Ck blw Snyder ADMIN GAGE (2302917, R) AURORA INTAKE (0801001)	2302910_Pln	27
OHGJEFCO.03a-e	23152.15647	Aurora Outside Use (08_Aurora_O)	Ohler Aug Stn (2302910_A) Jefferson Ck blw Snyder ADMIN GAGE (2302917, R) AURORA INTAKE (0801001)	2302910_Pln	27
OHGJEFCO.04a-e	23152.15648	Spinney Mountain Reservoir (2304013), Account 3	Ohler Aug Stn (2302910_A) Jefferson Ck blw Snyder ADMIN GAGE (2302917, R) AURORA INTAKE (0801001)	2302910_Pln	27
OHGJEFCO.05a-e	23152.15649	Aurora Reservoir System (0203379), Account 1	Ohler Aug Stn (2302910_A) Jefferson Ck blw Snyder ADMIN GAGE (2302917, R) AURORA INTAKE	2302910_Pln	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
			(0801001)		
OHGJEFCO.06a-e	23152.15649	Strontia Springs Reservoir (0803983), Account 2	Ohler Aug Stn (2302910_A) Jefferson Ck blw Snyder ADMIN GAGE (2302917, R) AURORA INTAKE (0801001)	2302910_Pln	27
FRNCRKCO.02a-c	23152.15646	Aurora Inside Use (08_Aurora_I)	French Ck abv Michigan Aug Station (2302914_A) Michigan abv Jefferson ADMIN GAGE (2302907, R) AURORA INTAKE (0801001)	2302914_Pln	27
FRNCRKCO.03a-c	23152.15647	Aurora Outside Use (08_Aurora_O)	French Ck abv Michigan Aug Station (2302914_A) Michigan abv Jefferson ADMIN GAGE (2302907, R) AURORA INTAKE (0801001)	2302914_Pln	27
FRNCRKCO.04a-c	23152.15648	Spinney Mountain Reservoir (2304013), Account 3	French Ck abv Michigan Aug Station (2302914_A) Michigan abv Jefferson ADMIN GAGE (2302907, R) AURORA INTAKE (0801001)	2302914_Pln	27
FRNCRKCO.05a	23152.15649	Aurora Reservoir System (0203379), Account 1	French Ck abv Michigan Aug Station (2302914_A) Michigan abv Jefferson ADMIN GAGE (2302907, R) AURORA INTAKE (0801001)	2302914_Pln	27
FRNCRKCO.06a	23152.15649	Strontia Springs Reservoir (0803983), Account 2	French Ck abv Michigan Aug Station (2302914_A) Michigan abv Jefferson ADMIN GAGE (2302907, R) AURORA INTAKE (0801001)	2302914_Pln	27
RCKTARCO.14a-c	23152.15646	Aurora Inside Use (08_Aurora_I)	Rock Ck abv Tarryall Aug Station (2302915_A) Tarryall at Borden Ditch ADMIN GAGE (2302909, R) AURORA INTAKE (0801001)	2302915_Pln	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
RCKTARCO.15a-c	23152.15647	Aurora Outside Use (08_Aurora_O)	Rock Ck abv Tarryall Aug Station (2302915_A) Tarryall at Borden Ditch ADMIN GAGE (2302909, R) AURORA INTAKE (0801001)	2302915_Pln	27
RCKTARCO.16a-c	23152.15648	Spinney Mountain Reservoir (2304013), Account 3	Rock Ck abv Tarryall Aug Station (2302915_A) Tarryall at Borden Ditch ADMIN GAGE (2302909, R) AURORA INTAKE (0801001)	2302915_Pln	27
RCKTARCO.17a-c	23152.15649	Aurora Reservoir System (0203379), Account 1	Rock Ck abv Tarryall Aug Station (2302915_A) Tarryall at Borden Ditch ADMIN GAGE (2302909, R) AURORA INTAKE (0801001)	2302915_Pln	27
RCKTARCO.18a-c	23152.15649	Strontia Springs Reservoir (0803983), Account 2	Rock Ck abv Tarryall Aug Station (2302915_A) Tarryall at Borden Ditch ADMIN GAGE (2302909, R) AURORA INTAKE (0801001)	2302915_Pln	27
SCHFLMCO.04a-c	23152.15646	Aurora Inside Use (08_Aurora_I)	Schattinger abv Michigan Aug Station (2302916_A) Michigan abv Jefferson ADMIN GAGE (2302907, R) AURORA INTAKE (0801001)	2302916_Pln	27
SCHFLMCO.05a-c	23152.15647	Aurora Outside Use (08_Aurora_O)	Schattinger abv Michigan Aug Station (2302916_A) Michigan abv Jefferson ADMIN GAGE (2302907, R) AURORA INTAKE (0801001)	2302916_Pln	27
SCHFLMCO.06a-c	23152.15648	Spinney Mountain Reservoir (2304013), Account 3	Schattinger abv Michigan Aug Station (2302916_A) Michigan abv Jefferson ADMIN GAGE (2302907, R) AURORA INTAKE (0801001)	2302916_Pln	27
SCHFLMCO.07a-c	23152.15649	Aurora Reservoir	Schattinger abv Michigan	2302916_Pln	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		System (0203379), Account 1	Aug Station (2302916_A) Michigan abv Jefferson ADMIN GAGE (2302907, R) AURORA INTAKE (0801001)		
SCHFLMCO.08a-c	23152.15649	Strontia Springs Reservoir (0803983), Account 2	Schattinger abv Michigan Aug Station (2302916_A) Michigan abv Jefferson ADMIN GAGE (2302907, R) AURORA INTAKE (0801001)	2302916_Pln	27
JEFSNYCO.04a-c	23152.15646	Aurora Inside Use (08_Aurora_I)	Jefferson Ck blw Synder Aug Station (2302917_A) Jefferson Ck ISF (2302116_Dwn, R) AURORA INTAKE (0801001)	2302917_Pln	27
JEFSNYCO.05a-c	23152.15647	Aurora Outside Use (08_Aurora_O)	Jefferson Ck blw Synder Aug Station (2302917_A) Jefferson Ck ISF (2302116_Dwn, R) AURORA INTAKE (0801001)	2302917_Pln	27
JEFSNYCO.06a-c	23152.15648	Spinney Mountain Reservoir (2304013), Account 3	Jefferson Ck blw Synder Aug Station (2302917_A) Jefferson Ck ISF (2302116_Dwn, R) AURORA INTAKE (0801001)	2302917_Pln	27
JEFSNYCO.07a-c	23152.15649	Aurora Reservoir System (0203379), Account 1	Jefferson Ck blw Synder Aug Station (2302917_A) Jefferson Ck ISF (2302116_Dwn, R) AURORA INTAKE (0801001)	2302917_Pln	27
JEFSNYCO.08a-c	23152.15649	Strontia Springs Reservoir (0803983), Account 2	Jefferson Ck blw Synder Aug Station (2302917_A) Jefferson Ck ISF (2302116_Dwn, R) AURORA INTAKE (0801001)	2302917_Pln	27
DIXCOMCO.03a-c	23152.15646	Aurora Inside Use (08_Aurora_I)	Dixon Flume Holthusen Aug Stn (2302918_A) Petrie Ditch (2300902, R) AURORA INTAKE (0801001)	2302918_Pln	27
DIXCOMCO.04a-c	23152.15647	Aurora Outside Use (08_Aurora_O)	Dixon Flume Holthusen Aug Stn (2302918_A)	2302918_Pln	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
			Petrie Ditch (2300902, R) AURORA INTAKE (0801001)		
DIXCOMCO.05a-c	23152.15648	Spinney Mountain Reservoir (2304013), Account 3	Dixon Flume Holthusen Aug Stn (2302918_A) Petrie Ditch (2300902, R) AURORA INTAKE (0801001)	2302918_Pln	27
DIXCOMCO.06a-c	23152.15649	Aurora Reservoir System (0203379), Account 1	Dixon Flume Holthusen Aug Stn (2302918_A) Petrie Ditch (2300902, R) AURORA INTAKE (0801001)	2302918_Pln	27
DIXCOMCO.15a-c	23152.15649	Strontia Springs Reservoir (0803983), Account 2	Dixon Flume Holthusen Aug Stn (2302918_A) Petrie Ditch (2300902, R) AURORA INTAKE (0801001)	2302918_Pln	27

Reusable Effluent

Effluent exchanges and storage releases provide supplemental supplies to meet the Aurora demand. The following three rules exchange reusable effluent to supply the aurora demands (2) and storage in Aurora Reservoir (1):

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
MetroAur.02	50029.00000	Aurora Inside Use (08_Aurora_I)	AURORA INTAKE (0801001)	MetroAur	28
MetroAur.03	50029.00001	Aurora Outdoor Use (08_Aurora_O)	AURORA INTAKE (0801001)	MetroAur	28
MetroAur.04	53291.00001	Aurora Well Aug Plan (0802593)		MetroAur	49

Three other Plan release rules are included for the use of reusable effluent to meet. Note the latter two rules only simulate releases when the well depletions and the return flows are not satisfied in priority using operating rule IDs 0802593.01 and AuroraRF.01, respectively.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
MetAurRL.01	1.00000			Release Limit - MetroAurRL	47
MetroAur.05	53291.00002	Aurora Reservoir System (0203379)	AURORA INTAKE (0801001)	MetroAur	28
MetroAur.06	51864.00006	AurLastChRF		MetroAur	48

Storage Releases

The following six rules are used to supply the Aurora demand with releases from storage.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Spinney.01	50029.00005	Aurora Inside Use (08_Aurora_I)	AURORA INTAKE (0801001)	Spinney Mountain Reservoir (2304013), Account 3	32
Spinney.02	50029.00006	Aurora Inside Use (08_Aurora_I)	AURORA INTAKE (0801001)	Spinney Mountain Reservoir (2304013), Account 2	2
Spinney.03	50029.00007	Aurora Outdoor Use (08_Aurora_O)	AURORA INTAKE (0801001)	Spinney Mountain Reservoir (2304013), Account 3	32
Spinney.04	50029.00008	Aurora Outdoor Use (08_Aurora_O)	AURORA INTAKE (0801001)	Spinney Mountain Reservoir (2304013), Account 2	2
AurorRes.01	50029.00009	Aurora Inside Use (08_Aurora_I)		Aurora Reservoir System (0203379), Account 1	32
AurorRes.02	50029.00010	Aurora Outdoor Use (08_Aurora_O)		Aurora Reservoir System (0203379), Account 1	32

The following nine rules are used to meet the South Park DRFs with releases from storage.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Spinney.05	1.00010	SpinMtnDRF		Spinney Mountain Reservoir (2304013), Account 3	48
Spinney.06	1.00010	SpinDRF_03		Spinney Mountain Reservoir (2304013), Account 3	48
Spinney.07	1.00010	SpinDRF_04		Spinney	48

				Mountain Reservoir (2304013), Account 3	
Spinney.08	1.00010	SpinDRF_07		Spinney Mountain Reservoir (2304013), Account 3	48
Spinney.09	1.00010	SpinDRF_11		Spinney Mountain Reservoir (2304013), Account 3	48
Spinney.10	1.00010	SpinDRF_13		Spinney Mountain Reservoir (2304013), Account 3	48
Spinney.11	1.00010	SpinDRF_16		Spinney Mountain Reservoir (2304013), Account 3	48
Spinney.12	1.00010	SpinDRF_17		Spinney Mountain Reservoir (2304013), Account 3	48
Spinney.13	1.00010	SpinDRF_21		Spinney Mountain Reservoir (2304013), Account 3	48

The following rule releases stored water from Strontia Springs to the Aurora Reservoir system.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Strontia.03	50029.00011	Aurora Reservoir System (0203379), Account 1	AURORA INTAKE (0801001)	Strontia Springs Reservoir (0803983), Account 2	3

One other storage release rule is included to meet augmentation requirements for the Cherry Creek wellfield.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type

0802593.01	53291.00000	Aurora Well Aug Plan (0802593)			43
AuroraRF.01	51864.00000	AurLastChRF			43
AurorRes.03	53291.00003	Aurora Well Aug Plan (0802593)		Aurora Reservoir System (0203379), Account 1	49

5.10.8.3 City of Englewood

The City of Englewood is located in the southwest Denver metropolitan area. The community was served by the Denver Water Board until 1952, during a period when Englewood started purchasing water rights in the South Platte River and Bear Creek basins. Englewood built its primary water treatment plant near Union Avenue using an intake structure located at the site of the Petersburg Ditch headgate. In 1965, the City constructed McLellan Reservoir on the east side of the South Platte River near County Line Road and Santa Fe Drive.

The Englewood Intake (0801013) is the major component of Englewood's water supply system. It forms the basis of how supplies are represented to meet the Englewood demands in the SPDSS model, along with Englewood's ownership in the Boreas Pass Ditch and McLellan Reservoir. Note the Englewood Intake node is used as a carrier for all municipal water supplies, except for storage releases of water from McLellan Reservoir.

5.10.8.3.1 Transmountain Supplies

Until the SPDSS model and western slope models are integrated, the transmountain supplies from the Boreas Pass Ditch (2304611) are set equal to historical deliveries. These supplies are operated in the model as the primary supply, which results in the use of all the imports to meet the Englewood demand or stored in McLellan Reservoir (0803832). The following three rules are used to supply Boreas Pass Ditch imports directly to Englewood's demands (2) and storage (1).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Boreas.01	1.00001	Englewood Inside Use (08_Englwd_I)	Englewood Intake (0801013)	Boreas Tunnel Carrier (Boreas_C)	27
Boreas.02	1.00002	Englewood Outside Use (08_Englwd_O)	Englewood Intake (0801013)	Boreas Tunnel Carrier (Boreas_C)	27
Boreas.03	1.00003	McLellan Reservoir (0803832), Account 2	CITY DITCH PL (0801008)	Boreas Tunnel Carrier (Boreas_C)	27

5.10.8.3.2 *Changed Water Rights*

The following three rules are used to meet Englewood's demand from the water rights previously adjudicated to the Brown Ditch (1) and the Platte Canyon Ditch (2) that have been transferred to the Englewood Intake. Monthly volumetrics input for these rules are based on the decretal terms and conditions in Case Nos. 86CW14 (Brown Ditch) and 80CW35 (Platte Canyon Ditch).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
EngBrown.01	4717.00000	Englewood Outside Use (08_Englwd_O	Englewood Intake (0801013)	0801013.06	45
EnglwdPL.02-03	5112.00000	Englewood Inside Use (08_Englwd_I)	Englewood Intake (0801013)	0801013.03	45

The following three rules are used to store the credits from the Petersburg Ditch (1) and Nevada Ditch (2) water rights in the EngIntPln structure; the subsequent three rules are used to meet the Englewood demand (2) and for storage in McLellan Reservoir (1) with water released from the EngIntPln. The last rule is used to release any unused credits back to the river. Monthly volumetrics input for these rules are based on the decretal terms and conditions in Case No. 80CW35.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
EnglwdPL.01	4352.00000	EngIntPln	100%	0801013.02	26
EnglwdPL.04	4260.00000	EngIntPln	100%	0801013.01	26
EnglwdPL.05	5843.00000	EngIntPln	100%	0801013.04	26
EnglwdPL.06	5843.00001	Englewood Inside Use (08_Englwd_I)	Englewood Intake (0801013)	EngIntPln	27
EnglwdPL.07	5843.00002	Englewood Outside Use (08_Englwd_O	Englewood Intake (0801013)	EngIntPln	27
EnglwdPL.08	5843.00003	McLellan Reservoir (0803832), Account 2	CITY DITCH PL (0801008)	EngIntPln	28
EngPlnSp.72	5843.00009	Englewood Intake (0801013)		EngIntPln	29

The volumetrics used in the above rules represent one time use limits. Therefore, no return flow obligations are created from Englewood's use of these rights. In addition, the reusable supplies associated with Englewood's operations are not currently represented in the model.

Englewood also owns the majority of the McBroom Ditch (0900816). These rights are used primarily to irrigate a golf course near the confluence of the South Platte River and Bear Creek. The rights are used less often for diversion at the Englewood Intake. The golf course demand is assumed to be part of Englewood's outside use and the use of the changed right is therefore not modeled through other operating rules.

5.10.8.3.3 Storage Releases

The following two rules are used to supply the Englewood demand with releases from storage. The subsequent two rules are used to carry the McLellan Reservoir storage rights into the reservoir via the City Ditch (0801008).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
McLellan.01	5884.00000	Englewood Inside Use (08_Englwd_I)		McLellan Reservoir (0803832), Account 2	2
McLellan.02	5884.00001	Englewood Outside Use (08_Englwd_O		McLellan Reservoir (0803832), Account 2	2
McLellan.03	36060.00000	McLellan Reservoir (0803832), Accounts 1-2	CITY DITCH PL (0801008)	0803832.01	45
McLellan.04	50759.00000	McLellan Reservoir (0803832), Accounts 1-2	CITY DITCH PL (0801008)	0803832.02	45

5.10.8.4 Public Service Company

Xcel Energy has power plants at various locations in the upper South Platte River Basin. These facilities include the Cherokee Plant (02_ChrkPP), located near the confluence of Clear Creek and the South Platte River; the Fort St. Vrain Plant (02_VRNPP), located near the confluence of St. Vrain Creek and the South Platte River; and the Arapahoe Plant (0801014, decommissioned in 2013), located on the South Platte River below the Bear Creek confluence. Two other plants in the basin managed by Xcel Energy are not included in the model. The Zuni Plant is a once-through plant to generate steam for downtown Denver buildings. Xcel Energy has a 50 acre-feet per year take-of-pay lease with Denver Water, of which only about 5 to 10 acre-feet per year is used. Xcel Energy got ownership of the Calpine Plant in 2010. The plant is located below the Henrylyn Irrigation District service area. It is served by wellfield north of Fort Lupton from where water is piped 15 miles to plant. It is a zero-discharge plant (100% CU rate) and the replacement supply is Aurora effluent via a long-term lease.

5.10.8.4.1 Cherokee Power Plant (02_ChrkPP) and Fisher Ditch (0700570)

The Cherokee Power plant is located near the terminus of the Fisher Ditch (0700570) and uses changed Fisher Ditch water as its primary supply during the summer. Xcel Energy acquired and changed a total of about 49 percent of the Fisher Ditch Company starting in the early-1990s. A 1991 priority water right from Clear Creek was also adjudicated (the Cherokee Pipeline water right). The

Cherokee plant was supplied prior to that time with contract water from DW through their ownership of water rights in the Farmers Gardners Ditch (0200800). Winter supplies for the power plant have been supplied by a contract for reusable effluent from DW, starting in 2004. There is also a small reservoir located adjacent to the plant (Copeland Reservoir, 0704354) that provides some cooling water. As presented below, the following operating rules are used to supply water to the Cherokee Power Plant.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cherokee.01	1.00001	Cherokee Power Plant (02_ChrkPP)	Reuse PL to Cherokee (DW_ReusePL)	DWB Metro Reuse Plan (MetroDW)	27
Cherokee.99	1.00000			Release Limit (DWB_PSCo_RL)	47
Fish.99	1.00000			Fisher Release Limit (FishPSC_RL)	47
Fish.08a-g	4198.00002	Cherokee Power Plant (02_ChrkPP)	Fisher Ditch (0700570) Fisher D to PSCO (0700570_C)	PSCoFishPln	27
FandG.01	4822.00000	FandGSplPln	100%	0200800.01	26
FandG.02	8857.00000	FandGSplPln	100%	0200800.02	26
FandG.03a-b	8857.00001	FandGIndPln	100%	FandGSplPln	46
FandG.04	8857.00002	Farmers Gardeners Ditch (0200800)		FandGIrrPln	27
Cherokee.02	8857.00002	Cherokee Power Plant (02_ChrkPP)	Farmers Gardeners Ditch (0200800)	FandGIndPln	27
Cherokee.04	8857.00004	Farmers Gardeners Ditch (0200800)		FandGIndPln	27
Fish.10	51711.00000	Cherokee Power Plant (02_ChrkPP)	Fisher Ditch (0700570)	0700570.03	45

Storage Releases

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Copeland.01	51711.00001	Cherokee Power Plant (02_ChrkPP)		Copeland Reservoir (0704354), Account 1	3
Cherokee.03	8857.00003	Copeland Reservoir (0704354), Account 1	Farmers Gardeners Ditch (0200800)	FandGIndPln	27
Fish.09	4198.00003	Copeland Reservoir (0704354), Account 1	Fisher Ditch (0700570) Fisher D to PSCO (0700570_C)	PSCoFishPln	27
PSCoRF.01-07	43099.00000	PSCoFishApr-Oct			43

Exchanges of reusable water from locations downstream of Clear Creek are also available for use to meet demands at the Cherokee Plant or make replacements of out-of-priority diversions through the Fisher Ditch. The exchanges up Clear Creek are only sporadically available due to the intervening water rights in the Colorado Agricultural Ditch (0700547 and 0700549) that are frequently placing calls. These additional uses of water and associated operations are not currently included in the SPDSS model. Plan IDs are included in the model representing PSCo's prorata ownership in the changed water rights in District 2 (PSCoLMPln, PSCoLBPln, PsCoMI2Plan1, PSCoMI2Pln2, and PSCoHewsPln). No operations with these changed rights are represented in the model; the plan supplies are currently included as placeholders for future modeling efforts.

5.10.8.4.2 Fort St. Vrain Power Plant (02_VRNPP)

The Fort St. Vrain Power Plant is located off of St. Vrain Creek near the terminus of the Jay Thomas Ditch (0200826) and uses the Goosequill Pump (0500939) out of St. Vrain Creek for approximately 90 percent of its physical supply. Industrial wells on site are also used for supply and, on occasion, its changed water rights in the Jay Thomas Ditch via the Jay Thomas Pump Station.

Xcel Energy's junior water right at Goosequill Pump Station is often in priority and it can divert under the changed Goosequill Ditch right or divert water out-of-priority under its augmentation plan its junior rights are not in priority. Conversations with Xcel Energy personnel, the water commissioner, and review of HydroBase DivClass records indicate the use of its South Platte ditch rights for the augmentation plan are small enough that representation in the model was not warranted. To simplify the representation of the Ft. St. Vrain plant, all of the supply is diverted at the Goosequill Pump Station under the senior changed Goosequill Ditch right for 20 cfs. Since diversions under the changed Goosequill Ditch right are limited to 315 acre-feet per year, on average, this approach overestimates the amount that can be diverted in priority. Nonetheless, this simplification was determined to be reasonable since Xcel Energy's junior rights at the pump station and its industrial wells are typically in priority.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
FtStVrn.01	11841.04474	Fort St. Vrain Power Plant (02_VRNPP)		0500939.01	11

5.10.8.4.3 Arapahoe Power Plant

Prior to it being decommissioned in 2013, the demand at the Arapahoe plant was supplied from a river pump and two wells with replacements provided via a Raw Water Contract from Denver Water. Review of the DivClass in HydroBase for the Arapahoe plant identified various sources over time, including Chatfield Reservoir, Cheesman Reservoir, Strontia Springs Reservoir, Metro Reuse, Bi-City Reuse, Conduit 20 and Denver Bear Ck Transfer. To simplify the representation of the Arapahoe plant, Denver Water's Conduit 20 is used as a source throughout the study period.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
ArapahPP.01	22254.00001	Arapahoe Power Plant (0801014)		Cnd20DirPln	27

5.10.8.5 Clear Creek (Water District 7) Operations

The Clear Creek Basin originates along the eastern edge of the Continental Divide, stretching north and south of Interstate 70 and the Eisenhower Tunnel. In addition to high quality hiking, rafting, and other outdoor opportunities, the Clear Creek Basin supplies numerous municipalities in the Denver metropolitan area and the Coors Brewery and other industrial interests. The Denver Water Board also conveys its Moffat Tunnel imports down South Boulder Creek and into the Ralston Creek tributary through the South Boulder Diversion Conduit (see Figure 5-4).

The Clear Creek Basin is typically controlled, in particular by the senior water rights under the Colorado Agricultural Ditch and Lower Clear Creek Ditch, located above the Derby gage and the Clear Creek confluence with the South Platte River. Some of the major irrigation ditches and reservoirs pivotal to the administration of the Clear Creek Basin (water district 7) are highlighted in Figure 5-4

The major operations of components critical to Clear Creek operations, particularly the water supplies to the major M&I users in the basin are summarized below. M&I supplies are provided, in large part, from changed uses of shares in the senior irrigation ditch and reservoir companies. The discussions include details of modeling decisions and operating rules to represent these systems in the SPDSS model. Note the prorata share ownership over time varies as has the operations of different cooperative agreements. The approach in the SPDSS Historical dataset was to settle on a "representative" characterization of water rights ownership and operations in place over the latter part of the 1975 – 2012 calibration period. The operational rules can be further refined by future modelers but the approach herein is considered reasonable for use in large-scale basin model intended for water resources planning and management.

Additional descriptions of Clear Creek operations, major and minor water users, et cetera can be found in the documents listed at the beginning of Section 5.10.8.

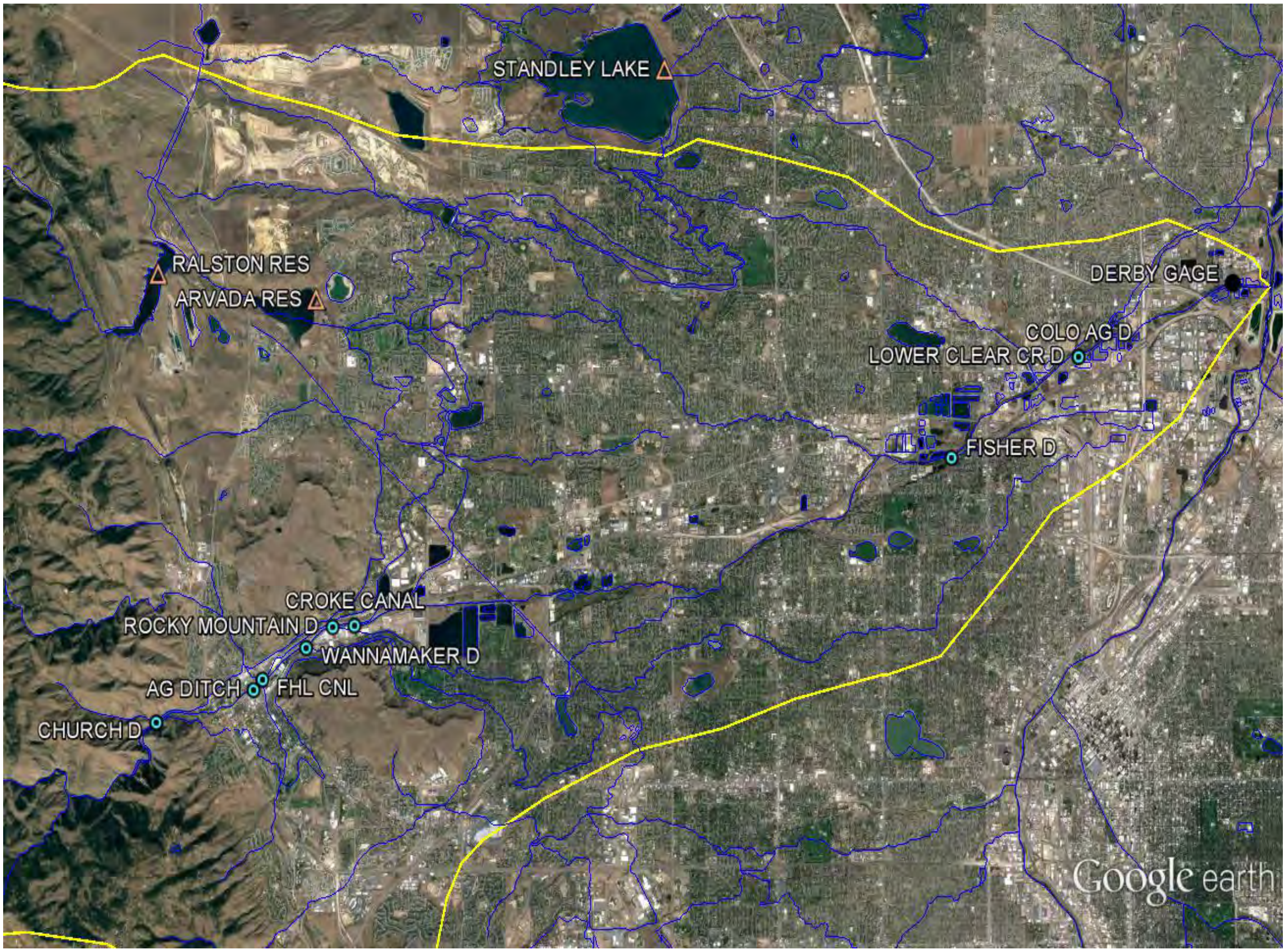


Figure 5-4: Clear Creek Basin Operations

5.10.8.6 City of Golden

There are six major municipal providers that rely in part, or in whole, on Clear Creek for its water supply –Golden, Arvada, Westminster, Thornton, Northglenn, and Consolidated Mutual Water Company, serving Lakewood. Golden is the uppermost of the six major municipal providers in the Clear Creek Basin (see Figure 5-5). The City of Golden is located on Clear Creek near the mouth of the canyon, below the Church Ditch (0700540) and above the Agricultural Ditch (0700502) and Farmers' Highline Canal (0700569). The Molson-Coors Brewery is located in Golden and the two entities have a certain amount of overlapping operations due to their proximity to one another. Both entities, and their respective water supplies, are located upstream from the Croke Canal (0700553), which fills Standley Lake (0203903). The locations of the Golden and Coors WWTPs discharging upstream of the Croke Canal was a contentious issue for many years until settled in the Cosmic Agreement, as discussed in Section 5.10.8.10.79. This affects the winter operations of the two entities.

Golden owns senior direct flow rights on Clear Creek along with irrigation ditch rights that have been changed in water court. Golden's major delivery canal is the Golden City Ditch (0700542), which diverts water from Clear Creek north of Lookout Mountain and then runs alongside the Church Ditch. In addition, Golden owns the majority of the transmountain water delivered via the Berthoud Pass diversion to the headwaters of West Fork Clear Creek. It is understood the Berthoud Pass water is delivered to a portion of outside use at City of Golden (believed to be on south side of town and considered to be part of 07_Golden_O demand)

In the early-2000s, the City of Golden integrated a number of gravel pits at the bottom of West Fork Clear Creek to construct Guanella Reservoir (0704030, 2325 ac-ft). Golden also owns some smaller, drought protection reservoirs in the West Fork Clear Creek Basin (Lower Urad Reservoir – 0703393, 250 ac-ft and Upper Urad Reservoir- 0703394, 332 ac-ft). These smaller reservoirs are not included in the SPDSS model.

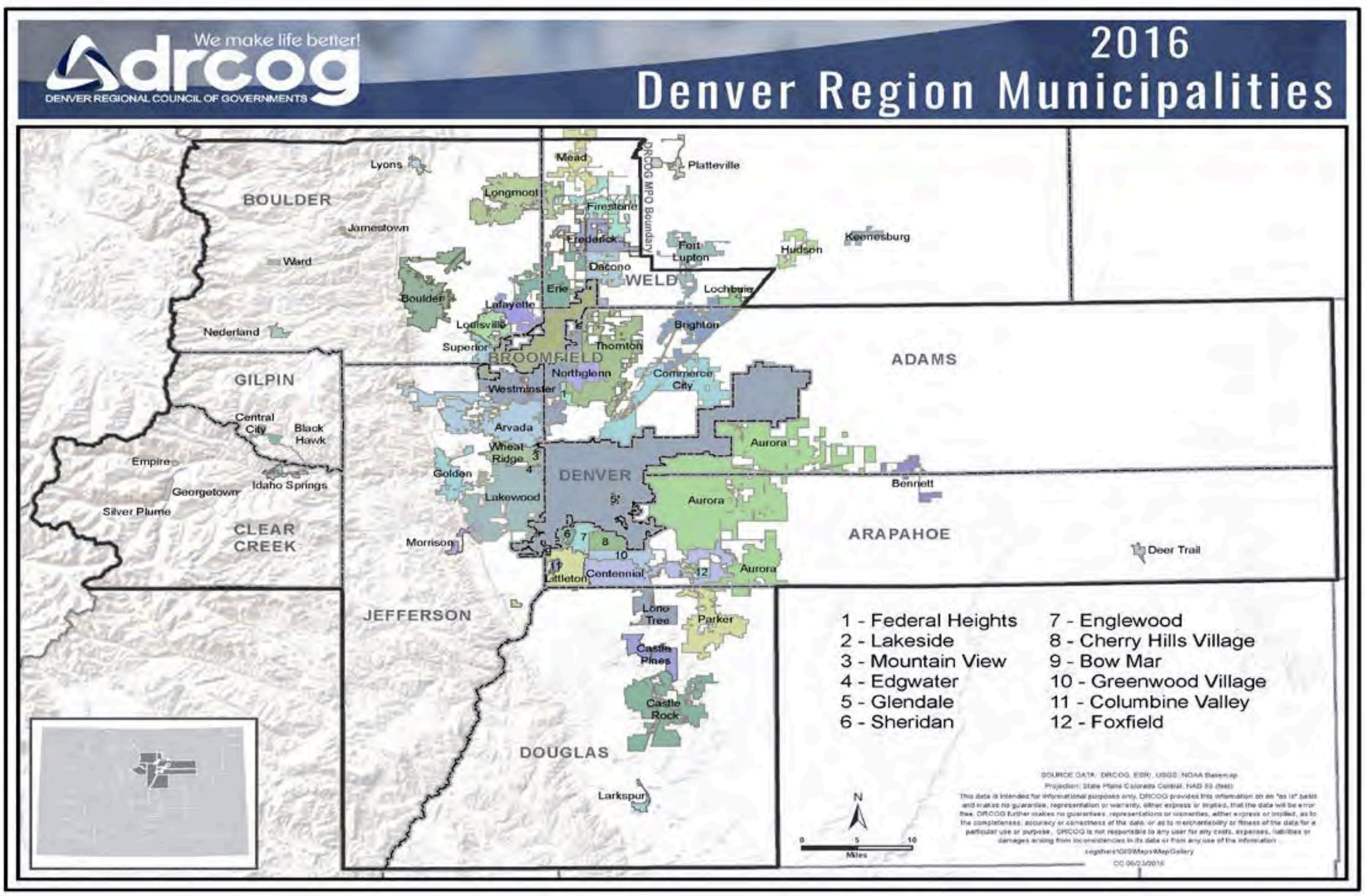


Figure 5-5: Denver Region Municipalities (Source: DRCOG)

5.10.8.6.1 Transmountain Supplies

Golden shares the yield of the Berthoud Pass diversion (0704625) with the City of Northglenn. Golden gets the first 2 cfs between May through July and the first 4 cfs starting in August thorough the end of season. Northglenn gets the remaining water from the Berthoud Pass diversion.

Until the SPDSS model and western slope models are integrated, the transmountain supplies are set equal to historical deliveries. These supplies are operated in the model as the primary supply, which results in the use of all the imports to meet the Golden demand or stored in Standley Lake. The following two rules are used to supply Berthoud Pass imports directly to the Golden inside demands.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Berthoud.01	1.00001	Golden Indoor Use (07_Golden_I)	GoldSpringBerthoudDivn (BerthGold1) GoldSummerBerthoudDivn (BerthGold2, R) Golden City Ditch (0700542)	Berthoud Tunnel Carrier (Berthoud_C)	27
Berthoud.03	1.00001	Golden Indoor Use (07_Golden_I)	GoldSummerBerthoudDivn (BerthGold2) Nglenn Berthoud Divn (BerthNglenn, R) Golden City Ditch (0700542)	Berthoud Tunnel Carrier (Berthoud_C)	27

The following two rules are used to supply Berthoud Pass imports direct to the Golden outside demands, although this supply is represented as junior to most of the City of Golden's other supplies.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Berthoud.02	1.00002	Golden Outdoor Use (07_Golden_O)	GoldSpringBerthoudDivn (BerthGold1) GoldSummerBerthoudDivn (BerthGold2, R) Golden City Ditch (0700542)	Berthoud Tunnel Carrier (Berthoud_C)	27
Berthoud.04	1.00002	Golden Outdoor Use (07_Golden_O)	GoldSummerBerthoudDivn (BerthGold2) Nglenn Berthoud Divn (BerthNglenn, R) Golden City Ditch (0700542)	Berthoud Tunnel Carrier (Berthoud_C)	27

The City of Golden purchased the Vidler Tunnel (0704626) in 2001. The following rule stores the Vidler Tunnel imports into Guanella Reservoir (0704030), corresponding with the City's typical operations:.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Vidler.01	48212.46546	Guanella Reservoir (0704030), Account 1		Vidler Tunnel Carrier (Vidler_C)	28

One cfs of the Henderson Mine water (0700715) is owned by Coors and Golden may take credit for this water in drought years via an IGA. This supply is not included in the SPDSS model since it is not characteristic of the City's standard operations.

5.10.8.6.2 In-basin Supplies

Golden's remaining municipal demand is satisfied primarily by river diversions through the Golden City Ditch. A number of senior rights (1860 to 1862 priority) were transferred to the Golden City Ditch (Ouelette – 0700632; Cort, Graves, Hughes - 0700551; Lee, Stewart & Eskins 0700601; and Swadley D and Enl. – 0700677). The Golden City Ditch also has a year-round 1879 priority that was originally adjudicated at the Golden Water Works (0700576).

The City of Golden also has changed water rights in the Lee Stewart & Eskins (LSE) Ditch. The City does not typically use the Priority 12 LSE water right (1861 priority) due to decretal limitations on its uses for changed purposes. It does use the 1863 to 1871 priority water rights in the ditch. The City also has prorata ownership (1.13%) in the Church Ditch (0700540) that was changed in Case No. 83CW361 but this water supply is not typically used.

Changed Water Rights

The senior direct flow rights are first stored in a changed water rights plan structure (GldnCtyDPln) using the following five rules, based on the standard approach used to represent changed water rights, as outlined in 4.9. The City of Golden is the sole owner of the water rights and the monthly limits on use of these rights are based on decretal terms and conditions.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
GldnCtyD.01	3804.00000	GldnCtyDPln	100%	0700542.01	26
GldnCtyD.02	4138.00000	GldnCtyDPln	100%	0700542.02	26
GldnCtyD.03	4152.00000	GldnCtyDPln	100%	0700542.04	26
GldnCtyD.04	4535.00000	GldnCtyDPln	100%	0700542.05	26
GldnCtyD.07	16718.10652	GldnCtyDPln	100%	0700542.06	26

Consolidated Mutual Water Company (Con Mutual) also owns a portion of the LSE water rights. Direct flow rights in the LSE Ditch are first stored in a changed water rights split plan structure (LSE_SplPln). The following two rules are used to put the 1863 and 1868 priority LSE water rights into the LSE_SplPln with monthly limits based on decretal terms and conditions. The last two rules are used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators, Golden, and Con Mutual). There are two rules to represent use of the water rights exclusively for irrigators and post-1991, when the changed rights starting to be used for other purposes. 1982 was chosen to represent this change since it is an approximate average of the first two LSE change cases - 91CW62 Consolidated Mutual; 94CW87 Golden.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LSE.04	4855.00000	LSE Split Plan (LSE_SplPln)	100%, 35,000 AF limit	0700601.02	26
LSE.05	6628.00000	LSE Split Plan (LSE_SplPln)	100%, 35,000 AF limit	0700601.03	26
LSE.09b	7773.00001	Con Mutual LSE Ditch Plan (ConM_LSEPln) Golden LSE Plan (Gold_LSEPln) LSE_Irrigation Plan (LSE_IrrPln)	38.1% 13.6% 48.3%	LSE Split Plan (LSE_SplPln)	46

The representation of the volumetrics is such that there would be no remaining volumetrics that would allow changed use of the 1869 and 1870 priority LSE water rights. Therefore, the yield for those two rights is stored in the LSE_IrrPln for use by the irrigators using the following two rules.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LSE.06	7030.00000	LSE_Irrigation Plan (LSE_IrrPln)	100%, 35,000 AF limit	0700601.04	26
LSE.07	7773.00000	LSE_Irrigation Plan (LSE_IrrPln)	100%, 35,000 AF limit	0700601.05	26

Golden is required to keep 15 percent of its changed water rights in the LSE Ditch. The following rule splits the Gold_LSEPln with 85 percent assigned to the GoldLSE2Pln and 15 percent to the LSE_IrrPln.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LSE.10	7773.00002	Golden LSE Plan after ditch loss (GoldLSE2Pln) LSE Irrigation Plan (LSE_IrrPln)	85% 15%	Golden LSE Plan (Gold_LSEPln)	46

The following five rules release water to Golden's demand from its changed rights in the Golden City Ditch (2) and LSE Ditch (3). The last rule below establishes limits on Golden's use of its changed LSE Ditch water based on the volumetric limits from Case No. 94CW87.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
GldnCtyD.05	4535.00001	Golden Indoor Use (07_Golden_I)	Golden City Ditch (0700542)	GldnCtyDPln	27
GldnCtyD.06	4535.00002	Golden Outdoor Use (07_Golden_O)	Golden City Ditch (0700542)	GldnCtyDPln	27
LSE.15a-b	7773.00004	Golden Indoor Use (07_Golden_I)	Golden City Ditch (0700542)	GoldLSE2Pln	28
LSE.16	7773.00005	Golden Outdoor Use (07_Golden_O)	Golden City Ditch (0700542)	GoldLSE2Pln	28
LSE.98	1.00000			LSEGol1_RL	47
LSE.99	1.00000			LSEGol2_RL	47

The following three rules release water to the LSE irrigation demand from its prorata water rights ownership (plan ID LSE_IrrPln) and unused credits in Golden's and Consolidated Mutual's plans. The last five rules release any remaining unused credits in various plans back to Clear Creek.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LSE.17	7773.00003	LSE Ditch Irrigators (0700601_I)	LSE Ditch (0700601)	LSE Irrigation Plan (LSE_IrrPln)	27
LSE.19	7773.00007	LSE Ditch Irrigators (0700601_I)	LSE Ditch (0700601)	Golden LSE Plan after ditch loss (GoldLSE2Pln)	27
LSE.20	7773.00007	LSE Ditch Irrigators (0700601_I)	LSE Ditch (0700601)	Con Mutual LSE Ditch Plan (ConM_LSEPln)	27
LSESpill.71	7773.00009	LSE Ditch (0700601)		LSE_SplPln	29
LSESpill.72	7773.00009	LSE Ditch (0700601)		LSE_IrrPln	29
LSESpill.73	7773.00009	LSE Ditch (0700601)		Gold_LSEPln	29
LSESpill.74	7773.00009	LSE Ditch (0700601)		GoldLSE2Pln	29
LSESpill.75	7773.00009	LSE Ditch (0700601)		GldPri12Pln	29

Return flows from Golden's winter use are considered Bypass Water and stored in West Gravel Lakes after a 2.75% transit loss. In order for the StateMod model to color winter diversions into the WWTP and then be shepherded down the creek to off-channel storage, subject to a transit loss, the winter diversions must be isolated from other water supplies. Therefore, a water right just senior to the Croke 1902 storage right was assigned to the Golden City Ditch. The following two rules are used to first store that water right into a changed water rights plan structure (CosmicPln1) and then release the water from the plan to meet the Golden demand.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.04	19054.99989	CosmcPln1	100%	0700542.07	26
Cosmic.06	19054.99991	Golden Inside Use (07_Golden_I)	Golden City Ditch (0700542)	CosmcPln1	27

The following rule then releases the winter effluent at plan ID Gold_WWTP down Clear Creek into the Lower Clear Creek Ditch (0700547) and into storage in the West Gravel Lakes (Acct 2). The stored water is then released during the non-Croke season, as discussed in Section 5.10.8.10.77.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.08	19054.99993	WGravelLks&Brannan (0203699), Account 2	Lower Clear Ck Ditch (0700547)	Golden WWTP (Gold_WWTP)	27

Storage Releases

The following two rules are used to release water from Guanella Reservoir to meet Golden's demand:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Guanella.01	48212.46547	Golden Indoor Use (07_Golden_I)	Golden City Ditch (0700542)	Guanella Reservoir (0704030), Account 1	3
Guanella.02	48212.46548	Golden Outdoor Use (07_Golden_O)	Golden City Ditch (0700542)	Guanella Reservoir (0704030), Account 1	3

The following two rules are used to release the contents of all the plan structures back to the river:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
GldnCtyD.71	4535.00009	Golden City Ditch (0700542)		GldnCtyDPln	29
CosmcSpl.71	19054.99999	Golden City Ditch (0700542)		CosmcPln1	29

5.10.8.7 Molson Coors aka Coors Brewery

Coors Brewery has been operating its malting and brewing facilities on Clear Creek for over 100 years. The brewery and its various water supplies and infrastructure are located amongst a number of the senior irrigation ditches and the Croke Canal. Coors was one of the first water users to adjudicate changes of use and augmentation plans on Clear Creek (Coors Aug I, II, and III). Coors also has the ability to use transmountain water from Straight Creek Tunnel.

The Coors Brewery has three primary water demands—brewing and malting ("A" water), commercial/municipal use within the Coors Industrial Complex ("B" water), and industrial cooling ("C" water). In general, the "A" water comes from underground springs distributed above and below the Croke Canal (07_CoorsA) and pipeline deliveries (07_CoorsB) from Coors's B Lakes (0703389). In the model, the B Lakes represent the portion of the Jefferson Storage system located on the north side of Clear Creek and are referred to as the "North Lakes" (0703389), while the A Lakes represent the portion of the Jefferson Storage System located on the south side of Clear Creek and are referred to as the "South Lakes" (0703010). The "B" water is used for general brewery needs within the Coors Industrial Complex and, prior to use, is stored in the A and B Lakes. The "C" water, diverted from Clear Creek via the Coors Industrial Ditch (0700725), is used to meet the cooling demand (07_CoorsC) and returned to Clear Creek less evaporative losses. For model simplification, the cooling demand (07_CoorsC) only represents the evaporative losses that result from the increased temperature of the water used for cooling purposes. Note, this approach is also used by Coors' water resources engineers in their operational modeling.

The operating rules used to represent Coors's operations are summarized below.

5.10.8.7.1 Coors A Water (07_CoorsA)

The Coors "A" Water demand is represented as a well structure associated with the various spring rights. Depletions associated with the spring diversions are assigned to the CoorsA_AugPln (0703390). The following two rules are used to shepherd reusable imports from Straight Creek Tunnel (0700903) and releases from the A Lakes :

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
CoorsA.01	46171.00001	Coors A Aug Plan (0703390)		StratCk_C	48
CoorsA.02	46171.00002	Coors A Aug Plan		0703010	48

		(0703390)			

5.10.8.7.2 Coors B Water (07_CoorsB)

Releases from the B Lakes are typically used to satisfy the Coors "B" water demand. Prior to the construction of the B Lakes in the early-1970s and adjudication of Coors Aug I, this demand was satisfied with the Golden Milling Company (0700578) water right. The following three rules are used to meet the B Water demand from the Coors B Lakes (2) and Milling Right (1):

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
CoorsB.01	43829.41262	Coors Potable Demand (07_CoorsB)		0703389	3
CoorsB.02	43829.41263	Coors Potable Demand (07_CoorsB)		0703010	3
CoorsB.03	5844.00000	Coors Potable Demand (07_CoorsB)		0700725.04	11

Return flows from Coors's winter use are considered Bypass Water and stored in West Gravel Lakes after a 2.75 percent transit loss. In order for StateMod to color winter diversions into the WWTP and then shepherd down the creek to off-channel storage, the winter diversions must be isolated from other water supplies. Therefore, a water right just senior to the Croke 1902 storage right was assigned to the Coors Industries Ditch. The following two rules are used to first store that water right into a changed water rights plan structure (CosmicPln2) and then release the water from the plan to meet the B Water demand:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.05	19054.99990	CosmcPln2	100%	0700725.03	26
Cosmic.07	19054.99992	Coors Malting Potable Demand (07_CoorsB)	Coors Ind Ditch (0700725)	CosmcPln2	27

The following rule then shepherd the winter effluent at plan ID 0702318 down Clear Creek into the Lower Clear Creek Ditch and into storage in the West Gravel Lakes (Acct 1). The stored water is then released during the non-Croke season, as discussed in Section 5.10.8.10.77.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.09	19054.99994	WGravelLks&Brannan (0203699), Account 1	Lower Clear Ck Ditch (0700547)	Coors WWTP (0702318)	27

Cosmic.97	1.00000			LCC Exchange Limit (Cosmic_RL3)	47

5.10.8.7.3 Coors C Water (07_CoorsC)

As noted above, the Coors "C" water demand represents the consumptive use of water associated with the cooling demand. This demand is met with the he following two rules:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
CoorsC.01	5844.00000	Coors Cooling Demand (07_CoorsC)		0700725.01	11
CoorsC.02	43829.41261	Coors Cooling Demand (07_CoorsC)		0700725.02	11

5.10.8.7.4 Changed Water Rights

Coors Brewery has senior direct flow rights in a number of ditches on Clear Creek, including the Church Ditch, Agricultural Ditch, Farmers High Line Canal, Wannamaker Ditch, Rocky Mountain Ditch, Reno Juchem Ditch, the Slough Ditches, and the South Side Ditch. The water rights were mostly changed in the Coors Aug Plan decrees (Case No. W-8036, 89CW234and 99CW236). The Coors Aug Plan operations are not explicitly represented in the SPDSS Model. However, representation of Coors' prorata ownership in many of these ditches is included in the model for either current or future use as a placeholder.

In the model, the consumptive use credits associated with some of Coors' changed water rights are used to maintain storage levels in the North (0703389) and South (0703010) Lakes to meet the respective demands from those structures. Therefore, the use of the changed water rights in the Farmers' Highline Canal, Wannamaker Ditch, and Rocky Mountain Ditch are summarized below.

The water rights for the Farmers' Highline Canal are first stored in a changed water rights plan structure (FHLSplPln) using the following eight rules based on the standard approach used to represent changed water rights, as outlined in Section 4.9. Note, monthly limits are imposed on individual owners when water is released from the sub-plan structure holding the individual's associated prorata ownership. The final rule is active starting in 1982 and is used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators, Arvada, Coors, Thornton, and Westminster). Coors' prorata ownership (3.9%) is stored in model ID CoorsFHLPln. The second-to-last rule is active through 1981, when the first significant change case was adjudicated (Coors I, W-8036). All of the yield is assigned to the irrigators prior to 1981.

CU credits associated with some of Coors' changed water rights, though, are used to maintain storage levels in the North Lakes and South Lakes to meet the respective demands from those structures. Therefore, the use of the changed water rights in the Farmers' Highline Canal, Wannamaker Ditch, and Rocky Mountain Ditch are summarized below.

The water rights for the Farmers' Highline Canal are first stored in a changed water rights plan structure (FHLSplPln) using the following rules based on the standard approach used to represent changed water rights, as outlined in Section 4.9. Monthly limits input on the storage of these rights is not limiting since there are multiple owners. The limits are imposed on the particular owners when water is released from the sub-plan structure holding that particular user's prorata ownership. The final rule is active starting in 1982 and is used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators, Arvada, Coors, Thornton, and Westminster). Coors' prorata ownership (3.9%) is stored in model ID CoorsFHLPln. The second-to-last rule is active through 1981, when the first significant change case was adjudicated (Coors I, W-8036). All of the yield is assigned to the irrigators prior to 1981.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
FHL.02	3789.00000	Farmers Highline Split Plan (FHL_SplPln)	100%, 45,000AF limit	0700569.02	26
FHL.03	3804.00000	Farmers Highline Split Plan (FHL_SplPln)	100%, 45,000AF limit	0700569.03	26
FHL.04	3835.00000	Farmers Highline Split Plan (FHL_SplPln)	100%, 45,000AF limit	0700569.04	26
FHL.05	4896.00000	Farmers Highline Split Plan (FHL_SplPln)	100%, 45,000AF limit	0700569.05	26
FHL.06	4919.00000	Farmers Highline Split Plan (FHL_SplPln)	100%, 45,000AF limit	0700569.06	26
FHL.07	5592.00000	Farmers Highline Split Plan (FHL_SplPln)	100%, 45,000AF limit	0700569.07	26
FHL.09	7449.00000	Farmers Highline Split Plan (FHL_SplPln)	100%, 45,000AF limit	0700569.09	26
FHL.10	8127.00000	Farmers Highline Split Plan (FHL_SplPln)	100%, 90,000AF limit	0700569.10	26
FHL.11a	8127.00001	Farmers Highline Irrigation Plan (FHL_IrrPln)	100%	Farmers Highline Split Plan (FHL_SplPln)	46
FHL.11b	8127.00001	Thornton FHL Plan (ThFHLPln) Westminster FHL Plan (WestyFHLPln) Arvada FHL Plan (ArvFHLPln) Coors FHL Plan (CoorsFHLPln) Farmers Highline Irrigation Plan (FHL_IrrPln)	16.6% 50.8% 10.9% 3.9% 17.8%	Farmers Highline Split Plan (FHL_SplPln)	46

The water rights for the Wannamaker Ditch are first stored in the WannSplPln using the following two rules. The final rule is active starting in 1975 and is used to split the Plan yield, prorata, to the sub-plans of Coors and the Wannamaker irrigators. Coors' prorata ownership (73.7%) is stored in model ID CoorsWanPln. Although the rights were first changed by in Coors Aug I, which was signed in 1981, the records of use for storage begin the in mid-1970s and coincide with the construction of the North Lakes (0703389). Therefore, a mid-1970 start date was chosen for use of the changed ditch shares. The second-to-last rule is active through 1974. All the yield is assigned to the irrigators prior to 1975.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Wann.01	3805.00000	Wannamaker Split Plan (WannSplPln)	100%, 35,000AF limit	0700698.01	26
Wann.02	6884.00000	Wannamaker Split Plan (WannSplPln)	100%, 35,000AF limit	0700698.02	26
Wann.03a	6884.00001	Wannamaker Irrigation Plan (WannIrrPln)	100%	Wannamaker Split Plan (WannSplPln)	46
Wann.03b	6884.00001	Coors Wannamaker Plan (CoorsWanPln) Wannamaker Irrigation Plan (WannIrrPln)	73.7% 26.3%	Wannamaker Split Plan (WannSplPln)	46

The following rules are included as changed ditch shares for Reno Juchem and Slough Ditches.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
RenoJuch.10	4152.00000	Coors Ren Juchem Plan (CoorsRJPln)	12.5%, 3.6 AF Limit	0700647.01	26
RenoJuch.11	4535.00000	Coors Ren Juchem Plan (CoorsRJPln)	8.9%, 29.2 AF Limit	0700647.02	26
RenoJuch.12	5592.00000	Coors Ren Juchem Plan (CoorsRJPln)	84.5%, 737.2 AF Limit	0700647.03	26
RenoJuch.13	5615.00000	Coors Ren Juchem Plan (CoorsRJPln)	6.1%, 54.6 AF Limit	0700647.04	26
RenoJuch.14	7449.00000	Coors Ren Juchem Plan (CoorsRJPln)	5.5%, 69.4 AF Limit	0700647.05	26
RenoJuch.15	10288.00000	Coors Ren Juchem Plan (CoorsRJPln)	3.2%, 211.8 AF Limit	0700647.06	26
RenoJuch.20	10288.00002	Reno Juchem Ditch (0700647)		Coors Ren Juchem Plan (CoorsRJPln)	27

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SloughD.01	3708.00000	Coors Slough Plan (CoorsSluPln)	32.47%, 265.5 AF limit	0700527_D.01	26
SloughD.02	3788.00000	Coors Slough Plan (CoorsSluPln)	44.51%, 263.5 AF limit	0700527_D.02	26
SloughD.03	4548.00000	Coors Slough Plan (CoorsSluPln)	46.18%	0700527_D.07	26
SloughD.04	4569.00000	Coors Slough Plan (CoorsSluPln)	8.98%	0700527_D.10	26
SloughD.05	4574.00000	Coors Slough Plan (CoorsSluPln)	12.00%	0700527_D.11	26
SloughD.06	4894.00000	Coors Slough Plan (CoorsSluPln)	10.14%	0700527_D.13	26
SloughD.07	4919.00000	Coors Slough Plan (CoorsSluPln)	21.6%	0700527_D.15	26
SloughD.08	5261.00000	Coors Slough Plan (CoorsSluPln)	10.24%	0700527_D.18	26
SloughD.09	5279.00000	Coors Slough Plan (CoorsSluPln)	6.57%	0700527_D.19	26
SloughD.10	5285.00000	Coors Slough Plan (CoorsSluPln)	36.86%	0700527_D.20	26
SloughD.11	5605.00000	Coors Slough Plan (CoorsSluPln)	6.76%	0700527_D.21	26
SloughD.12	5625.00000	Coors Slough Plan (CoorsSluPln)	49.58%	0700527_D.23	26
SloughD.13	5785.00000	Coors Slough Plan (CoorsSluPln)	32.30%	0700527_D.26	26
SloughD.14	8891.00000	Coors Slough Plan (CoorsSluPln)	10.99%	0700527_D.28	26
SloughD.15	8891.00005	Slough Ditches (0700527_D)		Coors Slough Plan (CoorsSluPln)	27

The water rights for the Rocky Mountain Ditch are first stored in the RM_SplPln using the following five rules. Monthly limits input on the storage of these rights is not limiting since there are multiple owners. The final rule is active starting in 1975 and is used to split the Plan yield, prorata, to the sub-plans of Coors and the Rocky Mountain Ditch irrigators. Coors' prorata ownership (71.4%) is stored in model ID CoorsRM_Pln. Although the rights were first changed by in Coors Aug I, which was signed in 1981, the records of use for storage begin the in mid-1970s and coincide with the construction of the North Lakes (0703389). Therefore, a mid-1970 start date was chosen for use of the changed ditch shares. The second-to-last rule is active through 1974. All the yield is assigned to the irrigators prior to 1975.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
RkyMtn.02	4504.00000	Rocky Mountain Split Plan (RM_SplPln)	100%, 45,000 AF Limit	0700652.02	26

RkyMtn.03	5265.00000	Rocky Mountain Split Plan (RM_SplPln)	100%, 45,000 AF Limit	0700652.03	26
RkyMtn.04	5569.00000	Rocky Mountain Split Plan (RM_SplPln)	100%, 45,000 AF Limit	0700652.04	26
RkyMtn.05	8475.00000	Rocky Mountain Split Plan (RM_SplPln)	100%, 45,000 AF Limit	0700652.05	26
RkyMtn.06	10302.00000	Rocky Mountain Split Plan (RM_SplPln)	100%, 45,000 AF Limit	0700652.06	26
RkyMtn.07a-b	10302.00001	Coors Rocky Mountain Plan (CoorsRM_Pln) Rocky Mountain Irrigation Plan (RM_IrrPln)	71.4% 28.6%	Rocky Mountain Split Plan (RM_SplPln)	46

The changed rights in the three ditch systems are included in the SPDSS model to store the associated CU credits. The following rules release water to the North Lakes (0703389) via the Wannamaker Ditch from Coors' changed rights in the Wannamaker Ditch (7) and Farmers' High Line Canal (9). The last two rules establish limits on the use of the changed ditch water based on decretal terms and conditions.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Wann.04a-g	43829.42308	Coors North Lakes (0703389), Account 1	Wannamaker Ditch (0700698) Wannamaker Aug Stn (0700698_A)	CoorsWanPln	27
FHL.22a-i	43829.43183	Coors North Lakes (0703389), Account 1	FARMERS HIGHLINE CNL (0700569) FHL Aug Stn (0700569_A) Wannamaker Ditch (0700698)	CoorsFHLPln	27
CoorsLk.01	43829.33370	Coors North Lakes (0703389, Acct 1)	Wannamaker Ditch (0700698)	0703389.01	45
Wann.99	1.00000			Coors Wann Release Limit (WannCoo_RL)	47
FHL.97	1.00000			Coors FHL Release Limit (FHL_Coo_RL)	47

The following rules release water to the South Lakes (0703010) from Coors' changed rights in the Rocky Mountain Ditch (5) and Wannamaker Ditch (6). The last two rules establish limits on the use of the changed ditch water based on decretal terms and conditions.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Wann.05a-g	43829.43182	Coors South Lakes (0703010), Account	Wannamaker Ditch (0700698)	CoorsWanPln	27

		1	Wannamaker Aug Stn (0700698_A)		
RkyMtn.08a-e	43829.43181	Coors South Lakes (0703010), Account 1	ROCKY MOUNTAIN DITCH (0700652) RMD Aug Stn (0700652_A)	CoorsRM_Pln	27
Wann.99	1.00000			Coors Wann Release Limit (WannCoo_RL)	47
RkyMtn.99	1.00000			Coors Rocky Mountain RL (CoorsRM_RL)	47

The first three following rules are used to release any unused ditch credits back to the ditch irrigators. The next six following rules are used to release the contents of all the Split Plan and Coors plan structures back to the river:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
FHL.26	43829.43184	FHL Irrigators (0700569_I)	Farmers Highline Canal (0700569)	Coors FHL Plan (CoorsFHLPln)	27
Wann.07	43829.43183	Wannamaker Ditch Irrigators (0700698_I)	Wannamaker Ditch (0700698)	Coors Wannamaker Plan (CoorsWanPln)	27
RkyMtn.10	43829.43182	Rocky Mountain Irrigators (0700652_I)	Rocky Mountain Ditch (0700652)	Coors Rocky Mountain Plan (CoorsRM_Pln)	27
FHLSpill.71	8127.00009	FHL Canal (0700569)		FHL_SplPln	29
FHLSpill.74	43829.43185	FHL Canal (0700569)		CoorsFHLPln	29
WannSpil.71	6884.00009	Wannamaker Ditch (0700698)		WannSplPln	29
WannSpil.72	43829.43189	Wannamaker Ditch (0700698)		CoorsWanPln	29
RkySpill.71	10302.00009	Rocky Mountain Ditch (0700652)		RM_SplPln	29
RkySpill.74	43829.43189	LSE Ditch (0700601)		CoorsRM_Pln	29

5.10.8.8 City of Arvada

The City of Arvada operates two water treatment plants that are coordinated with its variable supplies. Inside uses are provided by a contract with Denver Water, in which water from Ralston Reservoir is supplied via pipeline from Ralston Reservoir to Arvada's Ralston Reservoir treatment plant. The Denver Water contract supplies approximately 17,000 acre-feet per year. The contract water meets 100 percent of Arvada's inside use deliveries and supplements its outside uses. Arvada has changed water rights from Clear Creek and Ralston Creek that are stored and treated at Arvada Reservoir treatment plant.

All of Arvada’s wastewater returns at the Metro WWTP. The reusable portion of Arvada’s changed water rights is not represented in the model since the vast majority of indoor supply comes from contract deliveries. Similarly, any return flow obligations associated with Arvada’s use of changed ditch credits are not represented in the model since the winter replacements are provided by a lease with the City of Thornton and the reusable supplies from Arvada Reservoir in the summer is not significant.

The operating rules used in the SPDSS model for representing Arvada’s operations are summarized below.

Inside Use

The contract deliveries for Arvada’s use come from Denver Water Moffat Tunnel / Gross Reservoir / South Boulder Diversion Conduit / Ralston Reservoir system. The following two rules are used to supply water from the South Boulder Diversion Conduit and Ralston Reservoir (0703324) storage deliveries to meet Arvada’s inside use demand.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
06MOFPLN.01	1.00002	MoffatWTP	S BOULDER DIVR CONDUIT (0600590)	06_MOF_ACC	27
Ralston.01	1.00009	Arvada Inside Use (07_Arvada_I)		Ralston Res (0703324), Account 1	3

Outside Use

Arvada’s outside use is satisfied by changed water rights that are typically conveyed from Clear Creek down the Croke Canal (0700553). Deliveries from the Croke Canal are turned out to Ralston Creek downstream of a pipeline that conveys the water rights to storage in Arvada Reservoir (0703308). The yield of the changed water rights is supplemented by the Denver Water contract deliveries.

Changed Water Rights

A number of the City’s changed rights, particularly in the Reno Juchem Ditch (0700647) and Slough Ditches (0700527_D) were transferred to the Croke Canal and are diverted directed through the Croke Canal. The City’s other major changed ditch holdings are in the Farmers’ High Line Canal (0700569) and Church Ditch (0700540). Those rights are diverted through either the Croke Canal or, by exchange, to its pipeline on Ralston Creek (0700553_Arv). The City of Arvada’s changed rights and outside use demands are represented as discussed below.

No records of flows in Ralston Creek were identified and estimates of inflows were considered unsatisfactory. Due to concerns with physical inflows above the ditch, exchange operations on Ralston Creek were excluded from the SPDSS model.

The first nine rules listed below are used to store Arvada's changed water rights at the Croke Canal in the ArvRJPln. The tenth rule is used to release the plan water to Arvada's outside use demand. The following rule is used to release to the plan water to storage before the plan water is released in the last rule.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
RenoJuch.01	4138.00000	Arvada Reno Juchem Plan (ArvRJPln)	100%, 1001 AF Limit	0700553.01	26
RenoJuch.02	4535.00000	Arvada Reno Juchem Plan (ArvRJPln)	100%, 3.6 AF Limit	0700553.02	26
RenoJuch.03	4569.00000	Arvada Reno Juchem Plan (ArvRJPln)	100%, 121.8 AF Limit	0700553.03	26
RenoJuch.04	5235.00000	Arvada Reno Juchem Plan (ArvRJPln)	100%, 114.6 AF Limit	0700553.04	26
RenoJuch.05	5285.00000	Arvada Reno Juchem Plan (ArvRJPln)	100%, 225 AF Limit	0700553.05	26
RenoJuch.06	5592.00000	Arvada Reno Juchem Plan (ArvRJPln)	100%, 6.7 AF Limit	0700553.06	26
RenoJuch.07	5615.00000	Arvada Reno Juchem Plan (ArvRJPln)	100%, 15.3 AF Limit	0700553.07	26
RenoJuch.08	5665.00000	Arvada Reno Juchem Plan (ArvRJPln)	100%, 132.6 AF Limit	0700553.08	26
RenoJuch.09	7449.00000	Arvada Reno Juchem Plan (ArvRJPln)	100%, 35.7 AF Limit	0700553.09	26
RenoJuch.16	7449.00002	Arvada Outside Use (07_Arvada_O)	Croke Canal (0700553)	ArvRJPln	27
RenoJuch.17	7449.00003	Arvada Reservoir (0703308), Account 2	Croke Canal (0700553)	ArvRJPln	27
RJSpill.74	7449.00009	Croke Canal (0700553)		ArvRJPln	29

As outlined in Section 5.10.8.7 (Molson Coors), the changed water rights in the Farmers' High Line Canal are stored in the plan ID FHL_SplPln and then distributed to the various owners of the water rights. Arvada's prorata ownership (10.9%) from the Farmers' Highline Canal is stored in the ArvFHLPln. The first rule establishes limits on the use of the changed ditch water based on decretal terms and conditions (Case Nos. W-8083, W-8762, 82CW359, 85CW409, 85CW410, 88CW105, and 96CW148). Rules FHL.15a-i are used to deliver Arvada's changed water rights to meet the outside use demands. Rules FHL.16a-i are used to store excess plan contents in Arvada Reservoir. The next rule is used to release unused credits back to the ditch prior to plan contents being released back to Clear Creek. The groups of rules for each destination are used to distinguish the monthly CU factors for March through November.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
FHL.15a-i	8127.00003	Arvada Outside Use (07_Arvada_O)	FARMERS HIGHLINE CNL (0700569) FHL CNL Aug Stn (0700569_A)	ArvFHLPln	27
FHL.16a-i	54055.00001	Arvada Reservoir (0703308), Account 2	FARMERS HIGHLINE CNL (0700569) FHL CNL Aug Stn (0700569_A)	ArvFHLPln	27
FHL.25	54055.00002	FHL Irrigators (0700569_I)	Farmers Highline Canal (0700569)	Arvada FHL Plan (ArvFHLPln)	27
FHLSpill.73	54055.00009	FHL Canal (0700569)		ArvFHLPln	29

As outlined in Section 5.10.8.11 (City of Westminister), the changed water rights in the Church Ditch are stored in the plan ID s ChrchSplPl1 and ChrchSplPln and then distributed to the various owners of the water rights. Arvada's prorata ownership (5.8%) from the Church Ditch is stored in the ArvChPln. The first rule establishes limits on the use of the changed ditch water based on decretal terms and conditions (Case Nos. W-8083, W-8762, 82CW359, 85CW409, 85CW410, 88CW105, and 96CW148). The next seven rules listed below are used to deliver Arvada's changed water rights to meet the outside use demands. The next seven rules are used to store excess plan contents in Arvada Reservoir. The next rule is used to release unused credits back to the ditch prior to plan contents being released back to Clear Creek. The groups of seven rules for each destination are used to distinguish the monthly CU factors for April through October.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Church.11a-g	10546.00002	Arvada Outside Use (07_Arvada_O)	CHURCH DITCH (0700540) CHURCH DITCH Aug Stn (0700540_A)	ArvChPln	27
Church.12a-g	54055.00002	Arvada Reservoir (0703308), Account 2	CHURCH DITCH (0700540) CHURCH DITCH Aug Stn (0700540_A)	ArvChPln	27
Church.27	54055.00003	Church Ditch Irrigators (0700540_I)	Church Ditch (0700540)	Arvada Church Plan (ArvChPln)	27
ChSpill.74	54055.00009	Church Ditch (0700540)		ArvChPln	29

Storage Use

In addition to releases from Denver Water's Ralston Reservoir, Arvada has use of its own Arvada Reservoir. Arvada Reservoir is filled with excess changed ditch credits, as noted above. The two Arvada Reservoir storage rights are carried from Ralston Creek using the following two rules. The subsequent two rules release from Arvada Reservoir and Ralston Reservoir to meet Arvada outside demand. The last rule releases excess water from the South Boulder Diversion Conduit to storage in Arvada Reservoir and ultimately to Arvada's outside demand.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
ArvRes.01	44925.40107	Arvada Reservoir (0703308), Accounts 1-2	ArvadaReleaseFromCroke (0700553_Arv)	0703308.01	45
ArvRes.02	54055.00000	Arvada Reservoir (0703308), Accounts 1-2	ArvadaReleaseFromCroke (0700553_Arv)	0703308.02	45
ArvRes.03	54055.00003	Arvada Outside Use (07_Arvada_O)		Arvada Reservoir (0703308), Account 2	3
Ralston.02	54055.00009	Arvada Outside Use (07_Arvada_O)		Ralston Res (0703324), Account 1	3
06MOFPLN.06	54055.00001	Arvada Reservoir (0703308), Accounts 1-2	S BOULDER DIVR CONDUIT (0600590) ArvadaReleaseFromCroke (0700553_Arv)	06_MOF_ACC	27

5.10.8.9 Consolidated Mutual Water Company

Consolidated Mutual's (Con Mutual) operations are focused on Maple Grove Reservoir, located on Lena Gulch tributary to Clear Creek. Maple Grove Reservoir is interconnected with Con Mutual's Fairmont Reservoir and Welton Reservoir, with all three filled by the Agricultural Ditch (Ag Ditch). Con Mutual has acquired and changed the uses of shares in the Ag Ditch, Welch Ditch, and Lee Stewart Eskins Ditch to support its municipal demands.

All of Con Mutual's wastewater returns at the Metro WWTP. Con Mutual's changed water rights in the Welch Ditch and Agricultural Ditch are reusable and WWTP return flows from their use is accounted for in plan ID MetroConM. Representation of the use of changed water rights is consistent with standard approach outlined in Section 4.9. Most uses of the changed water rights generate return flow obligations, as discussed in Section 4.9. Return flow obligations that are out of priority are met with reusable supplies at the Metro WWTP.

The operating rules used in the SPDSS model for representing Con Mutual's operations are summarized below.

Changed Water Rights

The water rights for the Ag Ditch are first stored in a changed water rights plan structure (AgSplPln) using the following 11 rules. The final two rules are used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators, Con Mutual, and Coors). The last rule splits the yield to the three users and is active starting in 1981 when the first significant change case was adjudicated (Coors I, W-8036). All of the yield is assigned to the irrigators prior to 1981 using the second-to-last rule.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
AgDitch.01	3788.00000	Agricultural Ditch Split Plan (AgSplPln)	100%, 35,000AF limit	0700502.01	26
AgDitch.02	3792.00000	Agricultural Ditch Split Plan (AgSplPln)	100%, 35,000AF limit	0700502.02	26
AgDitch.03	3804.00000	Agricultural Ditch Split Plan (AgSplPln)	100%, 35,000AF limit	0700502.03	26
AgDitch.04	3818.00000	Agricultural Ditch Split Plan (AgSplPln)	100%, 35,000AF limit	0700502.04	26
AgDitch.05	4152.00000	Agricultural Ditch Split Plan (AgSplPln)	100%, 35,000AF limit	0700502.05	26
AgDitch.06	4171.00000	Agricultural Ditch Split Plan (AgSplPln)	100%, 35,000AF limit	0700502.06	26
AgDitch.07	4180.00000	Agricultural Ditch Split Plan (AgSplPln)	100%, 35,000AF limit	0700502.07	26
AgDitch.08	4535.00000	Agricultural Ditch Split Plan (AgSplPln)	100%, 35,000AF limit	0700502.08	26
AgDitch.09	5615.00000	Agricultural Ditch Split Plan (AgSplPln)	100%, 35,000AF limit	0700502.09	26
AgDitch.10	9121.00000	Agricultural Ditch Split Plan (AgSplPln)	100%, 49,000AF limit	0700502.10	26
AgDitch.11	12136.00000	Agricultural Ditch Irrigation Plan (AgIrrPln)	100%, 45,000AF limit	0700502.11	26
AgDitch.12a	9121.00001	Agricultural Ditch Irrigation Plan (AgIrrPln)	100%	Agricultural Ditch Split Plan (AgSplPln)	46
AgDitch.12b	9121.00001	Con Mutual Ag Ditch Plan (ConM_Ag_Pln) Coors Ditch Ag Plan (CoorsAgPln) Agricultural Ditch Irrigation Plan (AgIrrPln)	37.1% 15.7% 47.2%	Agricultural Ditch Split Plan (AgSplPln)	46

Con Mutual's prorata share (37.1%) is stored in plan ID ConM_Ag_Pln. The first rule below establishes the volumetric limits based on decretal terms and conditions (Case No. 94CW1297). Con Mutual's recent decree in Case No. 09CW107 is not included in the SPDSS model since it was adjudicated after the end of the model study period. The subsequent set of seven rules are used to release water from the plan to Con Mutual's indoor demand. The next set of seven rules are used to release water from the plan to Con Mutual's outdoor demand. The sets of seven rules for each destination are used to distinguish the monthly CU factors for April through October.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
AgDitch.98	1.00000			ConM Ag Ditch RL (Ag_ConM_RL)	47
AgDitch.15a-g	12136.00002	Con Mutual Inside Use (07_ConMut_I)	AGRICULTURAL DITCH (0700502) Ag Ditch Aug Stn (0700502_A)	ConM_Ag_Pln	27
AgDitch.16a-g	12136.00003	Con Mutual Outside Use (07_ConMut_O)	AGRICULTURAL DITCH (0700502) Ag Ditch Aug Stn (0700502_A)	ConM_Ag_Pln	27
AgDitch.17a-g	12136.00004	ConMutualAgg Reservoir (ConMutualAGG), Account 1	AGRICULTURAL DITCH (0700502) Ag Ditch Aug Stn (0700502_A)	ConM_Ag_Pln	27

The next rule is used to release the irrigators' prorata ownership in the ditch to their demands. The following two rules are used to release Con Mutual's and Coors' unused credits back to the irrigators prior to plan contents being released back to Clear Creek. The last four rules are used to release contents from the split plan and various users' plans.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
AgDitch.18	12136.00002	Agricultural Ditch irrigators (0700502_I)	Agricultural Ditch (0700502)	Agricultural Ditch Irrigation Plan (AgIrrPln)	27
AgDitch.19	12136.00007	Agricultural Ditch irrigators (0700502_I)	Agricultural Ditch (0700502)	Con Mutual Ag Ditch Plan (ConM_Ag_Pln)	27
AgDitch.20	12136.00003	Agricultural Ditch irrigators (0700502_I)	Agricultural Ditch (0700502)	Coors Ditch Ag Plan (CoorsAgPln)	27
AgSpill.71	9121.00009	Agricultural Ditch (0700502)		AgSplPln	29

AgSpill.72	12136.00009	Agricultural Ditch (0700502)		AgIrrPln	29
AgSpill.73	12136.00009	Agricultural Ditch (0700502)		ConM_Ag_Pln	29
AgSpill.74	12136.00009	Agricultural Ditch (0700502)		CoorsAgPln	29

The water rights for the Welch Ditch are first stored in a changed water rights plan structure (WelchPln) using the following three rules. The final two rules are used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators and Con Mutual). The last rule splits the yield to the two users and is active starting in 1995 corresponding with the adjudication of the first of Con Mutual's four change cases (Case Nos. 94CW197, 01CW56, 02CW226, and 09CW197). All of the yield is assigned to the irrigators prior to 1995 using the second-to-last rule.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Welch.01	3792.00000	Welch Split Plan (WelchPln)	100%, 35,000AF limit	0700699.01	26
Welch.02	4151.00000	Welch Split Plan (WelchPln)	100%, 35,000AF limit	0700699.02	26
Welch.03	7712.00000	Welch Split Plan (WelchPln)	100%, 35,000AF limit	0700699.03	26
Welch.04a	7712.00001	Welch Ditch Irrigation Plan (WelchIrrPln, 100%)	100%	Welch Split Plan (WelchPln)	46
Welch.04b	7712.00001	Welch Ditch Con Mutual Plan (WelcConMPln) Welch Ditch Irrigation Plan (WelchIrrPln)	47.6% 52.4%	Welch Split Plan (WelchPln)	46

Con Mutual's prorata share (47.6%) is stored in plan ID WelcConMPln. The first rule establishes the volumetric limits on Con Mutual's use of its Welch Ditch water limits based on decretal terms and conditions. The following set of six rules are used to release water from the plan to Con Mutual's indoor demand. The subsequent set of six rules are used to release water from the plan to Con Mutual's outdoor demand. The sets of six rules for each destination are used to distinguish the monthly CU factors for May through October.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Welch.99	1.00000			Welch Release Limit - Welch_RL	47
Welch.05a-f	7712.00002	Con Mutual Inside Use (07_ConMut_I)	Welch Ditch (0700699) Welch Aug Stn (0700699_A) Agricultural Ditch (0700502)	Con Mutual Welch D RFs (ConM_WelRFs)	27
Welch.06a-f	7712.00003	Con Mutual Outside Use (07_ConMut_O)	Welch Ditch (0700699) Welch Aug Stn	Con Mutual Welch D RFs	27

			(0700699_A) Agricultural Ditch (0700502)	(ConM_WelRFs)	
Welch.07a-f	7712.00004	ConMutualAgg Reservoir (ConMutualAGG), Account 1	Welch Ditch (0700699) Welch Aug Stn (0700699_A) Agricultural Ditch (0700502)	Con Mutual Welch D RFs (ConM_WelRFs)	27

The next rule is used to release the irrigators' prorata ownership in the ditch from its Plan ID WelchIrrPln to their demands. The subsequent two rules are used to release Con Mutual's unused credits back to the irrigators under the Welch Ditch and the Ag Ditch, respectively, prior to the plan contents being released back to Clear Creek. The last three rules are used to release contents from the split plan and the various users' plans.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Welch.08	7712.00002	Welch Ditch (0700699)	Welch Ditch (0700699)	Welch Ditch Irrigation Plan (WelchIrrPln)	27
Welch.09	7712.00008	Welch Ditch (0700699)	Welch Ditch (0700699)	Welch Ditch Con Mutual Plan (WelcConMPln)	27
Welch.10	12136.00003	Agricultural Ditch irrigators (0700502_I)	Welch Ditch (0700699) Agricultural Ditch (0700502)	Welch Ditch Irrigation Plan (WelchIrrPln)	27
WelchSpi.71	7712.00009	Welch Ditch (0700699)		WelchPln	29
WelchSpi.72	7712.00009	Welch Ditch (0700699)		WelcConMPln	29
WelchSpi.73	7712.00009	Welch Ditch (0700699)		WelchIrrPln	29

As outlined in Section 5.10.8.6 (City of Golden), the changed water rights in the Lee Stewart are stored in the plan ID LSE_SplPln and then distributed to the various owners of the water rights. Con Mutual's prorata ownership from the LSE is stored in the ConM_LSEPln. The Priority 12 senior right is also stored in the ConM_LSEPln and not assigned to Golden (since they City does not typically use that particular water right). Con Mutual also has a junior 1988 priority in the LSE. This water is stored in plan ID ConM_LS2Pln to distinguish Con Mutual as the sole owner of this water. Releases with the 1988 water are not currently modeled and the only active rule in the model with the 1988 water is a plan release.

The first rule below establishes the volumetric limits on Con Mutual's use of the senior LSE water based on decretal terms and conditions (Case No. 91CW62). The following two rules listed below are used to deliver the Priority 12 and 1988 water rights into the two Con Mutual plans. Arvada's changed water rights to meet the outside use demands. The next three rules are used to deliver ConM_LSEPln water to Con Mutual's demands (2) and into storage (1).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LSE.97	1.00000			ConM LSE RL (LSEConM_RL)	47
LSE.01a	4151.00000	Con Mutual LSE Ditch Plan (ConM_LSEPln)	100%, 35,000 AF limit	0700601.01	26
LSE.08	50711.00000	Con Mutual LSE 1988 Plan (ConM_LS2Pln)	100%, 6,240 AF limit	0700601.06	26
LSE.11	7773.00004	Con Mutual Inside Use (07_ConMut_I)	Lee Stewart Eskins Ditch (0700601)	ConM_LSEPln	27
LSE.12	7773.00005	Con Mutual Outside Use (07_ConMut_O)	Lee Stewart Eskins Ditch (0700601)	ConM_LSEPln	27
LSE.13	7773.00006	ConMutualAgg Reservoir (ConMutualAGG), Account 1	Lee Stewart Eskins Ditch (0700601)	ConM_LSEPln	27

The next rule is used to release unused credits back to the ditch prior to plan contents being released back to Clear Creek, using the last rule.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LSE.20	7773.00007	LSE Ditch Irrigators (0700601_I)	LSE Ditch (0700601)	Con Mutual LSE Ditch Plan (ConM_LSEPln)	27
LSESpill.76	7773.00009	LSE Ditch (0700601)		ConM_LSEPln	29

Use of the Ag Ditch and Welch Ditch credits generates return flow obligations accounted for in Plan IDs ConM_AgRFs and ConM_WelRFs. Return flow obligations are not created through the use of LSE Ditch credits. WWTP return flows from the Ag Ditch and Welch Ditch are reusable whereas those from the LSE Ditch are not reusable. The following four rules are used to meet the return flow obligations, either in priority via the Type 43 rules (2) or with reusable effluent via the following two rules. The last rule is used to release unused reusable effluent back to the river.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
ConMutRF.01	52826.00000	ConM_AgRFs			43
ConMutRF.02	52826.00000	ConM_WelRFs			43

ConMutRF.03	53508.00003	Con Mutual Ag D RFs (ConM_AgRFs)		Con Mutual Metro Reuse Plan (MetroConM)	49
ConMutRF.04	53508.00004	Con Mutual Welch D RFs (ConM_WelRFs)		Con Mutual Metro Reuse Plan (MetroConM)	49
MetSpill.77	90000.00000	Metro WWTP (Metro_WWTP)		MetroConM	29

Storage Use

Con Mutual operates three reservoirs – Maple Grove Reservoir (0704411), Fairmont Reservoir (0703702), and Welton Reservoir (0203083). Maple Grove Reservoir is located on Lena Gulch and can be filled primarily from the Ag Ditch using CU credits from the Ag Ditch and Welch Ditch water rights. The reservoirs are interconnected and represented as an aggregate reservoir on Lena Gulch (ID ConMutualAGG).

The reservoir storage rights are carried to storage from Clear Creek via the Ag Ditch using the following seven rules. The last two rules release storage water to Con Mutual's demand.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
CMAggRes.01	16718.04932	Con Mutual Agg Reservoir (ConMutualAGG, Acct 1)	Agricultural Ditch (0700502)	ConMutR.01	45
CMAggRes.02	16718.14107	Con Mutual Agg Reservoir (ConMutualAGG, Acct 1)	Agricultural Ditch (0700502)	ConMutR.02	45
CMAggRes.03	43829.37963	Con Mutual Agg Reservoir (ConMutualAGG, Acct 1)	Agricultural Ditch (0700502)	ConMutR.03	45
CMAggRes.04	43829.38280	Con Mutual Agg Reservoir (ConMutualAGG, Acct 1)	Agricultural Ditch (0700502)	ConMutR.04	45
CMAggRes.05	49308.47135	Con Mutual Agg Reservoir (ConMutualAGG, Acct 1)	Agricultural Ditch (0700502)	ConMutR.05	45
CMAggRes.06	51969.00000	Con Mutual Agg Reservoir (ConMutualAGG, Acct 1)	Agricultural Ditch (0700502)	ConMutR.06	45
CMAggRes.07	53508.00000	Con Mutual Agg Reservoir (ConMutualAGG, Acct 1)	Agricultural Ditch (0700502)	ConMutR.07	45
CMAggRes.08	53508.00001	Con Mutual Inside Use (07_ConMut_I)		ConMutualAgg Reservoir (ConMutualAGG)	3

				, Account 1	
CMAggRes.09	53508.00002	Con Mutual Outside Use (07_ConMut_O)		ConMutualAgg Reservoir (ConMutualAGG) , Account 1	3

5.10.8.10 Standley Lake – FRICO, Northglenn, Westminister, and Thonton

The FRICO-Standley Lake Division diverts, stores, and delivers water to both irrigation users and municipalities in the area north of Denver and west of the South Platte River. Operation of Standley Lake in the Clear Creek Basin is a complex system that has changed over time as ditch and reservoir shares have been changed to municipal and other uses. The Standley Lake Division essentially diverted water to storage for both direct and supplemental irrigation water use in the Big Dry Creek Basin prior to the early-1970s. The FRICO-Standley Lake Division currently supplies both irrigators (approximately one-third of system yield) and water to three municipal water providers (Cities of Westminster, Northglenn, and Thornton- the Standley Lake Cities). Through multiple irrigation ditch change of use cases, the municipalities are also able to store CU credits from their ownership of a number of Clear Creek ditch companies. In an effort to simplify the representation of changed water rights in the Standley Lake system, the uses of the changed rights are set to start in 1979 in the SPDSS model historical dataset.

As municipal use of the system increased over the last 40-plus years, a number of agreements have been reached between FRICO, the Standley Lake Cities, and other Clear Creek water users that determine operations of the reservoir. The general current operating procedures of the reservoir and associated ditch systems are discussed below along with information related to how the Standley Lake system is integrated with the municipal water supplies of the Standley Lake Cities.

Northglenn, Westminster, and FRICO get all of their water from Standley Lake. Thornton uses Standley Lake for supply during the winter, only. All of the water in Standley Lake owned by the municipalities is fully reusable. The operating rules used in the SPDSS model for representing Standley Lake operations are summarized below.

5.10.8.10.1 Croke 1902

The Croke 1902 is the primary storage water right for Standley Lake with a 1902 priority that was originally delivered down the Croke Canal. The yield of the water right is distributed between FRICO and the three Standley Lake Cities. Therefore, the water right is first stored in the StanLimPln using the following rule. The last rule is used to split the Plan yield, prorata, to the sub-plans of the various owners of the reservoir shares (irrigators, Northglenn, Thornton, and Westminster). Note the distribution of storage space in the reservoir is based on information provided by FRICO and included in the SPDSS Task 5 FRICO-Standley Lake Cities memorandum.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.99	1.00000			Release Limit (Standley_RL)	47
Stan.30	19055.00000	StanLimPln	100%	0700553.10	26
Stan.31	19055.00001	StanPlnW StanPlnT StanPlnN StanPlnF	40.26% 14.71% 28.45% 16.58%	StanLimPln	46

The Croke 1902 Water from the four sub-plans (StanPlnW, StanPlnN, StanPlnF, and StanPlnT) is stored in the users' accounts in Standley Lake 0203903 Accts 1, 2, 3, and 4, respectively). Note all Croke 1902 water is first stored and separately released to the demands (i.e., Croke water is not sent directly to demands). If a particular user's account if full of water, any water remaining in the Croke 1902 sub-Plans can be stored in others' storage space pursuant to the 4 Way Agreement. Any remaining water in the plans must then be released.

The following four rules are used to move the 1902 Croke water into the users' accounts. The last six rules release the plan contents back to the Clear Creek.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.32	19055.00001	Standley Lake (0203903), Account 1	Croke Canal (0700553)	StanPlnW	27
Stan.33	19055.00001	Standley Lake (0203903), Account 2	Croke Canal (0700553)	StanPlnN	27
Stan.34	19055.00001	Standley Lake (0203903), Account 3	Croke Canal (0700553)	StanPlnF	27
Stan.35	19055.00001	Standley Lake (0203903), Account 4	Croke Canal (0700553)	StanPlnT	27
Stan.49	19055.00009	Croke Canal (0700553)		StanLimPln	29
Stan.50	19055.00009	Croke Canal (0700553)		Stan1902Pln	29
Stan.51	19055.00009	Croke Canal (0700553)		StanPlnT	29
Stan.52	50403.00019	Croke Canal (0700553)		StanPlnN	29
Stan.53	50403.00019	Croke Canal (0700553)		StanPlnF	29
Stan.54	50403.00019	Croke Canal (0700553)		StanPlnW	29

5.10.8.10.2 Four-Way Agreement

The Four-Way Agreement, dated June 27, 1979, is an agreement between FRICO, Westminster, Thornton, and Northglenn that describes the operations and maintenance of the FRICO storage space within Standley Lake Reservoir. The fraction of the FRICO storage space allocated to each party is determined by dividing the number of shares held by each party by the total number of FRICO shares. The agreement also describes the process of storage space sharing between parties. If one entity stores in excess of its own storage entitlement and another entity has storage space, then a paper exchange is used to "bookover" water from the account that is in excess to the account that can legally fill. If the reservoir fills and spills, the booked over water is subject to getting bumped out.

The following scenario illustrates the operations within Standley Lake. Following the example is a list of the operating rules included in the SPDSS model to represent the system.

For instance, suppose Westminster has 15,000 acre-feet of FRICO water in its storage account (21,985 acre-foot capacity) at the beginning of the time step. After meeting their respective demands in the current time step, Northglenn and Westminster have 5,000 acre-feet of water stored in various plans (FRICO water, Church water, etc.). Northglenn stores its water via oprID Stan.31 (see previous table), which fills the account to 20,000 acre-feet capacity. This water is colored as reusable as part of the operating rule by assigning the 5,000 acre-feet (along with the initial 15,000 acre-feet) to the StanReuseW reservoir reuse plan.

Northglenn tries to store its water via the 4 Way Agreement oprID Stan.37. Only 1,985 acre-feet of Northglenn's water can be stored since the Westminster account is now full. Northglenn's 4 Way water in Westminster's account if colored as reusable in the StanNglPln1 reservoir reuse plan. Note the remainder of Northglenn's water in this example (3,015 acre-feet) is unused and must be released back to Clear Creek via oprID Stan.52. The two reservoir reuse plans allow multiple owners of water to be represented in the same storage account.

At the beginning of the next time step, Northglenn's demand is met first with its water in Westminster's account since that water is subject to be booked out once Westminster tries to store water in its own account. Whether or not the shared water is used, the model must "know" that even though the Westminster account is full there is 1,985 acre-feet of space available to Westminster. A "phantom" reservoir (ID PhantomStand) is used in the SPDSS model to allow the shared water to be booked out of Standley Lake at the beginning of the time step and then, if the booked out water is not used and there is still space available in other accounts, the booked out water is booked back into Standley Lake.

The general order of rules in the SPDSS model to represent operations of the Standley Lake storage accounts and the 4 Way Agreement is as follows. Note all of these rules start operations in 1979, coincident with execution of the 4 Way Agreement.

The first eight rules store excess water from the Croke 1902 right into other users' account.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.36	19055.00002	Standley Lake (0203903), Account 1	Croke Canal (0700553)	StanPlnN	27
Stan.37	50325.00012	Standley Lake (0203903), Account 1	Croke Canal (0700553)	StanPlnN	27
Stan.38	50325.00012	Standley Lake (0203903), Account 1	Croke Canal (0700553)	StanPlnF	27
Stan.39	19055.00002	Standley Lake (0203903), Account 4	Croke Canal (0700553)	StanPlnW	27
Stan.40	50403.00013	Standley Lake (0203903), Account 4	Croke Canal (0700553)	StanPlnW	27
Stan.41	19055.00002	Standley Lake (0203903), Account 4	Croke Canal (0700553)	StanPlnN	27
Stan.42	50403.00015	Standley Lake (0203903), Account 4	Croke Canal (0700553)	StanPlnN	27
Stan.43	50403.00015	Standley Lake (0203903), Account 4	Croke Canal (0700553)	StanPlnF	27

The following rules book water stored in others' account out of Standley and into PhantomStand to make room for the others' water (occurs at beginning of time step).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.01	1.00000	PhantomStand, Account 1		Standley Lake (0203903), Account 1	32
Stan.02	1.00000	PhantomStand, Account 2		Standley Lake (0203903), Account 1	32
Stan.03	1.00000	PhantomStand, Account 3		Standley Lake (0203903), Account 4	32
Stan.04	1.00000	PhantomStand, Account 4		Standley Lake (0203903), Account 4	32
Stan.05	1.00000	PhantomStand, Account 5		Standley Lake (0203903), Account 4	32

The next 14 rules are used to release the water stored under the 4 Way Agreement (now stored in PhantomStand) to meet demands prior to operations with the Croke 1902 right, to reduce the likelihood the 4 Way stored water will be released.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type

Stan.06	19054.99998	Northglenn Indoor Use (02_Nglenn_I)	Northglenn Standley PL (0200993)	PhantomStand, Account 1	3
Stan.07	19054.99998	Northglenn Indoor Use (02_Nglenn_I)	Northglenn Standley PL (0200993)	PhantomStand, Account 4	3
Stan.08	19054.99998	Northglenn Outdoor Use (02_Nglenn_O)	Northglenn Standley PL (0200993)	PhantomStand, Account 1	3
Stan.09	19054.99998	Northglenn Outdoor Use (02_Nglenn_O)	Northglenn Standley PL (0200993)	PhantomStand, Account 4	3
Stan.10	19054.99998	Westminster Inside Use (02_Westy_I)	Northglenn Standley PL (0200993)	PhantomStand, Account 3	3
Stan.11	19054.99998	Westminster Outside Use (02_Westy_O)	Northglenn Standley PL (0200993)	PhantomStand, Account 3	3
Stan.12	19054.99998	Whipple D (Bull Canal) (0200871)		PhantomStand, Account 2	3
Stan.13	19054.99998	German Ditch (0200872)		PhantomStand, Account 2	3
Stan.14	19054.99998	Big Dry Ck Ditch (0200873)		PhantomStand, Account 2	3
Stan.15	19054.99998	Yoxall Ditch (0200874)		PhantomStand, Account 2	3
Stan.16	19054.99998	Whipple D (Bull Canal) (0200871)		PhantomStand, Account 5	3
Stan.17	19054.99998	German Ditch (0200872)		PhantomStand, Account 5	3
Stan.18	19054.99998	Big Dry Ck Ditch (0200873)		PhantomStand, Account 5	3
Stan.19	19054.99998	Yoxall Ditch (0200874)		PhantomStand, Account 5	3

The next seven rules are used to release the water already stored in Standley Lake to meet demands prior to operations with the Croke 1902 right, to vacate space to be filled with the 1902 right.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.20	19054.99999	Northglenn Indoor Use (02_Nglenn_I)	Northglenn Standley PL (0200993)	Standley Lake (0203903), Account 2	32
Stan.21	19054.99999	Northglenn Outdoor Use (02_Nglenn_O)	Northglenn Standley PL (0200993)	Standley Lake (0203903), Account 2	32
Stan.20N	19054.99999	Northglenn Indoor Use (02_Nglenn_I)	Northglenn Standley PL (0200993)	Standley Lake (0203903), Account 3	27
Stan.21N	19054.99999	Northglenn Outdoor Use (02_Nglenn_O)	Northglenn Standley PL (0200993)	Standley Lake (0203903), Account 3	27
Stan.22	19054.99999	Westminster Inside Use (02_Westy_I)	Westminster Standley PL2 (0200992)	Standley Lake (0203903), Account 1	32

Stan.23	19054.99999	Westminster Outside Use (02_Westy_O)	Westminster Standley PL2 (0200992)	Standley Lake (0203903), Account 1	32
Stan.24a	19054.99999	Thornton Inside Use (02_Thorn_I)	Thornton Standley PL (0200994)	Standley Lake (0203903), Account 4	32

The 1902 Croke storage right is the next part of the Standley Lake operations to simulate, as described in the section above this 4 Way Agreement section. At this point in the model simulation, any 4 Way water that was stored in Standley Lake has been booked over to PhantomStand and used to meet demands, to the extent possible. The 1902 Croke operations allow storage of 1902 Croke water from the current time step to be stored in others' account pursuant to the 4 Way Agreement (oprIDs Stan.36 – Stan.43). At the end of the time step, the following five rules are used to try to book the remaining 4 Way water from the previous time step (that is currently in PhantomStand) back into shared space in Standley Lake.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.44	99999.00000	Standley Lake (0203903), Account 1		PhantomStand, Account 1	34
Stan.45	99999.00000	Standley Lake (0203903), Account 1		PhantomStand, Account 2	34
Stan.46	99999.00000	Standley Lake (0203903), Account 4		PhantomStand, Account 3	34
Stan.47	99999.00000	Standley Lake (0203903), Account 4		PhantomStand, Account 4	34
Stan.48	99999.00000	Standley Lake (0203903), Account 4		PhantomStand, Account 5	34

5.10.8.10.3 COSMIC Agreement

The Croke Canal headgate is located downstream of the pre-1988 Golden and Coors effluent return point. This caused Clear Creek water diverted at the Croke Canal headgate to be of poor quality during winter months. During the late 1970s and early 1980s, Coors and Golden considered diverting additional water from Clear Creek that belonged to downstream water users Westminster and Thornton and replacing it with treated effluent. Westminster and Thornton fought this concept through a number of forums including the Water Quality Control Commission and the Water Court. The parties negotiated an innovative settlement that involved the joint funding of a solution that gave Coors and Golden additional water supplies from Clear Creek, while preserving the quality of the Standley Lake water supply. The agreement committed all parties to operate water rights to avoid the introduction of Coors and Golden effluent into Standley Lake. The Clear Creek Water Quality Settlement has been nicknamed the "COSMIC Agreement".

The main result of the COSMIC Agreement is that Coors and Golden now discharge their wastewater effluent to Clear Creek below the diversion point of the Croke Canal during the winter storage season. This water, previously available to the Croke Canal, is stored in West Gravel Lakes and Jim Baker Reservoir until it can be exchanged back upstream.

During the winter operation season (Croke Season: Nov 1- Mar 30) when the Croke Canal is diverting under its 1902 priority, Coors and Golden effluent is discharged below the Croke Canal and stored in West Gravel Lakes and Jim Baker Reservoir.

During the irrigation season (Non-Croke Season: April 1- Oct 31), the stored effluent is exchanged upstream for distribution to FRICO shareholders.

The general order of rules in the SPDSS model to represent operations of the Standley Lake and West Gravel Lake storage accounts and the Cosmic Agreement is as follows. Note the location of the Coors/Golden WWTP is fixed at its current location throughout the study period.

Croke Season

Return flows from Coors' and Golden's winter use are considered Bypass Water and stored in West Gravel Lakes. In order for the StateMod model to color effluent from winter diversions and then be shepherded down the creek to off-channel storage, subject to a transit loss, the winter diversions must be isolated from other water supplies. Therefore, water rights just senior to the Croke 1902 storage right are assigned to the Golden City Ditch and Coors Industries Ditch. The first two rules below are used to store the two COSMIC rights into plan IDs CosmPln1 and CosmPln2. The next two rules set the volumetric Croke season limits on the use of the rights, as outlined in the Cosmic Agreement. The last two rules are used to release the plan contents to the Golden and Coors demands, with the effluent colored as reusable. Although the Coors/Golden WWTP is essentially a single structure, two separate WWTPs are included in the SPDSS model (IDs 0702318 and Gold_WWTP) to account for the bypass water for the two entities separately.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.04	19054.99989	CosmcPln1	100%	0700542.07	26
Cosmic.05	19054.99990	CosmcPln2	100%	0700725.03	26
Cosmic.98	1.00000			Coors Release Limit (Cosmic_RL1)	47
Cosmic.99	1.00000			Golden Release Limit (Cosmic_RL2)	47
Cosmic.06	19054.99991	Golden Inside Use (07_Golden_I)	Golden City Ditch (0700542)	CosmcPln1	27
Cosmic.07	19054.99992	Coors Malting	Coors Ind Ditch	CosmcPln2	27

		Potable Demand (07_CoorsB)	(0700725)		

West Gravel Lakes is set up with four accounts – Coors Bypass, Golden Bypass, Thornton 1 Time Use, and Thornton Reuse. The Bypass accounts are sized to hold the maximum delivery outlined in the Cosmic Agreement (Coors – 2,758 acre-feet; Golden – 1,113 acre-feet). The two Thornton accounts are equal to the maximum reservoir capacity of 3,400 acre-feet. The following two rules are used to convey the reusable effluent to the West Gravel Lakes, subject to the 2.75% transit loss.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.08	19054.99993	WGravelLks&Brannan (0203699), Account 2	Lower Clear Ck Ditch (0700547)	Golden WWTP (Gold_WWTP)	27
Cosmic.09	19054.99994	WGravelLks&Brannan (0203699), Account 1	Lower Clear Ck Ditch (0700547)	Coors WWTP (0702318)	27

An additional wrinkle noticed during model simulation is the West Gravel Lakes storage right simulated in-priority diversions during the Croke Season, which limited the available space to store the Bypass water. Therefore, the following rule is used to keep the One Time Use account in West Gravel Lakes empty during the Croke season:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.03	1.00001	WGL Nov1 Release (CosmicRel)		WGravelLks&Brannan (0203699), Account 3	3

Non-Croke Season

The Bypass water is now exchanged up to Standley, junior to the Croke 1902 right. The first two rules exchange the Coors Bypass and Golden Bypass water from the West Gravel Lakes up to plan IDs CosCoExPln and CosGoExPln. The following two rules split the plan contents to sub-plans for the Standley Lake shareholders.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.10	19055.00004	CosCoExcPln		WGravelLks&Brannan (0203699), Account 1	47
Cosmic.23	19055.00004	CosGoExcPln		WGravelLks&Brannan (0203699), Account 2	28

Cosmic.11	19055.00004	CosCoExcWe CosCoExcNg CosCoExcFR	47.20% 33.36% 19.44%	CosCoExcPln	46
Cosmic.24	19055.00004	CosGoExcWe CosGoExcNg	91% 9%	CosGoExcPln	46

The plan IDs are all located upstream of the Croke Canal headgate so that the exchange potential is sure to be available prior to the water being used by the recipients.

Note Thornton does not exchange its portion of the Bypass water upstream. Instead, the following two rules are used to take the water remaining in the Bypass accounts at the end of the Non-Croke season and book that water over to Thornton's Reuse account in West Gravel Lakes:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.01	1.00000	WGravelLks&Brannan (0203699), Account 4		WGravelLks&Brannan (0203699), Account 1	34
Cosmic.02	1.00000	WGravelLks&Brannan (0203699), Account 4		WGravelLks&Brannan (0203699), Account 2	34

The following 12 rules are used to release the contents of the sub-plans with the Coors Bypass water (8) and Golden Bypass water (4) to the recipients' demands.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.12	19055.00004	Westminster Inside Use (02_Westy_I)	Croke Canal (0700553)	CosCoExcWe	27
Cosmic.13	19055.00004	Westminster Outside Use (02_Westy_O)	Croke Canal (0700553)	CosCoExcWe	27
Cosmic.14	19055.00004	Northglenn Indoor Use (02_Nglenn_I)	Croke Canal (0700553)	CosCoExcNg	27
Cosmic.15	19055.00004	Northglenn Outdoor Use (02_Nglenn_O)	Croke Canal (0700553)	CosCoExcNg	27
Cosmic.16	19055.00004	Whipple D (Bull Canal) (0200871)	Croke Canal (0700553)	CosCoExcFR	27
Cosmic.17	19055.00004	German Ditch (0200872)	Croke Canal (0700553)	CosCoExcFR	27
Cosmic.18	19055.00004	Big Dry Ck Ditch (0200873)	Croke Canal (0700553)	CosCoExcFR	27
Cosmic.19	19055.00004	Yoxall Ditch (0200874)	Croke Canal (0700553)	CosCoExcFR	27
Cosmic.25	19055.00004	Westminster Inside Use (02_Westy_I)	Croke Canal (0700553)	CosGoExcWe	27
Cosmic.26	19055.00004	Westminster Outside Use	Croke Canal (0700553)	CosGoExcWe	27

		(02_Westy_O)			
Cosmic.27	19055.00004	Northglenn Indoor Use (02_Nglenn_I)	Croke Canal (0700553)	CosGoExcNg	27
Cosmic.28	19055.00004	Northglenn Outdoor Use (02_Nglenn_O)	Croke Canal (0700553)	CosGoExcNg	27

The following five rules are used to release the contents of the sub-plans with the Coors Bypass water (3) and Golden Bypass water (2) to the recipients' demands.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.20	19055.00004	Standley Lake (0203903), Account 1	Croke Canal (0700553)	CosCoExcWe	27
Cosmic.21	19055.00004	Standley Lake (0203903), Account 3	Croke Canal (0700553)	CosCoExcNg	27
Cosmic.22	19055.00004	Standley Lake (0203903), Account 4	Croke Canal (0700553)	CosCoExcFR	27
Cosmic.29	19055.00004	Standley Lake (0203903), Account 1	Croke Canal (0700553)	CosGoExcWe	27
Cosmic.30	19055.00004	Standley Lake (0203903), Account 3	Croke Canal (0700553)	CosGoExcNg	27
CosmcWGL.01	50403.00019	WGravelLks& Brannan (0203699), Account 1		CosCoExcNg	27
CosmcWGL.02	50403.00020	WGravelLks& Brannan (0203699), Account 1		CosCoExcFR	27
CosmcWGL.03	50403.00018	WGravelLks& Brannan (0203699), Account 1		CosCoExcWe	27
CosmcWGL.04	50403.00021	WGravelLks& Brannan (0203699), Account 2		CosCoExcWe	27
CosmcWGL.05	50403.00022	WGravelLks& Brannan (0203699), Account 2		CosCoExcNg	27

Northglenn-FRICO Exchanged

Bull Reservoir is modeled as an off-channel reservoir on the Northglenn WWTP outfall tributary. It stores effluent under the reservoir rights. Storage of native flow is not simulated (i.e no carriers) so all water in the reservoir is Northglenn effluent (mostly reusable). Releases from Northglenn effluent in Bull Lake are used to meet FRICO demands. Releases from FRICO account to remaining demand. Operating rules are shown below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
NglFRICO.02	19055.00006	Whipple D (Bull Canal) (0200871)		BullReservoir (0203351), Account 1	3
NglFRICO.03	19055.00006	German Ditch (0200872)		BullReservoir (0203351), Account 1	3
NglFRICO.04	19055.00006	Big Dry Ck Ditch (0200873)		BullReservoir (0203351), Account 1	3
NglFRICO.05	19055.00006	Yoxall Ditch (0200874)		BullReservoir (0203351), Account 1	3
NglFul.02	48275.00000	NglnFulRFs		NglennReuse	49

5.10.8.11 City of Westminister

The City of Westminster is physically located in the Big Dry Creek Basin and the majority of its raw water supply originates from Clear Creek and flows to Standley Lake. The City owns shares or inches in each of the Farmers’ High Line Canal, the Croke Canal, and the Church Ditch canal companies. The Farmers' High Line Canal and Reservoir Company has been a part of Westminster's water supply since the 1950s. Westminster presently owns or controls a majority of the shares in the Company. The Church Ditch inches were acquired by Westminster beginning in about 1960. The City also owns shares in the Standley Division of FRICO. The City owns the majority of shares in the Kershaw Ditch that diverts from the north side of Clear Creek at Tennyson Street and the Manhart Ditch that diverts water from the north bank of Ralston Creek about one mile upstream of its confluence with Clear Creek. Water derived from the Kershaw and Manhart ditches is used for water rights exchanges. Westminster owns Jim Baker Reservoir (aka Happe Ponds).

Prior to accumulating shares in the Church Ditch, Farmers' High Line, Kershaw Ditch, and Standley Lake Division on Clear Creek and in the Manhart Ditch on Ralston Creek, Westminster used non-tributary wells, contract water from Denver Water Board, and direct flow from the Kershaw Ditch for its municipal water supply.

The Manhart Ditch is the sole key ditch represented on Ralston Creek identified as key by the water commissioner. No records of flows in Ralston Creek were identified and estimates of inflows were considered unsatisfactory. Due to concerns with physical inflows above the ditch, operations with the changed Manhart Ditch water rights were excluded from the SPDSS model. There are some preliminary rules related to the Manhart Ditch that are kept in the operating rules file as placeholders for future modelers (Manhart.99).

Westminster's wastewater returns at its WWTP on Big Dry Creek (Westy_WWTP, approx. two-thirds) and the Metro WWTP (approx. one-thirds). Westminster's changed water rights are reusable and WWTP return flows from their use is accounted for in plan ID WestyReuse. The StateMod algorithm is not current able to color the effluent as reusable at two locations (i.e., Westy_WWTP and MetroWWTP); therefore, all of the WWTP returns are input as occurring at the Westy_WWTP. All of Westminster's water in Standley Lake is reusable and accounted for in plan ID StanReuseW. Representation of the use of changed water rights is consistent with standard approach outlined in Section 4.9. Most uses of the changed water rights also generate return flow obligations. Return flow obligations that are out of priority are met with reusable supplies at the Westy_WWTP.

The operating rules used in the SPDSS model for representing Westminster's operations are summarized below.

Changed Water Rights

As outlined in Section 5.10.8.7 (Molson Coors), the changed water rights in the Farmers' High Line Canal are stored in the plan ID FHL_SplPln and then distributed to the various owners of the water rights. Westminster's prorata ownership (50.8%) from the Farmers' High Line Canal is stored in the WestyFHLPln. The Priority 1 and Priority 8 water rights in what was previously the Wadsworth Ditch are owned exclusively by Westminster. These two rights are also stored in the WestyFHLPln. Monthly volumetrics are not assigned to the storage of those rights since volumetrics are assigned to the use of all of Westminster's changed rights in the Farmers' Highline Canal.

The first rule below establishes the volumetric limits on Westminster's use water rights based on decretal terms and conditions (Case Nos. W-8743, 86CW398, 86CW266, 90CW101, and 00CW263). The following two rules are used to deliver the Priority 1 and Priority 8 water rights into the Westminster plan. The next nine rules are used to release water from the plan to Westminster's indoor demand. The next nine rules are used to release water from the plan to Westminster's outdoor demand. The third set of nine rules is used to release water to Westminster's account in Standley Lake. The groups of nine rules for each destination are used to distinguish the monthly CU factors for March through November.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
FHL.99	1.00000			FHL Wes RL (FHL_Wes_RL)	47
FHL.01	3708.00000	Westminster FHL Plan (WestyFHLPln)	100%, 45,000AF limit	0700569.01	26
FHL.08	5785.00000	Westminster FHL Plan (WestyFHLPln)	100%, 45,000AF limit	0700569.08	26
FHL.17a-i	8127.00002	Westminster Inside Use (02_Westy_I)	FARMERS HIGHLINE CNL (0700569)	WestyFHLPln	27
FHL.18a-i	8127.00003	Westminster Outside	FARMERS	WestyFHLPln	27

		Use (02_Westy_O)	HIGHLINE CNL (0700569)		
FHL.19a-i	8127.00004	Standley Lake (0203903), Account 1	FARMERS HIGHLINE CNL (0700569)	WestyFHLPln	27

As outlined in Section 5.10.8.11 (City of Westminister), the changed water rights in the Church Ditch are stored in the plan ID ChrchSplPln and then distributed to the 7 users – Arvada, Coors, Golden, Northglenn, Thornton, Westminister, and Irrigators. Westminster's prorata ownership (52.1%) from the Church Ditch is stored in the WestyChPln.

The first rule below establishes the volumetric limits on Westminster's use water rights based on decretal terms and conditions (Case Nos. W-8743, 86CW398, 86CW266, 90CW101, and 00CW263). The next two split the changed ditch shares. Ther following set of seven rules are used to release water from the plan to Westminster's indoor demand. The next set of seven rules are used to release water from the plan to Westminster's outdoor demand. The third set of seven rules is used to release water to Westminster's account in Standley Lake. The set of seven rules for each destination are used to distinguish the monthly CU factors for April through October.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Church.99	1.00000			Church Wes RL (ChrchWe_RL)	47
Church.01	4535.00000	Church Ditch Split Plan 1 (ChrchSplPl1)	100%, 35,000AF limit	0700540.01	26
Church.02	4535.00001	Arvada Church Plan (ArvChPln) Coors Church Plan (CoorsChPln) Golden Church Plan (GoldChPln) Northglenn Church Plan (NglennChPln) Thornton Church Plan (ThChurchPln) Westminster Church Plan (WestyChPln) Church Ditch Irrigation Plan (ChrchIrrPln)	15.8% 8.7% 1.1% 7.4% 6.8% 47.4% 12.8%	Church Ditch Split Plan 1 (ChrchSplPl1)	46
Church.13a-g	10546.00002	Westminster Inside Use (02_Westy_I)	CHURCH DITCH (0700540)	WestyChPln	27
Church.14a-g	10546.00003	Westminster Outside Use (02_Westy_O)	CHURCH DITCH (0700540)	WestyChPln	27
Church.15a-g	10546.00004	Standley Lake (0203903), Account 1	CHURCH DITCH (0700540)	WestyChPln	27

The 1861 water right for the Kershaw Ditch is first stored in a changed water rights plan structure (KerSplPln). The City of Westminster has adjudicated two change cases for its shares of the Kershaw Ditch – Case Nos. 86CW398 and 02CW266. The cases have different priority dates adjudicated for exchanges to Standley Lake. Therefore, Westminster's prorata ownership of the shares is represented separately in plan IDs WestKer1Pln (38.1%) and WestKer1Pln (38.2%). The final three rules are used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators and Westminster). The first of the three rules is active between 1986 through 1993, corresponding with Westminster's prorata ownership in Case No. 86CW398. The last rule is active starting in 1994, corresponding with Westminster's original change case and Case No. 93CW176. All of the yield is assigned to the irrigators prior to 1986 in the first of the last three rules.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Kershaw.01	4140.00000	Kershaw Split Plan (KerSplPln)	100%, 35,000 AF Limit	0700597.01	26
Kershaw.02a	4140.00001	Kershaw Irrigation Plan (KerIrrPln)	100%	Kershaw Split Plan (KerSplPln)	46
Kershaw.02b	4140.00001	Westminster 86cw398 exchange plan (WestKer1Pln) Kershaw Irrigation Plan (KerIrrPln)	38.1% 61.9%	Kershaw Split Plan (KerSplPln)	46
Kershaw.02c	4140.00001	Westminster 86cw398 exchange plan (WestKer1Pln) Westminster 93cw176 exchange plan (WestKer2Pln) Kershaw Irrigation Plan (KerIrrPln)	38.1% 38.2% 23.7%	Kershaw Split Plan (KerSplPln)	46

The first two rules below establish the volumetric limits on Westminster's use of water rights based on terms and conditions in the two change decrees. The two rules distinguish the supply available to the exchange priority dates from the respective decrees. There next 14 rules used to release water from the 86CW398 plan (7) and 93CW176 (7) plan to Westminster's indoor demand by exchange to the Farmers' Highline Canal. The next 14 rules are used to do similar exchanges to Westminster's outside demand. The third set of 14 rules is used to do similar exchanges to Westminster's storage count in Standley Lake. The last set of 14 rules is used to release water directly to Jim Baker Reservoir. The groups of seven rules for each supply and destination are used to distinguish the monthly CU factors for April through October.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type

Kershaw.98	1.00000			Kershaw 86 Wes RL (WesKer86_RL)	47
Kershaw.99	1.00000			Kershaw 93 Wes RL (WesKer93_RL)	47
Kershaw.03a-g	50038.00000	Westminster Inside Use (02_Westy_I)	KERSHAW DITCH (0700597) KERSHAW DITCH Aug Stn (0700597_A) Fisher Ditch (0700570, R) FARMERS HIGHLINE CNL (0700569)	WestKer1Pln	27
Kershaw.04a-g	52586.00000	Westminster Inside Use (02_Westy_I)	KERSHAW DITCH (0700597) KERSHAW DITCH Aug Stn (0700597_A) Fisher Ditch (0700570, R) FARMERS HIGHLINE CNL (0700569)	WestKer2Pln	27
Kershaw.05a-g	50038.00001	Westminster Outside Use (02_Westy_O)	KERSHAW DITCH (0700597) KERSHAW DITCH Aug Stn (0700597_A) Fisher Ditch (0700570, R) FARMERS HIGHLINE CNL (0700569)	WestKer1Pln	27
Kershaw.06a-g	52586.00001	Westminster Outside Use (02_Westy_O)	KERSHAW DITCH (0700597) KERSHAW DITCH Aug Stn (0700597_A) Fisher Ditch (0700570, R) FARMERS HIGHLINE CNL (0700569)	WestKer2Pln	27
Kershaw.07a-g	50038.00002	Standley Lake (0203903), Account 1	KERSHAW DITCH (0700597) KERSHAW DITCH Aug Stn (0700597_A) Fisher Ditch (0700570, R) FARMERS	WestKer1Pln	27

			HIGHLINE CNL (0700569)		
Kershaw.08a-g	52586.00002	Standley Lake (0203903), Account 1	KERSHAW DITCH (0700597) KERSHAW DITCH Aug Stn (0700597_A) Fisher Ditch (0700570, R) FARMERS HIGHLINE CNL (0700569)	WestKer2Pln	27
Kershaw.09a-g	50038.00003	Jim Baker Reservooir (0703336), Account 1	KERSHAW DITCH (0700597) KERSHAW DITCH Aug Stn (0700597_A)	WestKer1Pln	27
Kershaw.10a-g	52586.00003	Jim Baker Reservooir (0703336), Account 1	KERSHAW DITCH (0700597) KERSHAW DITCH Aug Stn (0700597_A)	WestKer2Pln	27

The following three rules release water to the Kershaw irrigation demand from its prorata water rights ownership (plan ID KerIrrPln) and unused credits in the Westminster's two changed water rights plans. The next five rules release any remaining unused Kershaw Ditch credits in various plans back to Clear Creek. The last two rules are used to release any unused credits in the Church Ditch and the Farmers' Highline Canal back to irrigators under the respective ditches.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Kershaw.11	4140.00002	Kershaw Ditch Irrigators (0700597_I)	Kershaw Ditch (0700597)	Kershaw Irrigation Plan (KerIrrPln)	27
Kershaw.12	50038.00008	Kershaw Ditch Irrigators (0700597_I)	Kershaw Ditch (0700597)	Kershaw Ditch Irrigators (0700597_I)	27
Kershaw.13	52586.00008	0 Kershaw Ditch Irrigators (0700597_I)	Kershaw Ditch (0700597)	Westminster 93cw176 exchange plan (WestKer2Pln)	27
KerSpill.71	4140.00009	Kershaw Ditch (0700597)		KerSplPln	29
KerSpill.72	4140.00009	Kershaw Ditch (0700597)		WestyKerPln	29
KerSpill.73	50038.00009	Kershaw Ditch (0700597)		WestKer1Pln	29

KerSpill.74	52586.00009	Kershaw Ditch (0700597)		WestKer2Pln	29
KerSpill.75	4140.00009	Kershaw Ditch (0700597)		KerIrrPln	29
FHL.24	16549.00002	FHL Irrigators (0700569_I)	Farmers Highline Canal (0700569)	Westminster FHL Plan (WestyFHLPln)	27
Church.24	16718.13227	Church Ditch Irrigators (0700540_I)	Church Ditch (0700540)	Westminster Church Plan (WestyChPln)	27

The following four rules are used to meet the return flow obligations associated with the various changes of use, either in priority via the Type 43 rules (2) or with reusable effluent (2). The next rule is used to release reusable effluent to meet Northglenn's wintertime return flow obligations accounted for in plan ID NglnBDCRFs. The final rule is used to release unused reusable effluent back to the river.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
WestyRF.01	55150.00000	WestyChRFs			43
WestyRF.02	55150.00000	WestyFHLRFs			43
WestyRF.03	5150.10000	WestyChRFs		WestyReuse	48
WestyRF.04	5150.10000	WestyFHLRFs		WestyReuse	48
NglWest.01	55150.10001	NglnBDCRFs		WestyReuse	48
WestWWSpl.71	90000.00000	Westminster WWTP (Westy_WWTP)		WestyReuse	29

Storage Use

Westminster stores and delivers its water supplies from Standley Lake and Jim Baker Reservoir. Westminster's ownership in the FRICO system is represented with a single account in Standley Lake (Acct 1). Pursuant to the 4 Way Agreement, Westminster also can store water in the account owned by Thornton (Acct 4) (see Section 5.10.8.10.78). The following six rules are used to release water from Standley Lake to meet Westminster's demand from either the 4 Way accounts in PhantomStand (2) or from Westminster's account in Standley Lake (2).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.10	19054.99998	Westminster Inside Use (02_Westy_I)	Northglenn Standley PL (0200993)	PhantomStand, Account 3	3

Stan.11	19054.99998	Westminster Outside Use (02_Westy_O)	Northglenn Standley PL (0200993)	PhantomStand, Account 3	3
Stan.22	19054.99999	Westminster Inside Use (02_Westy_I)	Westminster Standley PL2 (0200992)	Standley Lake (0203903), Account 1	32
Stan.23	19054.99999	Westminster Outside Use (02_Westy_O)	Westminster Standley PL2 (0200992)	Standley Lake (0203903), Account 1	32

The Jim Baker Reservoir storage right is carried to storage from Clear Creek via the Kershaw Ditch using the following rule. The next two rules release storage water to Westminster's demand by exchange via the Croke Canal. The last rule is used to release storage water to Westminster's account in Standley Lake by exchange via the Croke Canal.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
JimBaker.01	50565.00000	Jim Baker Reservoir (0703336, Acct 1)	Kershaw Ditch (0700597)	0703336.01	45
JimBaker.02	50565.00001	Westminster Inside Use (02_Westy_I)	Croke Canal (0700553)	Jim Baker Reservooir (0703336), Account 1	33
JimBaker.03	50565.00001	Westminster Outside Use (02_Westy_O)	Croke Canal (0700553)	Jim Baker Reservoir (0703336), Account 1	33
JimBaker.04	50565.00001	Standley Lake (0203903), Account 1	Croke Canal (0700553)	Jim Baker Reservoir (0703336), Account 1	33

Additional Supplies

Water released from the Coors and Golden WWTPs during the winter (the Croke season) is typically stored in West Gravel Lakes (0203699). Westminster is entitled to a portion of the stored water (Golden Bypass and Coors Bypass), as discussed in Section 5.10.8.10.79. Westminster's Bypass water is accounted for in plan IDs CosCoExcWe and CosGoExcWe. The four rules listed below are used to release the Bypass Water to the Westminster demand via the Croke Canal. The next two rules are used to release the Bypass Water to storage in Westminster's account in Standley Lake from Coors and Golden, respectively. The last two rules release any unused Bypass Water back to Clear Creek.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.12	19055.00004	Westminster Inside Use (02_Westy_I)	Croke Canal (0700553)	CosCoExcWe	27
Cosmic.13	19055.00004	Westminster Outside	Croke Canal	CosCoExcWe	27

		Use (02_Westy_O)	(0700553)		
Cosmic.25	19055.00004	Westminster Inside Use (02_Westy_I)	Croke Canal (0700553)	CosGoExcWe	27
Cosmic.26	19055.00004	Westminster Outside Use (02_Westy_O)	Croke Canal (0700553)	CosGoExcWe	27
Cosmic.20	19055.00004	Standley Lake (0203903), Account 1	Croke Canal (0700553)	CosCoExcWe	27
Cosmic.29	19055.00004	Standley Lake (0203903), Account 1	Croke Canal (0700553)	CosGoExcWe	27
CosmcSpl.77	50404.00009	Croke Canal (0700553)		CosCoExcWe	29
CosmcSpl.81	50404.00009	Croke Canal (0700553)		CosGoExcWe	29

5.10.8.12 City of Thornton

The City of Thornton uses a water rights portfolio that contains supplies in both the Clear Creek Basin and Water District 2 on the South Platte River. Thornton has changed water rights in the FRICO-Standley Lake system and the ditch systems that convey water to the lake (Church Ditch and Farmers' Highline Canal). The City's other water supply come primarily from its majority ownership in the calling rights at the bottom of Clear Creek (Lower Clear Creek Ditch / Colorado Agricultural Ditch system) and its approximately one half ownership of the shares in the Little Burlington Ditch.

The West Gravel Lakes and Brannan Lakes are located at the end of the Lower Clear Creek Ditch (0700547), adjacent to the west side of the South Platte River. The lakes are represented in aggregate (0203699) and are used to both supply water to the City and store and release Bypass Water as part of the Cosmic Agreement (see Section 5.10.8.10.79.). Across the river to the east, Thornton owns a set of interconnected, lined gravel pits (East Gravel Lakes, 0203700). The East Gravel Lakes are located off the Burlington Ditch and used to store the City's credits from the Burlington Ditch system (0200915). The lakes feed into the Wes Brown water treatment plant (WesBrownWTP), which supplies potable water predominantly in the summer to meet Thornton's demand. The Thornton Water Treatment plant processes water from Standley Lake and is used predominantly during the winter.

All of Thornton's wastewater returns at the Metro WWTP. Thornton's changed water rights are reusable and WWTP return flows from their use is accounted for in plan ID MetroTh. All of Thornton's water in Standley Lake is reusable and accounted for in plan ID StanReuseT. Other than water stored in priority in the East Gravel Lakes and West Gravel Lakes, the reusable supplies in those reservoirs are accounted for in plan IDs EGLks_Pln and WGLks_Pln. Representation of the use of changed water rights is consistent with standard approach outlined in Section 4.9. Most uses of the changed water rights also generate return flow obligations. Return flow obligations that are out of priority are met with reusable supplies at the Metro WWTP.

The operating rules used in the SPDSS model for representing Thornton's operations are summarized below.

Changed Water Rights

As outlined in Section 5.10.8.17, the changed water rights in the Burlington Ditch are stored in four plan IDs and then distributed to the various owners of the water rights. The first rule establishes limits on the use of the Thornton's changed Burlington Ditch water based on decretal terms and conditions (Case Nos. 87CW107, 90CW229, and 05CW010). The next four rules are used to release water from Thornton's plans (10.28, 7.987, 6.0 and 200 cfs rights) to meet its indoor demand. The following four rules are used to release water from the plans to Thornton's outdoor demand. The third set of four rules is used to release water to East Gravel Lakes. The final set of four rules is used to exchange water to the West Gravel Lakes via the Lower Clear Creek Ditch. The storage of changed Burlington Ditch shares are assigned priorities junior to the respective storage rights.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
ThBurl.99	1.00000			Thornton Plan Release Limit - ThBurl_RL	47
ThBurl.01	5205.00001	Thornton Inside Use (02_Thorn_I)	Burlington Canal (0200802) East Gravel Lakes Divn (3700) WesBrownWTP	ThBur10Pln	27
ThBurl.02	5205.00002	Thornton Inside Use (02_Thorn_I)	Burlington Canal (0200802) East Gravel Lakes Divn (3700) WesBrownWTP	ThWell7Pln	27
ThBurl.03	5205.00003	Thornton Inside Use (02_Thorn_I)	Burlington Canal (0200802) East Gravel Lakes Divn (3700) WesBrownWTP	ThSanstPln	27
ThBurl.04	13108.00001	Thornton Inside Use (02_Thorn_I)	Burlington Canal (0200802) East Gravel Lakes Divn (3700) WesBrownWTP	Th200_85Pln	27
ThBurl.05	5205.00001	Thornton Outdoor Use (02_Thorn_O)	Burlington Canal (0200802) East Gravel Lakes Divn (3700) WesBrownWTP	ThBur10Pln	27
ThBurl.06	5205.00002	Thornton Outdoor Use (02_Thorn_O)	Burlington Canal (0200802) East Gravel Lakes Divn (3700) WesBrownWTP	ThWell7Pln	27
ThBurl.07	5205.00003	Thornton Outdoor Use (02_Thorn_O)	Burlington Canal (0200802)	ThSanstPln	27

			East Gravel Lakes Divn (3700) WesBrownWTP		
ThBurl.08	13108.00001	Thornton Outdoor Use (02_Thorn_O)	Burlington Canal (0200802) East Gravel Lakes Divn (3700) WesBrownWTP	Th200_85Pln	27
ThBurl.09	51864.50688	East Gravel Lakes (0203700), Account 2	Burlington Canal (0200802) East Gravel Lakes Divn (3700)	ThBur10Pln	27
ThBurl.10	51864.50688	East Gravel Lakes (0203700), Account 2	Burlington Canal (0200802) East Gravel Lakes Divn (3700)	ThWell7Pln	27
ThBurl.11	51864.50688	East Gravel Lakes (0203700), Account 2	Burlington Canal (0200802) East Gravel Lakes Divn (3700)	ThSanstPln	27
ThBurl.12	51864.50688	East Gravel Lakes (0203700), Account 2	Burlington Canal (0200802) East Gravel Lakes Divn (3700)	Th200_85Pln	27
ThBurl.13	51864.50689	WGravelLks&Brannan (0203699), Account 4	Burlington Canal (0200802) Burlington Canal (0200802, R) Lower Clear Ck Ditch (0700547)	ThBur10Pln	27
ThBurl.14	51864.50689	WGravelLks&Brannan (0203699), Account 4	Burlington Canal (0200802) Burlington Canal (0200802, R) Lower Clear Ck Ditch (0700547)	ThWell7Pln	27
ThBurl.15	51864.50689	WGravelLks&Brannan (0203699), Account 4	Burlington Canal (0200802) Burlington Canal (0200802, R) Lower Clear Ck Ditch (0700547)	ThSanstPln	27
ThBurl.16	51864.50689	WGravelLks&Brannan (0203699), Account 4	Burlington Canal (0200802) Burlington Canal	Th200_85Pln	27

			(0200802, R) Lower Clear Ck Ditch (0700547)		

Thornton has not yet exercised its exchange of its Burlington share water to West Gravel Lakes; however, the rules for this operation were included.

As outlined in Section 5.10.8.11 (City of Westminister), the changed water rights in the Church Ditch are stored in plan IDs ChrchSplPln and ChrchSplPl1 and then distributed to the various owners of the water rights. Thornton's prorata ownership (7.8%) is stored in model ID ThChurchPln. The first rule establishes limits on the use of the Thornton's changed Church water based on decretal terms and conditions (Case No. 89CW132). The next three rules are used to release water to meet Thornton's municipal demand (2) and to storage in Thornton's account in Standley Lake.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Church.98	1.00000	NA	Limit 1,064.1 AF	ChrchTh_RL	47
Church.17	10546.00002	Thornton Inside Use (02_Thorn_I)	100%, Church Ditch (0700540)	Thornton Church Ditch Plan (ThChurchPln)	27
Church.18	10546.00003	Thornton Outside Use (02_Thorn_O)	100%, Church Ditch (0700540)	Thornton Church Ditch Plan (ThChurchPln)	27
Church.19	10546.00004	Standley Lake (0203903)	100%, Church Ditch (0700540) Acct 4	Thornton Church Ditch Plan (ThChurchPln)	27

As outlined in Section 5.10.8.7 (Molson Coors), the changed water rights in the Farmers' High Line Canal are stored in plan ID FHL_SplPln and then distributed to the various owners of the water rights. Thornton's prorata ownership (16.6%) is stored in model ID ThFHLPln. The first rule establishes limits on the use of the Thornton's changed Farmers' High Line Canal water based on decretal terms and conditions (Case Nos. 87CW334 and 02CW266). The next three rules are used to release water to meet Thornton's municipal demand (2) and to storage in Thornton's account in Standley Lake. The last rule is used to release unused credits back to the irrigators.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
FHL.98	1.00000	NA	Limit 8,152.1 AF	FHL_Thn_RL	47
FHL.20	8127.00002	Thornton Inside Use (02_Thorn_I)	100%, FHL Canal (0700569)	Thornton FHL Canal Plan (ThFHLPln)	27
FHL.21	8127.00003	Thornton Outside Use (02_Thorn_O)	100%, FHL Canal (0700569)	Thornton FHL Canal	27

				Plan (ThFHLPln)	
FHL.23	16549.00002	FHL Irrigators (0700569_I)	Farmers Highline Canal (0700569)	Thornton FHL Plan (ThFHLPln)	27

The 1861 water right for the Fisher Ditch is first stored in a changed water rights plan structure (FishSplPln) and limited based on decretal terms and conditions. The final two rules are used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators, Thornton, and Public Service Company). Thornton's prorata ownership (14.4%) is stored in plan ID ThFishPln. The last rule splits the yield to the three users and is active starting in 1991 when the first significant change case was adjudicated (Thornton's Case No. 89CW132). All of the yield is assigned to the irrigators prior to 1991 using the second-to-last rule. Note Western Mobile and the City of Arvada changed 4.0% and 0.74% of the ditch shares, respectively. These changes are not represented in the USR Model since Western Mobile is not explicitly represented and the Arvada pro-rata ownership is pretty minor.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Fish.98	1.00000	NA	Limit 994.5 AF	FishTh_RL	47
Fish.01	4198.00000	Fisher Split plan (FishSplPln)	100%, 45,000 AF Limit	0700570.01	26
Fish.02a	4198.00001	Fisher Irrigation Plan (FishIrrPln)	100%	Fisher Split plan (FishSplPln)	46
Fish.02b	4198.00001	Thornton Fisherr plan (ThFishPln) PSCo Fisher Plan (PSCoFishPln) Fisher Irrigation Plan (FishIrrPln)	14.4% 49% 36.6%	Fisher Split plan (FishSplPln)	46

Thornton's operations with its Fisher Ditch shares are represented with two sets of rules since only April – July deliveries trigger winter return flow obligations. The first four rules are used to release water to meet South Platte River return flow obligations associated with changed uses of its various Clear Creek changed water rights. The next four rules exchange the Fisher Ditch water to Thornton's account in Standley Lake via the Farmers' High Line Canal (2) and Croke Canal. The last two rules release the plan water to storage in West Gravel Lakes via the Lower Clear Creek Ditch.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type

Fish.03a	55835.00001	Thornton SPR RFs abv Brantner (ThornSPRFs2)	100%, Fisher Ditch (0700570) Thornton Lower Clear Ck RFs (ThLCC_RFs, R)	Thornton Fisher Ditch Plan (ThFishPln)	27
Fish.03b	55835.00001	Thornton SPR RFs abv Brantner (ThornSPRFs2)	100%, Fisher Ditch (0700570) Thornton Lower Clear Ck RFs (ThLCC_RFs, R)	Thornton Fisher Ditch Plan (ThFishPln)	27
Fish.04a	55835.00002	Standley Lake (0203903)	100%, Fisher Ditch (0700570) Thornton Lower Clear Ck RFs (ThLCC_RFs, R) Church Ditch (0700540) Acct 4	Thornton Fisher Ditch Plan (ThFishPln)	27
Fish.04b	55835.00003	Standley Lake (0203903)	100%, Fisher Ditch (0700570) Thornton Lower Clear Ck RFs (ThLCC_RFs, R) Church Ditch (0700540) Acct 4	Thornton Fisher Ditch Plan (ThFishPln)	27
Fish.05a	55835.00004	Standley Lake (0203903)	100%, Fisher Ditch (0700570) Thornton Lower Clear Ck RFs (ThLCC_RFs, R) FHL Canal (0700569) Acct 4	Thornton Fisher Ditch Plan (ThFishPln)	27
Fish.05b	55835.00005	Standley Lake (0203903)	100%, Fisher Ditch (0700570) Thornton Lower Clear Ck RFs (ThLCC_RFs, R) FHL Canal (0700569) Acct 4	Thornton Fisher Ditch Plan (ThFishPln)	27
Fish.06a	55835.00006	Standley Lake (0203903)	100%, Thornton Lower Clear Ck RFs (ThLCC_RFs, R) Croke Canal (0700553) Acct 4	Thornton Fisher Ditch Plan (ThFishPln)	27
Fish.06b	55835.00007	Standley Lake (0203903)	100%, Thornton Lower Clear Ck RFs	Thornton Fisher Ditch Plan (ThFishPln)	27

			(ThLCC_RFs, R) Croke Canal (0700553) Acct 4		
Fish.07a	55835.00008	WGravelLks&Brannan Reservoir (0203699)	100%, Fisher Ditch (0700570) CoAg Ditch (0700549, R) Lower Clear Ck Ditch (0700547) Acct 4	Thornton Fisher Ditch Plan (ThFishPln)	27
Fish.07b	55835.00009	WGravelLks&Brannan Reservoir (0203699)	100%, Fisher Ditch (0700570) CoAg Ditch (0700549, R) Lower Clear Ck Ditch (0700547) Acct 4	Thornton Fisher Ditch Plan (ThFishPln)	27

The water rights for the Colorado Agricultural (Colorado Ag) Ditch are first stored in a changed water rights plan structure (CoAgSplPln). The City of Thornton has adjudicated two change cases for its shares of the Colorado Ag Ditch – Case Nos. 89CW132 and 02CW266. The 1989 case de-mutualized the ditch shares, which makes the unused credits not available to irrigators under the ditch. The 2002 shares were not de-mutualized and therefore do not have the same limit. Therefore, Thornton's prorata ownership of the shares is represented separately in plan IDs ThCoAg89Pln (32.5%) and ThCoAg02Pln (23.4%).

Right ID	**Admin #**	**Destination**	**Account, Carrier, Return Location (R), or % Split**	**Source**	**Right Type**
CoAg.01	5057.00000	CoAg Split Plan (CoAgSplPln)	100%, 35,000 AF Limit	0700549.01	26
CoAg.02	6273.00000	CoAg Split Plan (CoAgSplPln)	100%, 35,000 AF Limit	0700549.02	26

Although use of the 1874 priority water right in the Colorado Ag Ditch was included in Thornton's change cases, the yield of the senior 1863 and 1874 rights surpass the volumetrics placed on Thornton's changed shares in the SPDSS model. Therefore, the following rule provides the yield of the 1874 right to the Colorado Ag irrigators, accounted for in its plan ID CoAgIrrPln. The last rule splits the yield to the irrigators and the two Thornton plans.

Right ID	**Admin #**	**Destination**	**Account, Carrier, Return Location (R), or % Split**	**Source**	**Right Type**
CoAg.03	8861.00000	CoAg Irrigation Plan	100%, 13,720 AF	0700549.03	26

		(CoAgIrrPln)	Limit		
CoAg.04a-b	8861.00001	Thornton CoAg 89cw132Plan (ThCoAg89Pln) Thornton CoAg 02cw266 Plan (ThCoAg02Pln) CoAg Irrigation Plan (CoAgIrrPln)	32.5% 23.4% 44.1%	CoAg Split Plan (CoAgSplPln)	46

The first two rules below are used to establish volumetrics on the plan IDs based on the terms and conditions within the 89CW132 and 02CW266 decrees. The next four rules below are used to release water from both plan IDs to meet Thornton's inside use (2) and outside use (2) demands. The last set of rules (2) are used to store the water in Thornton's reuse account in West Gravel Lakes.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
CoAg.98	1.00000	NA	Limit 2,123.5 AF	ThCoAg89_RL	47
CoAg.99	1.00000	NA	Limit 1,541.3 AF	ThCoAg89_RL	47
CoAg.05a	8861.00002	Thornton Inside Use (02_Thorn_I)	100%, CoAg Ditch (0700549) Lower Clear Ck Ditch (0700547) Wes Brown Water Treatment Plant (WesBrownWTP)	Thornton CoAg 89CW132 Plan (ThCoAg89Pln)	27
CoAg.05b	8861.00002	Thornton Inside Use (02_Thorn_I)	100%, CoAg Ditch (0700549) Lower Clear Ck Ditch (0700547) Wes Brown Water Treatment Plant (WesBrownWTP)	Thornton CoAg 02CW266 Plan (ThCoAg02Pln)	27
CoAg.06a	8861.00003	Thornton Outside Use (02_Thorn_O)	100%, CoAg Ditch (0700549) Lower Clear Ck Ditch (0700547) Wes Brown Water Treatment Plant (WesBrownWTP)	Thornton CoAg 89CW132 Plan (ThCoAg89Pln)	27

CoAg.06b	8861.00003	Thornton Outside Use (02_Thorn_O)	100%, CoAg Ditch (0700549) Lower Clear Ck Ditch (0700547) Wes Brown Water Treatment Plant (WesBrownWTP)	Thornton CoAg 02CW266 Plan (ThCoAg02Pln)	27
CoAg.07a	8861.00004	WGravelLks&Brannan Reservoir (0203699)	100%, CoAg Ditch (0700549) Lower Clear Ck Ditch (0700547) Acct 4	Thornton CoAg 89CW132 Plan (ThCoAg89Pln)	27
CoAg.07b	8861.00004	WGravelLks&Brannan Reservoir (0203699)	100%, CoAg Ditch (0700549) Lower Clear Ck Ditch (0700547) Acct 4	Thornton CoAg 02CW266 Plan (ThCoAg02Pln)	27

The first rule below is used to release water from the irrigator's plan ID CoAgIrrPln to meet their demands. The subsequent rule releases any unused ditch credits from the ThCoAg02Pln back to the ditch irrigators. The last four rules are used to release the contents of all associated plan structures back to the river.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
CoAg.11	8861.00002	CoAg Irrigators (0700549_I)	CoAg Ditch (0700549)	CoAg Irrigation Plan (CoAgIrrPln)	27
CoAg.12	8861.00008	CoAg Irrigators (0700549_I)	CoAg Ditch (0700549)	Thornton CoAg 02cw266 Plan (ThCoAg02Pln)	27
CoAgSpill.71	8861.00009	Colorado Ag Ditch (0700549)		CoAgSplPln	29
CoAgSpill.72	8861.00009	Colorado Ag Ditch (0700549)		CoAgIrrPln	29
CoAgSpill.73	8861.00009	Colorado Ag Ditch (0700549)		ThCoAg89Pln	29
CoAgSpill.74	8861.00009	Colorado Ag Ditch (0700549)		ThCoAg02Pln	29

The 1861 water right for the Lower Clear Creek Ditch is first stored in a changed water rights plan structure (LCC_SplPln). Similar to its Colorado Ag Ditch shares, the Lower Clear Creek shares changed in Case No. 89CW132 is not available to the ditch irrigators whereas the 02CW266 yield is available to the irrigators. Thornton's prorata ownership is stored in plan IDs ThLCC89Pln (47.1%) and ThLCC02Pln (17.2%). The final three rules are used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators and Thornton). The last rule is active starting in 2007, after both of the change cases were completed. The second-to-last rule is active between 1991 and 2006, corresponding with Thornton's first change case. All of the yield is assigned to the irrigators prior to 1991 using the third to-last rule.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LCC.01	4323.00000	LCC Split Plan (LCC_SplPln)	100%, 35,000 AF Limit	0700547.01	26
LCC.02a	4323.00001	LCC Irrigation Plan (LCC_IrrPln)	100%	LCC Split Plan (LCC_SplPln)	46
LCC.02b	4323.00001	Thornton LCC 89CW132 Plan (ThLCC89Pln) LCC Irrigation Plan (LCC_IrrPln)	47.1% 52.9%	LCC Split Plan (LCC_SplPln)	46
LCC.02c	4323.00001	Thornton LCC 89CW132 Plan (ThLCC89Pln) Thornton LCC 02CW266 Plan (ThLCC02Pln) LCC Irrigation Plan (LCC_IrrPln)	47.1% 17.2% 35.7%	LCC Split Plan (LCC_SplPln)	46

The first two rules below are used to establish volumetrics on the plan IDs based on the terms and conditions within the 89CW132 and 02CW266 decrees. The next four rules below are used to release water from both plan IDs to meet Thornton's inside use (2) and outside use (2) demands. The next set of rules is used to store the water in Thornton's reuse account in West Gravel Lakes. The last six rules are used to store the plan yields in Thornton's account in Standley Lake, by exchange, via the Church Ditch (2), Farmers' High Line Canal (2), and Croke Canal (2).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LCC.98	1.00000	NA	Limit 3,715.3 AF	ThLCC_89_RL	47
LCC.99	1.00000	NA	Limit 1,358.9 AF	ThLCC_02_RL	47
LCC.03a	4323.00002	Thornton Inside Use (02_Thorn_I)	100%, Lower Clear Ck Ditch (0700547) Wes Brown Water Treatment Plant (WesBrownWTP)	Thornton LCC 89CW132 Plan (ThLCC89Pln)	27
LCC.03b	4323.00002	Thornton Inside Use (02_Thorn_I)	100%, Lower Clear Ck Ditch (0700547) Wes Brown Water Treatment Plant (WesBrownWTP)	Thornton LCC 02CW266 Plan (ThLCC02Pln)	27

LCC.04a	4323.00003	Thornton Outside Use (02_Thorn_O)	100%, Lower Clear Ck Ditch (0700547) Wes Brown Water Treatment Plant (WesBrownWTP)	Thornton LCC 89CW132 Plan (ThLCC89Pln)	27
LCC.04b	4323.00003	Thornton Outside Use (02_Thorn_O)	100%, Lower Clear Ck Ditch (0700547) Wes Brown Water Treatment Plant (WesBrownWTP)	Thornton LCC 02CW266 Plan (ThLCC02Pln)	27
LCC.05a	4323.00004	WGravelLks&Brannan Reservoir (0203699)	100%, Lower Clear Ck Ditch (0700547) CoAg Ditch (0700549) Acct 4	Thornton LCC 89CW132 Plan (ThLCC89Pln)	27
LCC.05b	4323.00004	WGravelLks&Brannan Reservoir (0203699)	100%, Lower Clear Ck Ditch (0700547) CoAg Ditch (0700549) Acct 4	Thornton LCC 02CW266 Plan (ThLCC02Pln)	27
LCC.06a	50350.00001	Standley Lake (0203903)	100%, Lower Clear Ck Ditch (0700547) LCCStoRelLimitToDitExch (LCCLimitPln) Church Ditch (0700540) Acct 4	Thornton LCC 89CW132 Plan (ThLCC89Pln)	27
LCC.06b	50350.00001	Standley Lake (0203903)	100%, Lower Clear Ck Ditch (0700547) LCCStoRelLimitToDitExch (LCCLimitPln) Church Ditch (0700540) Acct 4	Thornton LCC 02CW266 Plan (ThLCC02Pln)	27
LCC.07a	50350.00002	Standley Lake (0203903)	100%, Lower Clear Ck Ditch (0700547) LCCStoRelLimitToDitExch (LCCLimitPln) FHL Canal (0700569) Acct 4	Thornton LCC 89CW132 Plan (ThLCC89Pln)	27
LCC.07b	50350.00002	Standley Lake (0203903)	100%, Lower Clear Ck Ditch (0700547) LCCStoRelLimitToDitExch (LCCLimitPln) FHL Canal (0700569) Acct 4	Thornton LCC 02CW266 Plan (ThLCC02Pln)	27
LCC.08a	50350.0000	Standley Lake (0203903)	100%, Lower Clear Ck Ditch	Thornton LCC 89CW132 Plan	27

			(0700547) LCCStoRelLimitToDitExch (LCCLimitPln) Croke Canal (0700553) Acct 4	(ThLCC89Pln)	
LCC.08b	50350.00003	Standley Lake (0203903)	100%, Lower Clear Ck Ditch (0700547) LCCStoRelLimitToDitExch (LCCLimitPln) Croke Canal (0700553) Acct 4	Thornton LCC 02CW266 Plan (ThLCC02Pln)	27

The first rule below is used to release water from the irrigator's plan ID LCC_IrrPln to meet their demands. The subsequent rule releases any unused ditch credits from the ThLCC02Pln back to the ditch irrigators. The last four rules are used to release the contents of all associated plan structures back to the river.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LCC.09	4323.00002	LCC Irrigators (0700547_I)	LCC Ditch (0700547)	LCC Irrigation Plan (LCC_IrrPln)	27
LCC.10	50350.00004	LCC Irrigators (0700547_I)	LCC Ditch (0700547)	Thornton LCC 02CW266 Plan (ThLCC02Pln)	27
LCCSpill.71	4323.00009	Lower Clear Ck Ditch (0700547)		LCC_SplPln	29
LCCSpill.72	4323.00009	Lower Clear Ck Ditch (0700547)		LCC_IrrPln	29
LCCSpill.73	50350.00009	Lower Clear Ck Ditch (0700547)		ThLCC89Pln	29
LCCSpill.74	50350.00009	Lower Clear Ck Ditch (0700547)		ThLCC02Pln	29

The following 10 rules are used to meet the return flow obligations associated with the various changes of use, either in priority via the Type 43 rules (6) or with reusable effluent (4). The final rule is used to release unused reusable effluent back to the river.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
ThornRF.01	55835.00000	ThChurchRFs			43
ThornRF.02	55835.00000	ThFHL_RFs			43
ThornRF.03	55835.00000	ThCoAg89RFs			43
ThornRF.04	55835.00000	ThCoAg02RFs			43

ThornRF.05	55835.00000	ThBurRFsYR			43
ThornRF.06	55835.00000	ThBurRFsSum			43
ThMetro.01	60000.00001	ThBurRFsSum		MetroTh	48
ThMetro.02	60000.00002	ThBurRFsYR		MetroTh	48
ThMetro.03	60000.00003	ThornSPRFs1		MetroTh	48
ThMetro.04	60000.00004	ThornSPRFs2		MetroTh	48
MetSpill.74	90000.00000	Metro WWTP (Metro_WWTP)		MetroTh	29

Storage Use

Thornton uses storage water from Standley Lake primarily in the winter with the interconnected West Gravel Lakes and East Gravel Lakes providing the majority of its summertime supply. The storage units are connected to two water treatment plants and are intertwined with the City's various direct flow rights. The City's supplies for Standley Lake are outlined in both Section 5.10.8.10 and Section 5.10.8.14 and the use of changed water rights, discussed above. The East Gravel Lakes (0203700) is composed of various lined mining cells (East Gravel Lakes #4, South Tani, North Dahlia, South Dahlia, and East Sprat Platte). East Gravel Lakes is represented at 17,500 acre-feet capacity with two accounts – one-time use and reuse. West Gravel Lakes (0203699) is aggregated with Brannan Lakes and is represented with a capacity of 3,400 acre-feet with four accounts – one-time use, reuse, and two Cosmic Bypass accounts (see Section 5.10.8.10.79). The following three rules divert the East Gravel Lakes water rights to storage through the Burlington Ditch. The next two rules divert the West Gravel Lakes water rights to storage through the Lower Clear Creek Ditch.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
EGL.01	47116.46368	East Gravel Lakes (0203700, Acct 1)	Burlington Canal (0200802)	0203700.01	45
EGL.02	51864.50687	East Gravel Lakes (0203700, Acct 1)	Burlington Canal (0200802)	0203700.02	45
EGL.03	51864.50687	East Gravel Lakes (0203700, Acct 1)	Burlington Canal (0200802)	0203700.03	45
WGL.01	48198.00000	(0203699, Acct 3)	Lower Clear Ck Ditch (0700547)	0203699.01	11
WGL.02	50477.00000	(0203699, Acct 3)	Lower Clear Ck Ditch (0700547)	0203699.02	11

The following four rules release water from the East Gravel Lakes to meet Thornton's demand from the one-time use account (2) and the reuse account (2). The next four rules release water from the

West Gravel Lakes to meet Thornton's demand from the one-time use account (2) and the reuse account (2). The priorities assigned to these rules are junior to the storage rights and the direct flow rights used to meet the municipal demands.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
EGL.04	51864.50688	Thornton Inside Use (02_Thorn_I)	Acct 1	East Gravel Lakes (0203700)	3
EGL.05	51864.50689	Thornton Outside Use (02_Thorn_O)	Acct 1	East Gravel Lakes (0203700)	3
EGL.06	51864.50688	Thornton Inside Use (02_Thorn_I)	Acct 2	East Gravel Lakes (0203700)	3
EGL.07	51864.50689	Thornton Outside Use (02_Thorn_O)	Acct 2	East Gravel Lakes (0203700)	3
WGL.06	19055.00003	Thornton Inside Use (02_Thorn_I)	WesBrownWTP	WGravelLks&Brannan (0203699), Account 4	3
WGL.07	19055.00003	Thornton Outside Use (02_Thorn_O)	WesBrownWTP	WGravelLks&Brannan (0203699), Account 4	3
WGL.08	19055.00003	Thornton Inside Use (02_Thorn_I)	WesBrownWTP	WGravelLks&Brannan (0203699), Account 3	3
WGL.09	19055.00003	Thornton Outside Use (02_Thorn_O)	WesBrownWTP	WGravelLks&Brannan (0203699), Account 3	3

Thornton's ownership in the FRICO system is represented with a single account in Standley Lake (Acct 4). The following first rule is used to store the Croke 1902 storage right into Thornton's account. The subsequent rules are used to release Standley Lake water to Thornton's inside use demand during the winter and summer, respectively. As a backup to ensure the water is available if the East Gravel Lakes and West Gravel Lakes supplies are insufficient, the Stan.25 is used to release the Standley Lake water to the outside use.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.31	19055.00001	StanPlnW StanPlnT StanPlnN StanPlnF	40.26% 14.71% 28.45% 16.58%	StanLimPln	46
Stan.24a	19054.99999	Thornton Inside Use (02_Thorn_I)	Thornton Standley PL (0200994)	Standley Lake (0203903), Account 4	32

Stan.24b	60000.00000	Thornton Inside Use (02_Thorn_I)	Thornton Standley PL (0200994)	Standley Lake (0203903), Account 4	32
Stan.25	60000.00000	Thornton Outside Use (02_Thorn_O)	Thornton Standley PL (0200994)	Standley Lake (0203903), Account 4	32
Stan.99	1.00000			Release Limit (Standley_RL)	47
Stan.33	19055.00001	Standley Lake (0203903), Account 2	Croke Canal (0700553)	StanPlnN	27

Other rules involving Thornton's account in Standley Lake include the storage of water by others pursuant to the 4 Way Agreement and the interplay of Cosmic Bypass water and West Gravel Lakes, as discussed in 5.10.8.10.78.

Additional Supplies

Water released from the Coors and Golden WWTPs during the winter (the Croke season) is typically stored in West Gravel Lakes (0203699). Thornton is entitled to a portion of the stored water (Golden Bypass and Coors Bypass), as discussed in Section 5.10.8.10.79.

5.10.8.13 City of Northglenn

The City of Northglenn is one of a number of municipalities that primarily use water from Clear Creek for its water supply. Northglenn currently receives about 70 percent of its water from FRICO-Standley supplies, part of which comes from an exchange of Northglenn WWTP effluent (stored in Bull Reservoir - 0203351) for water in Standley Lake owned by FRICO irrigators. The remainder of the supply comes from the Berthoud Pass Ditch and Church Ditch. The water district 2 supplies (Lupton Bottom Ditch, New Brantner Ditch, and Fulton Ditch) are used exclusively for replacement of return flow obligations. Replacements of Northglenn's winter return flow obligations are provided by Westminster reusable effluent.

Laramie Fox Hills water under the City limits was used to meet demands prior to the City expanding its supplies to include Standley Lake and various other ditch rights. The non-tributary well supplies are not represented in the model, which results in significant shortages simulated meet to Northglenn's demand prior to 1979.

All of Northglenn's wastewater returns at the Northglenn WWTP (Nglenn_WWTP) on Big Dry Creek. Northglenn's changed water rights are reusable and WWTP return flows from their use is accounted for in plan ID NglennReuse. Since the early-1980, Northglenn and FRICO have operated an exchange whereby Northglenn's effluent is stored in Bull Reservoir (0203551) for subsequent release to the FRICO irrigators in exchange for FRICO irrigators' water in Standley. There are a number of complexities related to this exchange regarding other return flow and replacement obligations. Attempts to develop a robust approach to simulating the exchange with the available StateMod operating rules was not successful. Therefore, the Northglenn-FRICO exchange is not represented in the SPDSS model.

All of Northglenn's water in Standley Lake is reusable and accounted for in plan ID StanReuseN. Representation of the use of changed water rights is consistent with standard approach outlined in Section 4.9. Most uses of the changed water rights generate return flow obligations, as discussed in Section 1.1.2. Return flow obligations that are out of priority are met with reusable supplies at the Northglenn WWTP or through a lease with the City of Westminster.

The operating rules used in the SPDSS model for representing Northglenn's operations are summarized below.

Transmountain Supplies

Northglenn shares the yield of the Berthoud Pass diversion (0704625) with the City of Golden. Golden gets the first 2 cfs between May through July and the first 4 cfs starting in August through the end of season. Northglenn gets the remainder of the water from the diversion.

Until the SPDSS model and western slope models are integrated, the transmountain supplies are set equal to historical deliveries. These supplies are operated in the model as the primary supply, which results in the use of all the imports to meet the Northglenn demand or stored in Standley Lake. The following three rules are used to supply Berthoud Pass imports directly to the Northglenn demands (2) and storage (1).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Berthoud.05	1.00001	Northglenn Inside Demand (02_Nglenn_I)	NglennBerthoudDivn (BerthNglenn) West Fk Clear Ck ISF (0702118_Dwn, R) CHURCH DITCH (0700540)	Berthoud Tunnel Carrier (Berthoud_C)	27
Berthoud.06	1.00002	Northglenn Outside Demand (02_Nglenn_0)	NglennBerthoudDivn (BerthNglenn) West Fk Clear Ck ISF (0702118_Dwn, R) CHURCH DITCH (0700540)	Berthoud Tunnel Carrier (Berthoud_C)	27
Berthoud.07	1.00003	Standley Lake (0203903), Account 2	NglennBerthoudDivn (BerthNglenn) West Fk Clear Ck ISF (0702118_Dwn, R) CHURCH DITCH (0700540)	Berthoud Tunnel Carrier (Berthoud_C)	27

Changed Water Rights

The first four rules listed below are used to store the Church Ditch (0700540) rights in the ChrchSplPln. The fifth rule is used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators, Arvada, Golden, Northglenn, Thornton, and Westminster).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Church.03	5538.00000	Church Ditch Split Plan 2 (ChrchSplPln)	100%, 35,000AF limit	0700540.02	26
Church.04	5615.00000	Church Ditch Split Plan 2 (ChrchSplPln)	100%, 35,000AF limit	0700540.03	26
Church.05	10184.00000	Church Ditch Split Plan 2 (ChrchSplPln)	100%, 35,000AF limit	0700540.04	26
Church.06	10546.00000	Church Ditch Split Plan 2 (ChrchSplPln)	100%, 35,000AF limit	0700540.05	26
Church.07	10546.00001	Arvada Church Plan (ArvChPln) Golden Church Plan (GoldChPln) Northglenn Church Plan (NglennChPln) Thornton Church Plan (ThChurchPln) Westminster Church Plan (WestyChPln) Church Ditch Irrigation Plan (ChrchIrrPln)	17.9% 1.3% 8.1% 7.8% 52.1% 12.8%	Church Ditch Split Plan 2 (ChrchSplPln)	46

Northglenn's prorata ownership (8.1%) is stored in model ID NglennChPln. The first three rules listed below are used to release the plan yield and convey the water via the Church Ditch to the Northglenn demand (2) and its account in Standley Lake (1). The fourth rule listed below establishes limits on Northglenn's use of its changed Church Ditch shares based on decretal terms and conditions (Case Nos. W8445-76, 79CW234, 79CW235, 79CW236, 82CW056 and 82CW057).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Church.08	10546.00002	Northglenn Inside Demand (02_Nglenn_I)	Church Ditch (0700540)	NglennChPln	27
Church.09	10546.00003	Northglenn Outside Demand (02_Nglenn_0)	Church Ditch (0700540)	NglennChPln	27
Church.10	10546.00004	Standley Lake (0203903), Account 2	Church Ditch (0700540)	NglennChPln	27
Church.97	1.00000			Church NG RL	47

				(ChrchNg_RL)	

The representation of the volumetrics in the SPDSS model is such that there would be no remaining volumetrics that would allow changed use of the 1881 and 1886 priority Church water rights. Therefore, the yield for those two rights is stored in the ChrchIrrPln for use by the irrigators using the following two rules.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Church.20	11647.00000	Church Ditch Irrigation Plan (ChrchIrrPln)	100%, 35,000AF limit	0700540.06	26
Church.21	16718.13224	Church Ditch Irrigation Plan (ChrchIrrPln)	100%, 49,000AF limit	0700540.09	26

The following seven rules release water to the Church irrigation demand from its prorata water rights ownership (plan ID ChrchIrrPln) and unused credits in the municipal changed water rights plans. The last nine rules release any remaining unused credits in various plans back to Clear Creek.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Church.22	16718.13225	Church Ditch Irrigators (0700540_I)	Church Ditch (0700540)	Church Ditch Irrigation Plan (ChrchIrrPln)	27
Church.23	16718.13227	Church Ditch Irrigators (0700540_I)	Church Ditch (0700540)	Thornton Church Plan (ThChurchPln)	27
Church.24	16718.13227	Church Ditch Irrigators (0700540_I)	Church Ditch (0700540)	Westminster Church Plan (WestyChPln)	27
Church.25	16718.13227	Church Ditch Irrigators (0700540_I)	Church Ditch (0700540)	Northglenn Church Plan (NglennChPln)	27
Church.26	16718.13227	Church Ditch Irrigators (0700540_I)	Church Ditch (0700540)	Golden Church Plan (GoldChPln)	27
Church.27	54055.00003	Church Ditch Irrigators (0700540_I)	Church Ditch (0700540)	Arvada Church Plan (ArvChPln)	27
Church.28	16718.13227	Church Ditch Irrigators	Church Ditch (0700540)	Coors Church Plan	27

		(0700540_I)		(CoorsChPln)	
ChSpill.71	4535.00009	Church Ditch (0700540)		ChrchSplPl1	29
ChSpill.72	10546.00009	Church Ditch (0700540)		ChrchSplPln	29
ChSpill.73	16718.13229	Church Ditch (0700540)		ChrchIrrPln	29
ChSpill.74	54055.00009	Church Ditch (0700540)		ArvChPln	29
ChSpill.75	16718.13229	Church Ditch (0700540)		CoorsChPln	29
ChSpill.76	16718.13229	Church Ditch (0700540)		GoldChPln	29
ChSpill.77	16718.13229	Church Ditch (0700540)		NglennChPln	29
ChSpill.78	16718.13229	Church Ditch (0700540)		ThChurchPln	29
ChSpill.79	16718.13229	Church Ditch (0700540)		WestyChPln	29

Use of the Church Ditch credits generates return flow obligations accounted for in Plan ID NglnBDCRFs. The following Type 43 rules are used to meet the return flow obligations, in priority, based on terms and conditions identified in the change of use decree. The last rule is used to make winter replacements with reusable effluent from the City of Westminster.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
NglennRF.01	48274.00000	NglnBDCRFs			43
NglennRF.02	48274.10000	NglnFulRFs			43
NglWest.01	55150.10001	Nglenn Big Dry Ck RFs (NglnBDCRFs)		Westminster Reuse Plan (WestyReuse)	48

CU credits from Northglenn's share ownership in the Fulton Ditch (0200808) and Lupton Bottom Ditch (0200812) are used to meet summertime return flow obligations. Direct flow rights in the Fulton Ditch are first stored in a changed water rights split plan structure (FulSplPln). The following three rules are used to put the Fulton water rights into the FulSplPln based on the standard approach used to represent changed water rights, as outlined in Section 4.9. The fourth rule is used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators, SACWSD, Brighton, Northglenn, and Central Colorado WCD). Northglenn's prorata ownership (2%) is stored in model ID NglnFulPln. The last four rules release irrigation ditch credits or unused credits back to the ditch irrigators.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Fulton.01	5600.00000	FulSplPln	100%	0200808.01	26
Fulton.02	9686.00000	FulSplPln	100%	0200808.02	26
Fulton.03	10901.00000	FulSplPln	100%	0200808.03	26
Fulton.04	10901.00002	FulIrrPln SAC_FulPln BriFulPln NglnFulPln CenFulPln	73.5% 6.2% 16.2% 2.0% 2.1%	FulSplPln	46
Fulton.05	10901.00003	Fulton Irrigation (0200808_I)	Fulton Ditch (0200808)	FulIrrPln	27
SACFul.01	55498.90000	Fulton Irrigation (0200808_I)	Fulton Ditch (0200808)	SAC_FulPln	27
BriFul.01	45655.70002	Fulton Irrigation (0200808_I)	Fulton Ditch (0200808)	BriFulPln	27
CCWCDFul.01	66000.99999	Fulton Irrigation (0200808_I)	Fulton Ditch (0200808)	CenFulPln	27

Direct flow rights in the Lupton Bottoms Ditch are first stored in a changed water rights split plan structure (LB_SplPln). The following rules are used to put the LB water rights into the LB_SplPln. The last is used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators, SACWSD, Central Colorado WCD, PBSCo, and Northglenn). Northglenn's prorata ownership (8.3%) is stored in model ID NglennLBPln.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LB.01	4883.00000	LB_SplPln	100%	0200812.01	26
LB.02	8659.00000	LB_SplPln	100%	0200812.03	26
LB.03	8659.00002	LB_IrrPln SAC_LBPln CenLBPln PSCoLBPln	75.2% 8.6% 6.9% 1.0%	LB_SplPln	46

		NglennLBPln	8.3%		

The following rules are used to make replacements for the return flow obligations from the changed water rights in the Fulton Ditch (7) and Lupton Bottoms Ditch (7). Rules are included for each of the summer months so that variable CU factors with the changed rights are represented. The release limit rules listed below establish limits on Northglenn's use of its changed Fulton Ditch and Lupton Bottoms Ditch shares, respectively, based on volumetric limits from the change of use decrees.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
NglFul.99	1.00000			NGlenn Fulton RL (NglnFul_RL)	47
NglFul.01a-g	48274.00002	Nglenn Big Dry Ck RFs (NglnBDCRFs)	Fulton Ditch (0200808) Fulton Aug Station (0200808_A) Brantner Ditch (0200809, R)	NglnFulPln	27
NglLB.99	1.00000			NGlenn LB RL (NglennLB_RL)	47
NglLB.01a-g	48274.30000	Nglenn Big Dry Ck RFs (NglnBDCRFs)	Lupton Bottom Ditch (0200812) Lupt Btm Aug Stn (0200812_A)	NglennLBPln	27

Use of credits in the Fulton Ditch and Lupton Bottoms Ditch also generates return flow obligations accounted for in Plan IDs NglnFulRFs and NglennLBRFs. The following rules are used to meet the return flow obligations, either in priority via the Type 43 rules (2) or with reusable effluent via the latter two rules.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
NglFul.01	48274.20000	Fulton Irrigation (0200808_I)	Fulton Ditch (0200808)	NglnFulPln	27
NglLB.01	48274.40000	Lupton Button Irrigation (0200812_I)	Lupton Bottom Ditch	NglennLBPln	27

			(0200812)		
ChSpill.77	16718.13229	Church Ditch (0700540)		NglennChPln	29
FulSpill.75	48274.20009	Fulton Ditch (0200808)		NglnFulPln	29
LB_Spill.73	48274.40009	Lupton Bottom Ditch (0200812)		NglennLBPln	29
NglnWWSpl.71	90000.00000	Northglenn WWTP (Nglenn_WWTP)		NglennReuse	29
NglLB.02	48275.00000	NglennLBRFs		NglennReuse	48

Any remaining return flow obligations on Big Dry Creek are met during the winter via Westminster's reusable effluent pursuant to an agreement between the two cities.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
NglWest.01	55150.10001	Nglenn Big Dry Ck RFs (NglnBDCRFs)		Westminster Reuse Plan (WestyReuse)	48

The following six rules are used to release any remaining ditch credits back to the ditch irrigators (3), and then released back to the river (3). The seventh rule below releases any unused reusable effluent back to the river.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Church.25	16718.13227	Church Ditch Irrigators (0700540_I)	Church Ditch (0700540)	Northglenn Church Plan (NglennChPln)	27
NglFul.01	48274.20000	Fulton Irrigation (0200808_I)	Fulton Ditch (0200808)	NglnFulPln	27
NglLB.01	48274.40000	Lupton Button Irrigation (0200812_I)	Lupton Bottom Ditch (0200812)	NglennLBPln	27
ChSpill.77	16718.13229	Church Ditch (0700540)		NglennChPln	29
FulSpill.75	48274.20009	Fulton Ditch (0200808)		NglnFulPln	29
LB_Spill.73	48274.40009	Lupton Bottom Ditch (0200812)		NglennLBPln	29
NglnWWSpl.71	90000.00000	Northglenn WWTP (Nglenn_WWTP)		NglennReuse	29

Storage Releases

Northglenn's ownership in the FRICO system is represented with a single account in Standley Lake (Acct 2). Pursuant to the 4 Way Agreement, Northglenn also can store water in the accounts owned by Westminster (Acct 1) and Thornton (Acct 4) (see Section 5.10.8.10.78). The following six rules are used to release water from Standley Lake to meet Northglenn's demand from either the 4 Way accounts in PhantomStand (4) or from Northglenn's account in Standley Lake (2).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.06	19054.99998	Northglenn Indoor Use (02_Nglenn_I)	Northglenn Standley PL (0200993)	PhantomStand, Account 1	3
Stan.07	19054.99998	Northglenn Indoor Use (02_Nglenn_I)	Northglenn Standley PL (0200993)	PhantomStand, Account 4	3
Stan.08	19054.99998	Northglenn Outdoor Use (02_Nglenn_O)	Northglenn Standley PL (0200993)	PhantomStand, Account 1	3
Stan.09	19054.99998	Northglenn Outdoor Use (02_Nglenn_O)	Northglenn Standley PL (0200993)	PhantomStand, Account 4	3
Stan.20	19054.99999	Northglenn Indoor Use (02_Nglenn_I)	Northglenn Standley PL (0200993)	Standley Lake (0203903), Account 2	32
Stan.21	19054.99999	Northglenn Outdoor Use (02_Nglenn_O)	Northglenn Standley PL (0200993)	Standley Lake (0203903), Account 2	32

Additional Supplies

Water released from the Coors and Golden WWTPs during the winter (the Croke season) is typically stored in West Gravel Lakes (0203699). Northglenn is entitled to a portion of the stored water (Golden Bypass and Coors Bypass), as discussed in Section 5.10.8.10.79. Northglenn's Bypass water is accounted for in plan IDs CosCoExcNg and CosGoExcNg. The four rules listed below are used to release the Bypass Water to the Northglenn demand via the Croke Canal. The next two rules are used to release the Bypass Water to storage in Northglenn's account in Standley Lake. The last two rules release any unused Bypass Water back to Clear Creek.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.14	19055.00004	Northglenn Indoor Use	Croke Canal	CosCoExcNg	27

		(02_Nglenn_I)	(0700553)		
Cosmic.15	19055.00004	Northglenn Outdoor Use (02_Nglenn_O)	Croke Canal (0700553)	CosCoExcNg	27
Cosmic.27	19055.00004	Northglenn Indoor Use (02_Nglenn_I)	Croke Canal (0700553)	CosGoExcNg	27
Cosmic.28	19055.00004	Northglenn Outdoor Use (02_Nglenn_O)	Croke Canal (0700553)	CosGoExcNg	27
Cosmic.21	19055.00004	Standley Lake (0203903), Account 3	Croke Canal (0700553)	CosCoExcNg	27
Cosmic.30	19055.00004	Standley Lake (0203903), Account 3	Croke Canal (0700553)	CosGoExcNg	27
CosmcSpl.79	50404.00009	Croke Canal (0700553)		CosCoExcNg	29
CosmcSpl.82	50404.00009	Croke Canal (0700553)		CosGoExcNg	29

5.10.8.14 FRICO-Standley Lake Irrigators

The FRICO-Standley Lake Division has provided water to a variety of ditches along Big Dry Creek for irrigation. These structures include the Whipple Ditch (aka Bull Canal, 0200871), German Ditch (0200872), Big Dry Creek Ditch (0200873), and Yoxall Ditch (0200874). The Whipple Ditch has been the primary beneficiary of water from Standley Lake, according to records in HydroBase and an August 1990 Tipton & Kalmbach engineering report developed to support City of Westminster water court Case Nos. 86CW397, 88CW267, and 89CW129

The irrigators' ownership in the FRICO system is represented with a single account in Standley Lake (Acct 3). The following four rules are used to release water from the FRICO storage account to the irrigation demands.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.26	19055.00008	Whipple D (Bull Canal) (0200871)		Standley Lake (0203903), Account 3	2
Stan.27	19055.00008	German Ditch (0200872)		Standley Lake (0203903), Account 3	2
Stan.28	19055.00008	Big Dry Ck Ditch (0200873)		Standley Lake (0203903), Account 3	2
Stan.29	19055.00008	Yoxall Ditch (0200874)		Standley Lake (0203903), Account 3	2

The size of storage accounts is fixed. Therefore, even though the lake was essentially used exclusively by irrigators through the 1960s and most of the 1970s, the FRICO account of 2,228 acre-feet, is representative of more current conditions. To provide sufficient water to meet the irrigation demands in the earlier part of the 1950-2012 study period, the following 12 rules are used to supply irrigation demands. These rules cease in 1978.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.20a	19056.00000	Whipple D (Bull Canal) (0200871)		Standley Lake (0203903), Account 2	32
Stan.20b	19056.00000	German Ditch (0200872)		Standley Lake (0203903), Account 2	32
Stan.20c	19056.00000	Big Dry Ck Ditch (0200873)		Standley Lake (0203903), Account 2	32
Stan.20d	19056.00000	Yoxall Ditch (0200874)		Standley Lake (0203903), Account 2	32
Stan.22a	19056.00000	Whipple D (Bull Canal) (0200871)		Standley Lake (0203903), Account 1	32
Stan.22b	19056.00000	German Ditch (0200872)		Standley Lake (0203903), Account 1	32
Stan.22c	19056.00000	Big Dry Ck Ditch (0200873)		Standley Lake (0203903), Account 1	32
Stan.22d	19056.00000	Yoxall Ditch (0200874)		Standley Lake (0203903), Account 1	32
Stan.24b	19056.00000	Whipple D (Bull Canal) (0200871)		Standley Lake (0203903), Account 4	32
Stan.24c	19056.00000	German Ditch (0200872)		Standley Lake (0203903), Account 4	32
Stan.24d	19056.00000	Big Dry Ck Ditch (0200873)		Standley Lake (0203903), Account 4	32
Stan.24e	19056.00000	Yoxall Ditch (0200874)		Standley Lake (0203903), Account 4	32

Pursuant to the 4 Way Agreement, FRICO irrigators also have the ability to store water in the accounts owned by Westminster (Acct 1) and Thornton (Acct 4) (see Section 5.10.8.10.78). The following six rules are used to release water from Standley Lake to meet the FRICO irrigation demand from the 4 Way accounts in PhantomStand.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Stan.12	19054.99998	Whipple D (Bull Canal) (0200871)		PhantomStand, Account 2	3
Stan.13	19054.99998	German Ditch (0200872)		PhantomStand, Account 2	3
Stan.14	19054.99998	Big Dry Ck Ditch (0200873)		PhantomStand, Account 2	3
Stan.15	19054.99998	Yoxall Ditch (0200874)		PhantomStand, Account 2	3
Stan.16	19054.99998	Whipple D (Bull Canal) (0200871)		PhantomStand, Account 5	3
Stan.17	19054.99998	German Ditch (0200872)		PhantomStand, Account 5	3
Stan.18	19054.99998	Big Dry Ck Ditch (0200873)		PhantomStand, Account 5	3
Stan.19	19054.99998	Yoxall Ditch (0200874)		PhantomStand, Account 5	3

Additional Supplies

Water released from the Coors and Golden WWTPs during the winter (the Croke season) is typically stored in West Gravel Lakes (0203699). The FRICO irrigators are entitled to a portion of the stored water (Coors Bypass only), as discussed in Section 5.10.8.10.79. FRICO irrigators' Bypass water is accounted for in plan ID CosCoExcFR. The four rules listed below are used to release the Bypass Water to the FRICO demand via the Croke Canal. The last rule is used to release any unused Bypass Water back to Clear Creek.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Cosmic.16	19055.00004	Whipple D (Bull Canal) (0200871)	Croke Canal (0700553)	CosCoExcFR	27
Cosmic.17	19055.00004	German Ditch (0200872)	Croke Canal (0700553)	CosCoExcFR	27
Cosmic.18	19055.00004	Big Dry Ck Ditch (0200873)	Croke Canal (0700553)	CosCoExcFR	27
Cosmic.19	19055.00004	Yoxall Ditch (0200874)	Croke Canal (0700553)	CosCoExcFR	27
CosmcSpl.78	50404.00009	Croke Canal (0700553)		CosCoExcFR	29

5.10.8.15 City of Brighton

The City of Brighton uses tributary wells to supply its municipal demands. Lagged depletions from well pumping impact the river and are accounted at the Brighton well augmentation plan (9902541) during model simulation. The following Type 43 rule is used to meet the replacement requirements, in priority, based on the most junior water right assigned to the City of Brighton's wells:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
9902541.01	43947.00001	Brighton Aug Plan (9902541)			43

Out-of-priority well depletions are replaced with reusable credits from the City of Brighton's changed Fulton Ditch shares. Currently, StateMod is not able to simulate changed water rights as a supply to meet augmentation plan depletions using the standard plan release operating rules (Type 27 or 28). Therefore, changed water rights are “routed” through a recharge area in order to make them available for to an augmentation plan. This is achieved by using an “immediate” delay pattern (i.e., Pattern 4; water is returned in the same time-step) for the recharge areas included on the ditches with the changed water rights.

Direct flow rights in the Fulton Ditch are first stored in a changed water rights split plan structure (FulSplPln). The following three rules are used to put the Fulton water rights into the FulSplPln based on the standard approach used to represent changed water rights, as outlined in Section 4.9. The fourth rule is used to split the Plan yield, prorata, to the sub-plans of the various owners of the ditch shares (irrigators, SACWSD, Brighton, Northglenn, and Central Colorado WCD).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Fulton.01	5600.00000	FulSplPln	100%	0200808.01	26
Fulton.02	9686.00000	FulSplPln	100%	0200808.02	26
Fulton.03	10901.00000	FulSplPln	100%	0200808.03	26
Fulton.04	10901.00002	FulIrrPln SAC_FulPln BriFulPln NglnFulPln CenFulPln	73.5% 6.2% 16.2% 2.0% 2.1%	FulSplPln	46

Brighton’s prorata ownership (16.2%) is stored in model ID BriFulPln. The following rules are used to route the plan yield to the recharge area ID 0200808_RB. Rules are included for each of the summer months so that variable CU factors with the changed rights are represented. The administration numbers are junior to the Type 43 rule 9902541.01 so the changed rights are only used if out-of-priority well depletions exist. The first rule listed below establishes limits on Brighton’s use of its changed Fulton Ditch shares based on the monthly and annual average farm headgate delivery volumetric limits from Case Nos. 04CW0174 and 00CW202.

Right ID	Admin #	Destination	Account, Carrier, Return Location	Source	Right Type

			(R), or % Split		
BriFul.99	1.00000			Brighton Fulton RL (BriFul_RL)	47
BriRepl.01a-g	45655.60000	Bright Fulton HCU Sto (0200808_RB)	Fulton Ditch (0200808) Fulton Aug Station (0200808_A)	BriFulPln	27

The 0200808_RB recharge area is associated with the reservoir plan ID 9902541_PlR in the <SP2016.plr> file. The recharge accretions from 9902541_PlR (used to represent the Fulton CU credits) are released to meet out-of-priority well depletions in the following rule:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BriRepl.02	45655.70000	Brighton Aug Plan (9902541)		Brighton Aug Plan RA Recharge (9902541_PlR)	48

Use of the Fulton Ditch credits for replacements generates terms and conditions accounted for in Plan ID BriFulRFs. Any remaining recharge accretions from 9902541_RlR are released to meet the Fulton Ditch return flows in the following rule.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BriRepl.03	45655.700001	BriFulRFs		Brighton Aug Plan RA Recharge (9902541_PlR)	49

Any unused Fulton credits are released back to the ditch irrigators, and ultimately released back to the river using the following rules.

Right ID	Admin #	Destination	Account, Carrier, Return Location	Source	Right Type

			(R), or % Split		
BriFul.01	45655.70002	Fulton Irrigation (0200808_I)	Fulton Ditch (0200808)	BriFulPln	27
FulSpill.74	45655.70009	Fulton Ditch (0200808)		BriFulPln	29

5.10.8.16 South Adam County Water Sanitation District

The South Adams County Water and Sanitation District (SACWSD) uses tributary wells to supply its municipal demands. Currently, StateMod is not able to simulate surface water deliveries to well demands. Therefore, Denver Water contract deliveries to SACWSD (2,000 acre-feet per year) are not represented.

Lagged depletions from well pumping impact the river and are accounted at the SACWSD well augmentation plan (9902502) during model simulation. The following Type 43 rule is used to meet the replacement requirements, in priority, based on the most junior water right assigned to the City of SACWSD's wells.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
9902502.01	53853.00001	SACWSD Aug Plan (9902502)			43

Out-of-priority well depletions are replaced with recharge accretions from the Ford Recharge Facility (02002003_R), located off of the Burlington Ditch (0200802). The recharge facility is filled, in priority, using the following Type 45 rule. Deliveries are limited to 400 acre-feet per month using the Type 47 rule.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
02020030.01	1.00000			Ford Res RL (0202003_RL)	47
02020030.02	49673.49271	SACWSD Ford Recharge (0202003_R)	Burlington Canal (0200802) FordRechargeDivn (2003)	0200802.19	45

Accretions from the recharge facility are used to make replacements to out-of-priority well depletions via the following rule.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
02020030.03	55498.10000	SACWSD Aug Plan (9902502)		Ford RA Recharge (0202003_PlR)	48

As outlined in Section 5.10.8.17, the changed water rights in the Burlington Ditch are stored in four plan IDs and then distributed to the various owners of the water rights. The first rule establishes limits on the use of SACWSD's changed Burlington Ditch water based on decretal terms and conditions (W-8440-76, 2001CW258, and 10CW304). The Ford Recharge facility is also filled with SACWSD's changed Burlington Ditch shares, which are stored in the Plans IDs SABur10Pln, SAWell7Pln, SASanstPln, and SA200_85Pln. The last four rules are used to store the Burlington yield in the Ford Recharge Facility.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SACBurl.99	1.00000			SACWSD Plan Release Limit - SACBurl_RL	47
SAC_Burl.02	5205.00001	SACWSD Ford Recharge (0202003_R)	Burlington Canal (0200802) Ford Recharge Diversion (2003)	SABur10Pln	27
SAC_Burl.03	5205.00002	SACWSD Ford Recharge (0202003_R)	Burlington Canal (0200802) Ford Recharge Diversion (2003)	SAWell7Pln	27
SAC_Burl.04	5205.00003	SACWSD Ford Recharge (0202003_R)	Burlington Canal (0200802) Ford Recharge Diversion (2003)	SASanstPln	27
SAC_Burl.05	13108.00001	SACWSD Ford Recharge (0202003_R)	Burlington Canal (0200802) Ford Recharge Diversion (2003)	SA200_85Pln	27

The rules that release to the Ford Recharge pit are carried through the Burlington Ditch (0200802) and the turnout from the Burlington Ditch to the Ford Recharge pit (2003). A ditch loss of 10 percent is included for water carried in the Burlington Canal to SACWSD (2003). Return flows are calculated consistent with SACWSD's change decrees and depend on the direct flow right diverted. For the 10.28 cfs and 200 cfs rights, the return flow obligation is a constant rate throughout the year equal to a total of 31% of the average annual delivery over the previous 20 years. This annual obligation of 31% equates to 2.6% per month, however, since return flow obligations in the SPDSS model are calculated based on river headgate diversions, the return flow obligation was reduced to 2.3% per month to account for the 10% ditch loss from the headgate to SACWSD's turnout. The return flow obligation for the 7.987 cfs right is 65% of the farm headgate delivery. This return flow obligation was reduced to 58.5% (consumptive use of 41.5%) per month to account for the 10% ditch loss to SACWSD's turnout. The return flow obligation for the 6.0 cfs right is 100% of the farm headgate delivery. For the 103.045 Burlington and 134.545 Wellington shares that SACWSD changed in Case No. W-8440-76, the return flow obligations average 21.5 ac-ft/month regardless of which water right is diverted. To simplify the SPDSS model, the return flow obligations for those shares are calculated in a similar manner to SACWSD's later change cases.

Reusable credits from changed shares in other ditch companies (Fulton, Brighton, Lupton Bottoms, Lupton Meadows, and Meadow Island No. 1) are also used for replacement. Currently, StateMod is not able to simulate changed water rights as a supply to meet augmentation plan depletions using the standard plan release operating rules (Type 27 or 28). Therefore, changed water rights are "routed" through a recharge area in order to make them available for to an augmentation plan. This is achieved by using an "immediate" delay pattern (i.e., Pattern 4; water is returned in the same time-step) for the recharge areas included on the ditches with the changed water rights.

Direct flow rights in the various ditch systems are first stored in changed water rights split plan structures (FulSplPln, BriSplPln, LB_SplPln, LM_SplPln, and MI1SplPln). The following rules are used to put the water rights into the split plans based on the standard approach used to represent changed water rights, as outlined in Section 4.9. The rule names correspond with the particular ditches and the last rule for each ditch is used to split the Plan yields, prorata, to the sub-plans of the various owners of the ditch shares. SACWSD's prorata ownership in the various ditch plans is included in the table below:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Fulton.01	5600.00000	FulSplPln	100%	0200808.01	26
Fulton.02	9686.00000	FulSplPln	100%	0200808.02	26
Fulton.03	10901.00000	FulSplPln	100%	0200808.03	26
Fulton.04	10901.00002	FulIrrPln SAC_FulPln BriFulPln NglnFulPln CenFulPln	73.5% 6.2% 16.2% 2.0% 2.1%	FulSplPln	46
LB.01	4883.00000	LB_SplPln	100%	0200812.01	26
LB.02	8659.00000	LB_SplPln	100%	0200812.03	26
LB.03	8659.00002	LB_IrrPln SAC_LBPln CenLBPln PSCoLBPln NglennLBPln	75.2% 8.6% 6.9% 1.0% 8.3%	LB_SplPln	46

LM.01	7739.00000	LM_SplPln	100%	0200812.02	26
LM.02	7739.00002	LB_IrrPln SAC_LMPln CenLMPln PSCoLMPln	79.8% 16.6% 1.7% 1.9%	LM_SplPln	46
MdwIsl1.01	5965.00000	MI1SplPln	100%	0200821.01	26
MdwIsl1.02	11807.00000	MI1SplPln	100%	0200821.02	26
MdwIsl1.03	11807.00002	MI1IrrPln SAC_MI1Pln	93.5% 6.5%	MI1SplPln	46

The following seven rules are used to route the plan yield to the recharge area IDs 0200808_RS, 0200810_RS, 0200812_RS, and 0200821_RS. Rules are included for each of the summer months so that variable CU factors with the changed rights are represented. The administration numbers are junior to the Type 43 rule 9902502.01 so the changed rights are only used if out-of-priority well depletions exist. The last rule listed for each ditch establishes limits on SACWSD's use of its changed ditch shares based on the monthly and annual average farm headgate delivery volumetric limits from the appurtenant change cases.

Fulton Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SACFul.99	1.0000			SAC Fulton RL (SACFul_RL)	47
SACRepl.01a-g	55498.20000	SACWSD Fulton HCU Sto (0200808_RS)	Fulton Ditch (0200808) Fulton Aug Station (0200808_A)	SACFulPln	27

Brighton Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SACBri.99	1.00000			SAC Brighton RL (SACBri_RL)	47
SACRepl.02a-g	55498.30006	SACWSD Brighton HCU Sto (0200810_RS)	Brighton Ditch (0200810) Brighton Aug Stn (0200810_A)	SAC_BriPln	27

Lupton Bottoms Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or	Source	Right Type

			% Split		
SACLB.99	1.00000			SAC LB RL (SACLB_RL)	47
SACRepl.03a-g	55498.40005	SACWSD LuptBtm HCU Sto (0200812_RS)	Lupton Bottom Ditch (0200812) Lupt Btm Aug Stn (0200812_A)	SAC_LBRFs	27

Lupton Meadows Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SACLM.99	1.00000			SAC PV RL (SACLM_RL)	47
SACRepl.04a-g	55498.50000	SACWSD LuptBtm HCU Sto (0200812_RS)	Lupton Bottom Ditch (0200812) Lupt Btm Aug Stn (0200812_A)	SAC_LMPln	27

Meadow Island Ditch No. 1

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SACMI1.99	1.00000			Meadow Island 1 RL (SACMI1_RL)	47
SACRepl.05a-g	55498.60006	SACWSD MI 1 HCU Sto (0200821_RS)	Meadow Island No. 1 Ditch (0200821) Mdw Isl 1 Aug Stn (0200821_A)	SAC_MI1Pln	27

The four 0200808_RS, 0200810_RS, 0200812_RS, and 0200821_RS recharge areas are associated with the reservoir plan ID 9902502_PlR in the <SP2016.plr> file. The recharge accretions from 9902502_PlR (used to represent the changed ditch credits, in aggregate) are released to meet out-of-priority well depletions in the following rule:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SACRepl.06	55498.20000	SACWSD Aug Plan (9902502)		SACWSC RA Recharge (9902502_PlR)	48
SACRepl.07	55498.20001	SAC_FulRFs		SACWSC RA Recharge (9902502_PlR)	49
SACRepl.08	55498.20002	SAC_BriRFs		SACWSC RA Recharge (9902502_PlR)	49
SACRepl.09	55498.20003	SAC_LBRFs		SACWSC RA Recharge (9902502_PlR)	48

SACRepl.10	55498.20004	SAC_MI1RFs		SACWSC RA Recharge (9902502_PlR)	48

Use of the ditch credits for replacements generates terms and conditions accounted for in Plan IDs SABurRFsSum, SABurRFsYR, SAC_FulRFs, SAC_BriRFs, SAC_LBRFs, and SAC_MI1RFs. Any Ford Recharge credits not used to meet well depletions are used to meet the various return flow obligations using the following rules:

Right ID	Admin #	Dstination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
02020030.04	55498.10001	SAC_FulRFs		Ford RA Recharge (0202003_PlR)	48
02020030.05	55498.10002	SAC_BriRFs		Ford RA Recharge (0202003_PlR)	48
02020030.06	55498.10003	SAC_LBRFs		Ford RA Recharge (0202003_PlR)	48
02020030.07	55498.10004	SAC_MI1RFs		Ford RA Recharge (0202003_PlR)	48
02020030.08	55498.10005	SABurRFsYR		Ford RA Recharge (0202003_PlR)	48
02020030.09	55498.10006	SABurRFsSum		Ford RA Recharge (0202003_PlR)	48

The following 20 rules are used to release any remaining ditch credits back to the ditch irrigators (11), and then released back to the river (9):

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SAC_Burl.06	5205.00002	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	SABur10Pln	27
SAC_Burl.07	5205.00003	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	SAWell7Pln	27
SAC_Burl.08	5205.00004	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	SASanstPln	27
SAC_Burl.09	13108.00002	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	SA200_85Pln	27
SAC_Burl.10	13108.00003	Barr Irrigators (0203837_I)	Burlington Canal (0200802)	SA200_85Pln	27
SAC_Burl.11	13108.00004	Barr Irrigators (0203837_I)	Burlington Canal (0200802) Denver Hudson Canal (0200805)	SA200_85Pln	27

SACFul.01	55498.90000	Fulton Irrigation (0200808_I)	Fulton Ditch (0200808)	SAC_FulPln	27
SACBri.01	55498.90001	Brighton Irrigation (0200810_I)	Brighton Ditch (0200810)	SAC_BriPln	27
SACLB.01	55498.90002	Lupton Button Irrigation (0200812_I)	Lupton Bottom Ditch (0200812)	SAC_LBPln	27
SACLM.01	55498.90003	Lupton Button Irrigation (0200812_I)	Lupton Bottom Ditch (0200812)	SAC_LMPln	27
SACMI1.01	55498.90005	Meadow Island No. 1 (0200821)		SAC_MI1Pln	27
BurSpill.72	5205.00009	Burlington Canal (0200802)		SABur10Pln	29
BurSpill.76	5205.00009	Burlington Canal (0200802)		SASanstPln	29
BurSpill.80	5205.00009	Burlington Canal (0200802)		SAWell7Pln	29
BurSpill.84	13108.00009	Burlington Canal (0200802)		SA200_85Pln	29
FulSpill.73	55498.90009	Fulton Ditch (0200808)		SAC_FulPln	29
BriSpill.73	55498.90009	Brighton Ditch (0200810)		SAC_BriPln	29
LB_Spill.75	55498.90009	Lupton Bottom Ditch (0200812)		SAC_LBPln	29
LM_Spill.72	55498.90009	Lupton Bottom Ditch (0200812)		SAC_LMPln	29
MI1Spill.73	55498.90009	Meadow Island No. 1 (0200821)		SAC_MI1Pln	29

5.10.8.17 Burlington Ditch System

The primary entities in the Burlington Ditch system are the Burlington Ditch, Reservoir, and Land Company (BDRLC); the Farmers Reservoir and Irrigation Company (FRICO); and the Henrylyn Irrigation District (HID). These companies have direct flow and storage water rights for water diverted at the Burlington Ditch. These rights were originally designed to serve irrigators; however, municipal suppliers have acquired shares in the BDRLC and FRICO. Water is diverted through the Burlington Ditch (0200802) for irrigation of lands located east of the South Platte River and for storage primarily in Barr Lake (02003837) and Horse Creek and Prospect Reservoirs (aggregated at 0103592).

The first primary entity in the Burlington Ditch system is BDRLC. Because some of the company's shareholders do not have access to storage in Barr Lake, there are two divisions. The Little Burlington Division's shareholders are served only by direct flow water, and the O'Brian Division shareholders are served by storage and direct flow water. To provide storage for the Little Burlington Division, the Wellington Reservoir Company was associated with the BDRLC. The Wellington Reservoir Company owns Wellington Reservoir, which is located upstream on Buffalo Creek. In addition, Duck (Altura) Lake, became a BDRLC asset for the Little Burlington Division. Both reservoirs are in the North Fork of the South Platte River Basin and are not explicitly represented in the SPDSS model.

The second primary entity in the Burlington Ditch system is FRICO. FRICO has four divisions, each centered on a reservoir. In addition to Barr Lake, the other divisions are Milton Lake, Standley Lake, and Marshall Lake

The third primary entity in the Burlington Ditch system is HID. The primary water supply of the HID is carried by the Denver-Hudson Canal, which is an extension of the Burlington Ditch. HID's main storage facilities include Horse Creek and Prospect reservoirs.

Some of the shares in BDRLC and FRICO have been purchased by municipal suppliers. Those with significant ownership in these companies include Thornton, South Adams County Water and Sanitation District (SACWSD), Brighton, and East Cherry Creek Valley Water and Sanitation District (ECCV). The Burlington Ditch headgate is an exchange point for Denver Water's reusable effluent from the Metro Denver Wastewater Reclamation Plant. The Burlington Ditch is also a decreed alternate point of diversion and carriage ditch for several of Thornton's water rights. Thornton has a decree for 8,000 ac-ft for the East Gravel Pit and a decree for 4,500 ac-ft for the South Dahlia Gravel Pit both diverted through the Burlington Ditch. These pits are known as East Gravel Lakes (aggregated at 0203700). SACWSD has a decree for recharge at the Ford Recharge Pit (0202003_R) diverted through the Burlington Ditch, which has a volumetric limit of 400 ac-ft.

Figure 5-6: Burlington Ditch System shows the major features of the Burlington Ditch System.

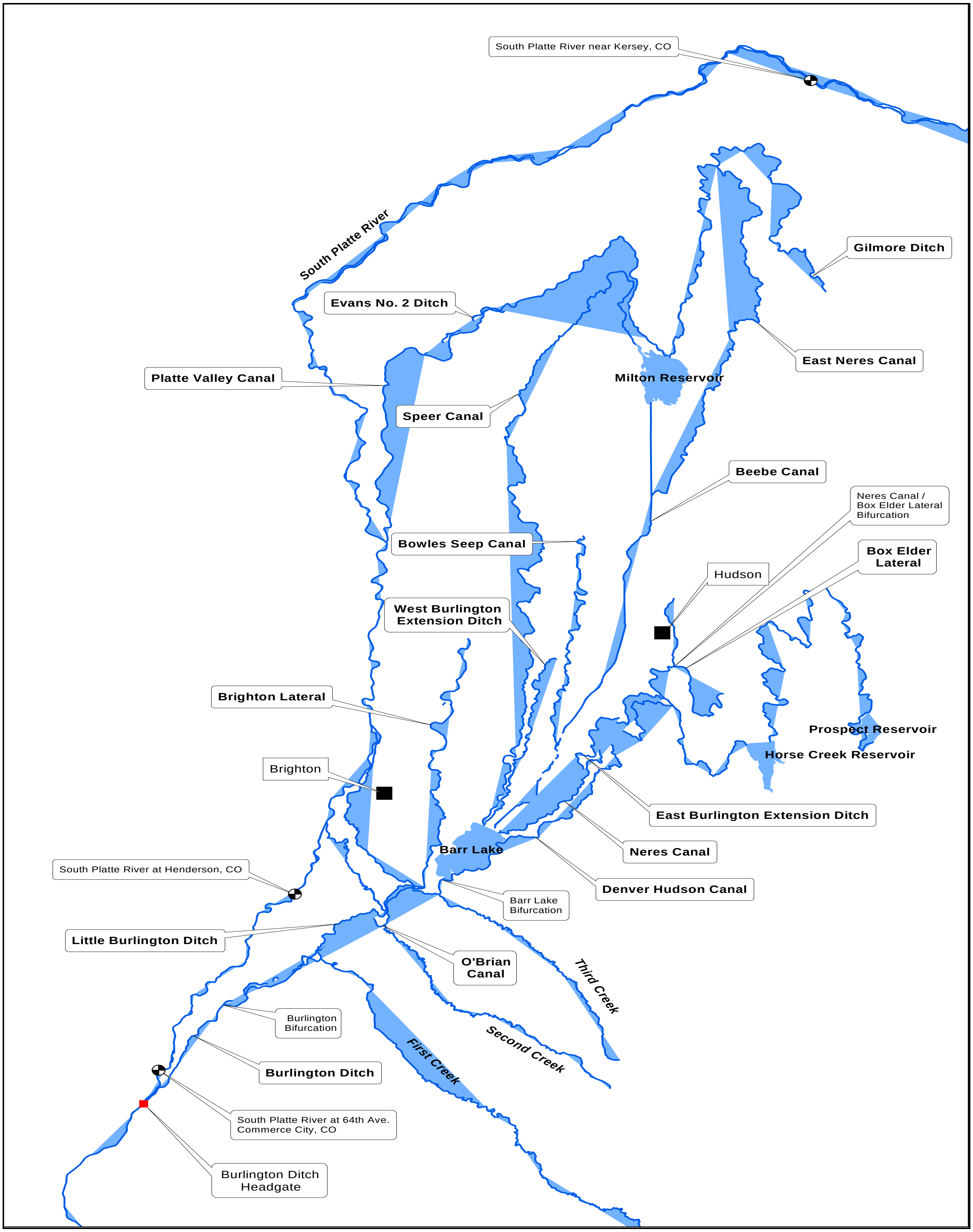


Figure 5-6: Burlington Ditch System

The Burlington Ditch diverts from the South Platte River near Riverside Cemetery on the east side of the river. The Burlington Ditch also receives water from the Metro Denver Wastewater Treatment Plant (Metro_WWTP), which is located on the east side of the South Platte River 1.5 miles downstream from the Burlington Ditch headgate. Metro WWTP effluent is delivered to the Burlington Ditch via the Metro Pumps and pipeline (Metro_Pumps and MetPump_PL). Water pumped at the Metro Pumps is either water that is fully consumable by Denver Water or water that would otherwise be available to FRICO under the exercise of its decrees.

The present-day Burlington Ditch results from the enlargement of 5.4 miles of the original Burlington Ditch and the construction of a 12.3-mile long O'Brian Canal (0203837_C) to connect the enlarged Burlington Ditch to Barr Lake. The Little Burlington Ditch (0200915) diverts from the Burlington-O'Brian Canal and extends about six miles to the northeast. The Little Burlington Ditch is used to supply Burlington Company stockholders along that canal and the Brighton Lateral. On the west side of Barr Lake, the Brighton Lateral extends from the end of the Little Burlington Ditch approximately 10 miles. The Burlington Ditch, Little Burlington Ditch and Brighton Lateral are all situated in the South Platte mainstem drainage area; therefore, return flows drain to the South Platte River.

The Burlington-O'Brian Canal extends from the headgate to a bifurcation immediately upstream of Barr Lake. The west branch flows into Barr Lake, and the east branch becomes the Denver-Hudson Canal (0200805). Barr Lake is an off-channel reservoir located in the Beebe Draw, a drainage basin east of the South Platte River and west of the Box Elder Creek Basin. Water stored in Barr Lake is released to the Speer Canal, East Burlington Extension Ditch, West Burlington Extension Ditch, Neres Canal and Beebe Canal. Water can also be released to the Bowles Seep Canal and East Neres Canals, both of which divert from the Beebe Canal.

The Denver-Hudson Canal extends northeast into the Box Elder and Lost Creek drainage basins. Water is delivered via the Denver-Hudson Canal to Horse Creek Reservoir. From Horse Creek Reservoir, the Denver-Hudson Canal then traverses into the Lost Creek drainage basin where is fills Prospect Reservoir, an off-stream reservoir.

Burlington Ditch Direct Rights

The BDRLC and Wellington Company have a direct flow water right for 27.4 cfs that was historically delivered to the Little Burlington Division above Barr Lake. This right was split into the following amounts to correctly model return flow obligations associated with Thornton's and SACWSD's change cases: 10.28 cfs, 7.987 cfs, 6.0 cfs and 3.133 cfs. The 3.133 cfs, which is currently owned by SACWSD, is not represented in the model because that portion of the right was changed in Case No. W-8440-76 and is left in the river as a source of replacement for SACWSD's augmentation plan.

There is also a 350 cfs, direct flow water right that was historically delivered both upstream and downstream of Barr Lake and to HID. Of the 350 cfs right, a maximum of 200 cfs is delivered above Barr Lake and the remaining 150 cfs was delivered below Barr Lake and to HID. In Case No. 02CW403, the Water Court ruled that this right can no longer be delivered below Barr Lake and to

HID. To represent the portions of this water right that were historically delivered to different locations, the water right was split into two rights, one for 200 cfs and another for 150 cfs.

The direct flow rights noted above are first stored in changed water rights plan structures ((Burl10Split, Well7Split, SanstSplit, 200_85Split, and 150_85Split) using the following five rules, based on the standard approach used to represent changed water rights, as outlined in Section 4.9.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Burl.01	5205.00000	Burlington10.28 Split Plan (Bur10Split)		0200802.03	26
Burl.02	5205.00000	Wellington7Divn (Well7Split)		0200802.04	26
Burl.03	5205.00000	Sanstad6Divn (SanstSplit)		0200802.05	26
Burl.04	13108.00000	Barr 1885 divn (200_85Split)		0200802.06	26
Burl.05	13108.00000	Burlington1885Divn (150_85Split)		0200802.07	26

Diversions under the 350 cfs direct flow right are split into two rules. The rule, Burl.04, diverts under the 200 cfs portion of this right, and Burl.05 diverts under the 150 cfs portion of the right. Rule Burl.05 is only active through 2009, to reflect the Water Court's ruling in Case No. 02CW403 that it can no longer be delivered below Barr Lake and to HID.

The following for rules are used to split the Plan yields, prorata, to the sub-plans of the various owners of the paired Burlington and Wellington shares - Thornton (ThBurl10Pln, ThWell7Pln, ThSanstPln, and Th200_85Pln), SACWSD (SABurl10Pln, SAWell7Pln, SASanstPln, and SA200_85Pln), and the remaining shareholders under the Little Burlington Ditch (LBBurl10Pln, LBWell7Pln, LBSanstPln, and LB200_85Pln).

A paired share consists of one Burlington and one Wellington share. There are 1,848.327 Burlington shares and 1,838.66 Wellington shares, which equates to a total of 1,843.5 paired shares. Thornton owns 837.5 Burlington shares and 825.7 Wellington shares, equal to 831.6 paired shares, which were changed in Case Nos. 87CW107, 90CW229, and 05CW010. Therefore, Thornton owns 45.1% of the paired shares. SACWSD owns 267.75 Burlington shares and 273.34 Wellington shares, equal to 270.54 paired shares, which were changed in Case Nos. W-8440-76, 2001CW258, and 10CW304. Therefore, SACWSD owns 14.7% of the paired shares. The remaining 743.08 Burlington shares and 739.62 Wellington shares, equal to 741.35 paired shares, are delivered to the Little Burlington Ditch. Brighton has also acquired and changed Burlington and Wellington shares, however those shares are not represented in the model since they were changed near the end of the study period (2007 and later).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Burl.06	5205.00001	ThBur10Pln LBBur10Pln	45.1% 40.2%	Bur10Split	46

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
		SABur10Pln	14.7%		
Burl.07	5205.00002	ThWell7Pln LBWell7Pln SAWell7Pln	45.1% 40.2% 14.7%	Well7Split	46
Burl.08	5205.00003	ThSanstPln LBSanstPln SASanstPln	45.1% 40.2% 14.7%	SanstSplit	46
Burl.09	13108.00001	Th200_85Pln LB200_85Pln SA200_85Pln	45.1% 40.2% 14.7%	200_85Split	46

The following rule splits the 150 cfs portion of the 350 cfs right among FRICO (FB150_85Pln) and HID (HID15085Pln) since that right was delivered below Barr Lake and to HID prior to 2009.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Burl.10	13108.00002	FB150_85Pln HID15085Pln	50% 50%	150_85Split	46

The following rules release any unused yield from the split plans back to the river:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BurSpill.71	5205.00009	Burlington Canal (0200802)		Bur10Split	29
BurSpill.75	5205.00009	Burlington Canal (0200802)		SanstSplit	29
BurSpill.79	5205.00009	Burlington Canal (0200802)		Well7Split	29
BurSpill.83	13108.00009	Burlington Canal (0200802)		200_85Split	29
BurSpill.89	13108.00009	Burlington Canal (0200802)		150_85Split	29

Thornton Burlington Operations

Thornton's operations with its changed Burlington Ditch shares is discussed in Section 5.10.8.12.

SACWSD Burlington Operations

SACWSD's operations with its changed Burlington Ditch shares is discussed in Section 5.10.8.16.

5.10.8.17.1 Little Burlington Operations

The following four rules are used to release water from Little Burlington's plans (10.28, 7.987, 6.0 and 200 cfs rights) to meet the irrigation demand under the Little Burlington Ditch. Losses are not included for the deliveries through the Burlington Ditch since the structure efficiency for the Little Burlington includes both ditch loss and farm loss.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LittBurl.01	5205.00001	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	LBBur10Pln	27
LittBurl.02	5205.00002	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	LBWell7Pln	27
LittBurl.03	5205.00003	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	LBSanstPln	27
LittBurl.04	13108.00001	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	LB200_85Pln	27

The following eight rules release any unused credits in Thornton's and SACWSD's Burlington Ditch plans back to the Little Burlington irrigators. The next two rules release Little Burlington's excess water to FRICO and HID for delivery below Barr Lake and HID's aggregated reservoir. Only excess water diverted under the 200 cfs and 150 cfs rights can be delivered to FRICO and HID, therefore, rules were not included for the 10.28, 7.987 and 6 cfs rights. The last for rules are used to release any unused Little Burlington irrigators' yield back to the South Platte River.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
ThBurl.17	51864.50690	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	ThBur10Pln	27
ThBurl.18	51864.50690	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	ThWell7Pln	27
ThBurl.19	51864.50690	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	ThSanstPln	27
ThBurl.20	51864.50690	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	Th200_85Pln	27
SAC_Burl.06	5205.00002	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	SABur10Pln	27

SAC_Burl.07	5205.00003	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	SAWell7Pln	27
SAC_Burl.08	5205.00004	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	SASanstPln	27
SAC_Burl.09	13108.00002	Little Burlington Ditch (0200915)	Burlington Canal (0200802)	SA200_85Pln	27
LittBurl.05	13108.20000	Barr Irrigators (0203837_I)	Burlington Canal (0200802)	LB200_85Pln	27
LittBurl.06	13108.20001	Henrylyn Irrigators (0200805_I)	Burlington Canal (0200802)	LB200_85Pln	27
BurSpill.74	5205.00009	Burlington Canal (0200802)		LBBur10Pln	29
BurSpill.78	5205.00009	Burlington Canal (0200802)		LBSanstPln	29
BurSpill.82	5205.00009	Burlington Canal (0200802)		LBWell7Pln	29
BurSpill.86	13108.20009	Burlington Canal (0200802)		LB200_85Pln	29

5.10.8.17.2 FRICO Operations

Prior to 2009 and the Water Court's decision in Case No. 02CW403, a portion of the 350 cfs direct flow right (the 150 cfs right plus any portion of the 200 cfs right that was not used above Barr Lake) was delivered below Barr Lake. In addition, FRICO owns a 600 cfs direct flow right that can be delivered to meet FRICO's irrigation demand below Barr Lake. FRICO and HID split these direct flow rights 50-50 pursuant to a 1921 Agreement. To simplify the model, the 600 cfs right is only delivered below Barr Lake. The following rules release water from the FB150_85Pln for the 150 cfs right to meet FRICO's irrigation demand below Barr Lake (0203837_I) and HID's irrigation demand below its aggregated reservoir (0200805_I).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
FRI_Burl.01	13108.00001	Barr Irrigators (0203837_I)	Burlington Canal (0200802)	FB150_85Pln	27
FRI_Burl.02	13108.30000	Barr Irrigators (0203837_I)	Burlington Canal (0200802) Denver Hudson Canal (0200805)	FB150_85Pln	27

The following rule diverts water attributable to the FRICO direct right for the 600 cfs right to meet FRICO's irrigation demand below Barr Lake.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
FRI_Burl.03	21252.00000	Barr Irrigators (0203837_I)	Burlington Canal (0200802)	0200802.09	27

These rules are operated before water is released from Barr Lake or HID's aggregated reservoir.

The following rule release Thornton and SACWSD's excess water to FRICO for delivery below Barr Lake. Only excess water diverted under the 200 cfs and 150 cfs rights can be delivered to FRICO and HID, therefore, rules were not included for the 10.28, 7.987 and 6 cfs rights. This rule is only active through 2009, since these water rights can no longer be delivered below Barr Lake pursuant to the Water Court's ruling in Case No. 02CW403. A 20% ditch loss was included for losses between the headgate and Barr Lake. Losses associated with FRICO's irrigation demands do not include ditch losses from the headgate to Barr Lake.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
ThBurl.25	51864.50692	Barr Irrigators (0203837_I)	Burlington Canal (0200802)	Th200_85Pln	27
SAC_Burl.10	13108.00003	Barr Irrigators (0203837_I)	Burlington Canal (0200802)	SA200_85Pln	27

The following rules release any unused yield in the FRICO plans back to the river:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BurSpill.87	13108.00009	Burlington Canal (0200802)		FB200_85Pln	29
BurSpill.90	13108.30009	Burlington Canal (0200802)		FB150_85Pln	29

5.10.8.17.3 Henrylyn Irrigation District (HID) Operations

Prior to 2009 and the Water Court's decision in Case No. 02CW403, a portion of the 350 cfs direct flow right (the 150 cfs right plus any portion of the 200 cfs right that was not used above Barr Lake) was delivered to HID. In addition, HID owns a 300 cfs direct flow right that can be delivered below HID's aggregated reservoir for irrigation. FRICO and HID split these direct flow rights 50-50 pursuant to a 1921 Agreement. To simplify the model, the 300 cfs right is only delivered to meet HID's irrigation demand. The following rules release water from the HID150_85Pln for the 150 cfs right to meet HID's irrigation demand below its aggregated reservoir (0200805_I) and FRICO's irrigation demand below Barr Lake (0203837_I).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
HIDBurl.01	13108.00002	Henrylyn Irrigators (0200805_I)	Burlington Canal (0200802)	HID15085Pln	27
HIDBurl.02	13108.30000	Barr Irrigators (0203837_I)	Burlington Canal (0200802)	HID15085Pln	27

The following rule diverts water attributable to the HID direct right for 300 cfs right to meet HID's irrigation demand below its aggregated reservoir.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
HIDBurl.03	21150.00000	Barr Irrigators (0203837_I)	Burlington Canal (0200802) Denver Hudson Canal (0200805)	0200802.08	27

These rules are operated before water is released from Barr Lake or HID's aggregated reservoir.

The following two rules release Thornton and SACWSD's excess water to HID for delivery below HID's aggregated reservoir. Only excess water diverted under the 200 cfs and 150 cfs rights can be delivered to HID, therefore, rules were not included for the 10.28, 7.987 and 6 cfs rights. These rules are only active through 2009, since these water rights can no longer be delivered below Barr Lake pursuant to the Water Court's ruling in Case No. 02CW403. A 20% ditch loss was included for losses between the headgate and Barr Lake and an additional 30% ditch loss was included for the Denver-Hudson Canal from the bifurcation to HID's aggregated reservoir. Losses associated with HID's irrigation demands do not include ditch losses from the headgate to Barr Lake or HID's aggregated reservoir.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
ThBurl.26	51864.50692	Barr Irrigators (0203837_I)	Burlington Canal (0200802) Denver Hudson Canal (0200805)	Th200_85Pln	27
SAC_Burl.11	13108.00004	Barr Irrigators (0203837_I)	Burlington Canal (0200802) Denver Hudson Canal (0200805)	SA200_85Pln	27

The following rules release any unused yield in the HID plans back to the river:

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BurSpill.88	13108.00009	Burlington Canal (0200802)		HID20085Pln	29
BurSpill.91	13108.30009	Burlington Canal (0200802)		HID15085Pln	29

5.10.8.17.4 Barr Lake Operations

Burlington and FRICO own 1885 and 1909 storage water rights for Barr Lake. Water stored in Barr Lake is used to supplement diversions under the direct flow water rights. In addition, FRICO owns a 1909 refill water right, which is typically used to refill Barr Lake during the fall when it's in priority. The following rules divert water under the 1885 storage, 1909 storage and 1909 refill rights to fill Barr Lake. Water is carried to Barr Lake via the Burlington Ditch.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Barr.01	13108.00000	Barr Lake (0203837, Acct 1)	Burlington Canal (0200802)	0203837.01	45
Barr.02	21562.00000	Barr Lake (0203837, Acct 2)	Burlington Canal (0200802)	0203837.02	45
Barr.03	21562.00001	Barr Lake (0203837, Acct 1 and 2)	Burlington Canal (0200802)	0203837.03	45

Separate accounts were included in Barr Lake for the senior 1885 storage right and the more junior 1909 storage right. Therefore, the following rule is used to book any water remaining in the 1885 account to the 1909 account at the end of the irrigation season on October 31st. This rule is necessary to maximize diversions under the 1885 storage water right.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Barr.04	99999.00000	Barr Lake (0203837, Acct 2)		Barr Lake (0203837, Acct 1)	6

Releases from Barr Lake are made to meet irrigation demands below Barr Lake after the storage water rights and direct flow water rights are operated. The following rules release water from the 1885 and 1909 storage account in Barr Lake to meet the irrigation demand below Barr Lake.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BarrRel.03	21562.00001	Barr Irrigators (0203837_I)		Barr Lake (0203837), Acct	3

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
				1	
BarrRel.04	21562.00001	Barr Irrigators (0203837_I)		Barr Lake (0203837), Acct 2	3

5.10.8.17.5 HID Aggregated Reservoir Operations

HID owns four storage water rights that are used to fill Horse Creek and Prospect Reservoirs. Water stored in HID's aggregated reservoir is used to supplement diversions under the direct flow water rights. The following rules divert water under the four storage water rights to fill HID's aggregated reservoir. Water is carried via the Burlington Ditch to the bifurcation and then via the Denver-Hudson to the aggregated reservoir.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
HenLyn.01	22239.00000	Henrylyn Reservoir System (0103592, Acct 1)	Burlington Canal (0200802) Denver Hudson Canal (0200805)	0103592.01	45
HenLyn.02	22355.00000	Henrylyn Reservoir System (0103592, Acct 1)	Burlington Canal (0200802) Denver Hudson Canal (0200805)	0103592.02	45
HenLyn.03	26498.00000	Henrylyn Reservoir System (0103592, Acct 1)	Burlington Canal (0200802) Denver Hudson Canal (0200805)	0103592.03	45
HenLyn.04	26498.00000	Henrylyn Reservoir System (0103592, Acct 1)	Burlington Canal (0200802) Denver Hudson Canal (0200805)	0103592.04	45

The following rule releases water from HID's aggregated reservoir to meet the irrigation demand below the reservoir after HID's storage rights and direct flow rights are operate.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
HIDRel.05	26498.00001	Henrylyn Irrigators (0200805_I)		Henrylyn Reservoir System (0103592), Acct 1	3

5.10.8.17.6 Metro Pumps Operations

The Metro Pumps (Metro_Pumps) were historically used to provide additional supplies to fill Barr Lake, Horse Creek and Prospect Reservoirs during the non-irrigation season. Water from the Metro WWTP was pumped into the Burlington Canal and delivered to storage. Pursuant to the 1921 Agreement, water delivered to the Burlington Canal from the Metro Pumps was split 50-50 between FRICO/Burlington and HID. The following rule diverts effluent from the Metro WWTP at the Metro Pumps and tracks those diversions in the Metro Pumps plan, MetPumpsPln.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Metro.01	1.00000	Metro Pumps Hist Diversions (Metro_Pumps)		MetPumps.01	25

The following two rules release water from the Metro Pumps plan, MetPumpsPln, to the Burlington Ditch where it is delivered either to Barr Lake or HID's aggregated reservoir

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Metro.02	1.00001	Barr Lake (0203837)	Metro Pumps Pipeline (MetPump_PL) Burlington Canal (0200802)	MetPumpsPln	27
Metro.03	1.00002	Henrylyn Reservoir System (0103592)	Metro Pumps Pipeline (MetPump_PL) Burlington Canal (0200802) Denver Hudson Canal (0200805)	MetPumpsPln	27

5.10.8.18 Milton Lake System

All of the components in the FRICO–Milton Lake Division except for the Evans No. 2 Ditch are owned and operated by FRICO. Milton Lake is filled via the Platte Valley Canal (0200817), which diverts from the east side of the South Platte River, northwest of the Town of Hudson. The Platte Valley Canal shares this headgate with the Evans No. 2 Ditch (see Figure 5-6). Platte Valley Canal water is carried through the Evans No. 2 Ditch from the headgate for about 10 miles at which point the ditch bifurcates to produce the Platte Valley Canal and the remainder of the Evans No. 2 Ditch. After the bifurcation, the Platte Valley Canal continues for approximately 10 miles, running parallel to Evan's Ditch No. 2, and feeds Milton Lake. Aside from the shared headgate, the Evans No. 2 system is operated completely independent from the FRICO system.

Milton Lake (0203876) is an off-channel reservoir located south of the Town of Hudson. Milton Lake and the irrigated lands within the FRICO–Milton Division are located in Beebe Draw and the Box Elder Creek drainage basins. Water is conveyed to Milton Lake through the Platte Valley Canal and from the Beebe Canal. The Beebe Canal extends from Barr Lake to Milton Lake. Most of the return flows in that area are collected in the Beebe Canal. Water from Beebe Canal consists of seepage collected from Barr Lake, return flows intercepted by the canal from irrigation in the Beebe Draw Basin, and South Platte River water diverted at the Burlington Ditch headgate and conveyed through Barr to the Beebe Canal. This operation is not included in the SPDSS model since it is infrequent. Water is released from Milton Lake to the Gilmore Ditch. All of the FRICO – Milton irrigation demands are located below Milton Lake. FRICO–Milton irrigation demands (0203876_I) are met with direct flow diversions and releases from Milton Lake.

FRICO owns a 1909 direct flow water right for 510 cfs that is used to meet irrigation demands below Milton Lake. This right is relatively junior, therefore, releases from Milton Lake are frequently used to supplement this right. FRICO owns a 1909 storage right for 26,773 ac-ft to fill Milton Lake. The following rule diverts water to storage in Milton Lake via the Platte Valley Canal. Water is carried via the Platte Valley Canal and a 20% ditch loss is assessed from the headgate to Milton Lake.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Milton.01	21698.00000	Milton Reservoir (0203876, Acct 1)	Platte Valley/Evans No2 (0200817)	0203876.01	45

The following rule diverts water from the South Platte River under the direct flow right to meet irrigation demands below Milton Lake. This rule is operated before water is released from the lake.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
MilDir.01	21698.00001	Milton Irrigators (0203876_I)	Platte Valley/Evans No2 (0200817)	0200817.02	27

The following rule releases water from storage in Milton Lake to meet irrigation demands below the lake.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Milton.02	21698.00002	Milton Irrigators (0203876_I)		Milton Reservoir (0203876), Acct 1	3

5.10.8.19 Lower Latham System

The Lower Latham Ditch and Lower Latham Reservoir are owned by the Lower Latham Ditch Company and Lower Latham Reservoir Company. These companies provide irrigation supplies to lands located south of the South Platte River near Kersey and east of LaSalle in Weld County, Colorado. Lower Latham Reservoir (0203858) is located 2.5 miles east of LaSalle. Water is conveyed to the reservoir for storage through the Union Ditch (0200828) under a contract agreement with the Union Ditch Company. Water is also conveyed to the reservoir through the Morrison Seepage Ditch.

The Morrison Seepage Ditch is not included in the SPDSS model. Storage water is released from the reservoir to the Lower Latham Ditch (0200834) for irrigation. The headgate for Lower Latham Ditch is on the east side of the South Platte River, between the headgates of Godfrey Ditch and Patterson Ditch.

Lower Latham System Operations

The Lower Latham Ditch Company owns several direct flow water rights that are used to meet irrigation demands under the Lower Latham Ditch (0200834_I). Releases from Lower Latham Reservoir are used to supplement these rights. The Lower Latham Reservoir Company owns three storage rights for Lower Latham Reservoir that are used to fill the reservoir. The following rules divert water to storage in Lower Latham Reservoir via the Union Ditch. One rule is included for each storage right. Water is carried via the Union Ditch and a 30% ditch loss is assessed from the headgate to Lower Latham Reservoir.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Latham.01	17706.00000	Lower Latham Reservoir (0203858, Acct 1)	Union Ditch (0200828)	0203858.01	45
Latham.02	18437.00000	Lower Latham Reservoir (0203858, Acct 1)	Union Ditch (0200828)	0203858.02	45
Latham.03	25050.23959	Lower Latham Reservoir (0203858, Acct 1)	Union Ditch (0200828)	0203858.03	45

The following rules divert water from the South Platte River at the Lower Latham Ditch under the direct flow rights to meet irrigation demands under the Lower Latham Ditch. One rule is included for each direct flow right. These rules operate before water is released from the reservoir.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Latham.04	7072.00000	Lower Latham Irrigators (0200834_I)	Lower Latham Ditch (0200834)	0200834.01	45
Latham.05	9112.00000	Lower Latham Irrigators (0200834_I)	Lower Latham Ditch (0200834)	0200834.02	45
Latham.06	10180.00000	Lower Latham Irrigators (0200834_I)	Lower Latham Ditch (0200834)	0200834.03	45
Latham.07	11620.00000	Lower Latham Irrigators (0200834_I)	Lower Latham Ditch (0200834)	0200834.04	45

The following rule releases water from storage in Lower Latham Reservoir to meet irrigation demands under the Lower Latham Ditch.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Latham.08	25050.23960	Lower Latham Irrigators (0200834_I)		Lower Latham Reservoir (0203858, Acct 1)	3

5.10.8.20 Remaining Ditch Credits to Irrigators

The following rules are used to release any unused ditch credits back to the ditch irrigators.

Farmer's Highline Canal

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
FHL.12	13240.00000	Farmers Highline Irrigation Plan (FHL_IrrPln)	100%, 105,000AF limit	0700569.11	26
FHL.13	16549.00000	Farmers Highline Irrigation Plan (FHL_IrrPln)	100%, 198,000AF limit	0700569.12	26
FHL.14	16549.00001	FHL Irrigators (0700569_I)	Farmers Highline Canal (0700569)	Farmers Highline Irrigation Plan (FHL_IrrPln)	27

Wannamaker Ditch

Wann.06	6884.00002	Wannamaker Ditch Irrigators (0700698_I)	Wannamaker Ditch (0700698)	Wannamaker Irrigation Plan (WannIrrPln)	27

Lee, Stewart and Eskins (LSE) Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
LSE.09a	7773.00001	LSE Irrigation Plan (LSE_IrrPln)	100%	LSE Split Plan (LSE_SplPln)	46

Rocky Mountain Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
RkyMtn.01	4180.00000	Rocky Mountain Irrigators (0700652_I)	100%, Rocky Mountain Ditch (0700652)	0700652.01	45
RkyMtn.09	10302.00002	Rocky Mountain Irrigators (0700652_I)	Rocky Mountain Ditch (0700652)	Rocky Mountain Irrigation Plan (RM_IrrPln)	27

Fisher Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Fish.11	4198.00002	Fisher Ditch Irrigators (0700570_I)	Fisher Ditch (0700570)	Fisher Irrigation Plan (FishIrrPln)	27

Plt Valley and Union Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
PltValley.01	7948.00000	Evans No. 2 Irrigators (0200817_I)	Platte Valley/Evans No. 2 (0200817)	0200817.01	45
PltValley.02	21698.00000	Evans No. 2 Irrigators (0200817_I)	Platte Valley/Evans No. 2 (0200817)	0200817.02	45
PltValley.03	25050.00000	Evans No. 2 Irrigators (0200817_I)	Platte Valley/Evans No. 2 (0200817)	0200817.03	45
Union.01	8670.00000	Union Ditch Irrigators (0200828_I)	Union Ditch (0200828)	0200828.01	45
Union.02	9075.00000	Union Ditch Irrigators (0200828_I)	Union Ditch (0200828)	0200828.02	45
Union.03	11629.00000	Union Ditch Irrigators (0200828_I)	Union Ditch (0200828)	0200828.03	45

Brighton Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BrightD.01	5083.00000	BriSplPln	100%	0200810.01	26
BrightD.02	7975.00000	BriSplPln	100%	0200810.02	26
BrightD.03	7975.00002	BriIrrPln SAC_BriPln CenBriPln	93.97% 5.53% 0.50%	BriSplPln	46
BrightD.04	7975.00003	Brighton Irrigation (0200810_I)	Brighton Ditch (0200810)	BriIrrPln	27
SACBri.01	55498.90001	Brighton Irrigation (0200810_I)	Brighton Ditch (0200810)	SAC_BriPln	27
CCWCDBri.01	62000.99999	Brighton Irrigation (0200810_I)	Brighton Ditch (0200810)	CenBriPln	27

Luptom Bottom and Lupton Meadows

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
OpLBIrr.01	8659.00003	Lupton Bottom Irrigation (0200812_I)	Lupton Bottom Ditch (0200812)	LB_IrrPln	27
SACLB.01	55498.90002	Lupton Bottom Irrigation (0200812_I)	Lupton Bottom Ditch (0200812)	SAC_LBPln	27
SACLM.01	55498.90003	Lupton Bottom Irrigation (0200812_I)	Lupton Bottom Ditch (0200812)	SAC_LMPln	27
CCWCDLB.01	64000.99999	Lupton Bottom Irrigation (0200812_I)	Lupton Bottom Ditch (0200812)	CenLBPln	27
CCWCDLM.01	61000.99999	Lupton Bottom Irrigation (0200812_I)	Lupton Bottom Ditch (0200812)	CenLMPln	27
PSCoLB.11	8659.00008	Lupton Bottom Irrigation (0200812_I)	Lupton Bottom Ditch (0200812)	PSCoLBPln	27
PSCoLM.11	7739.00008	Lupton Bottom Irrigation (0200812_I)	Lupton Bottom Ditch (0200812)	PSCoLMPln	27

Platteville Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Platvl.01	4565.00000	PVSplPln	100%	0200813.01	26
Platvl.02	7671.00000	PVSplPln	100%	0200813.02	26
Platvl.03	8689.00000	PVSplPln	100%	0200813.03	26
Platvl.04	8589.00002	PV_IrrPln CenPVPln	97.8% 2.2%	PVSplPln	46
Platvl.05	8589.00003	Platteville Irrigation (0200813_I)	Platteville Ditch (0200813)	PV_IrrPln	27
CCWCDPV.01	63000.99999	Platteville Irrigation (0200813_I)	Platteville Ditch (0200813)	CenPVPln	27

Meadow Island No. 1 and No. 2 Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
MdwIsl1.01	5965.00000	MI1SplPln	100%	0200821.01	26
MdwIsl1.02	11807.00000	MI1SplPln	100%	0200821.02	26
MdwIsl1.03	11807.00002	MI1IrrPln SAC_MI1Pln	93.5% 6.5%	MI1SplPln	46

MdwIsl1.04	11807.00003	Meadow Island No. 1 (0200821)		MI1IrrPln	27
SACMI1.01	55498.90005	Meadow Island No. 1 (0200821)		SAC_MI1Pln	27
MdwIsl2.01	5967.00000	M2SenSplPln	100%	0200822.01	26
MdwIsl2.02	9597.00000	M2SenSplPln	100%	0200822.02	26
MdwIsl2.03	10215.00000	M2JunSplPln	100%	0200822.03	26
MdwIsl2.04	9597.00002	MI2IrrPln PSCoMI2Pln1	93.8% 6.2%	M2SenSplPln	46
MdwIsl2.05	10215.00002	MI2IrrPln PSCoMI2Pln2	53.7 46.3	M2JunSplPln	46
MdwIsl2.06	10215.00003	Meadow Island No. 2 (0200822)		MI2IrrPln	27
PSCoMI2.01	9597.00008	Meadow Island No. 2 (0200822)		PSCoMI2Pln1	27
PSCoMI2.02	10215.00008	Meadow Island No. 2 (0200822)		PSCoMI2Pln2	27

Farmer's Independent Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
FarmInd.01	5803.00000	FarmSplPln	100%	0200824.01	26
FarmInd.02	9821.00000	FarmSplPln	100%	0200824.02	26
FarmInd.03	9821.00002	FarmIrrPln CenFarmPln	95.3% 4.7%	FarmSplPln	46
FarmInd.04	9821.00003	Farmers Independent Irrigation (0200824_I)	Farmers Indep Ditch (0200824)	FarmIrrPln	27
CCWCDFI.02	65000.99999	Farmers Independent Irrigation (0200824_I)	Farmers Indep Ditch (0200824)	CenFarmPln	27

Hewes Cook Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Hewes.01	5969.00000	Hewes Cook Irrigation (0200825_I)		0200825.01	11
Hewes.02	7892.00000	Hewes Cook Irrigation (0200825_I)		0200825.02	11

Hewes.03	16097.00000	Hewes Cook Irrigation (0200825_I)		0200825.03	11
Hewes.04	5969.00000	Hewes Cook Irrigation (0200825_I)		0200825.05	11
Hewes.05	7892.00000	Hewes Cook Irrigation (0200825_I)		0200825.06	11

Highland Ditch

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Highland.01	7944.00000	HighSplPln	100%	0200837.01	26
Highland.02	7944.00001	HighIrrPln CenHighPln	47.8% 52.2%	HighSplPln	46
Highland.03	7944.00002	Highland Irrigatin (0200837_I)	Highland Ditch (0200837)	HighIrrPln	27
CCWCDHi.01	80000.99999	Highland Irrigatin (0200837_I)	Highland Ditch (0200837)	CenHighPln	27
Highland.04	99999.00000	Highland Irrigatin (0200837_I)	Highland Ditch (0200837)	0200837.02	11

5.10.8.21 Remaining Releases

The following rules are to release any remaining, unallocated plan water back to the river.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
PlnSpill.71	0.99998	Boreas Pass Ditch (2304611)		BoreasPln	29
PlnSpill.71	1.00009	Boreas Pass Ditch (2304611)		Boreas_C	29
PlnSpill.72	0.99998	Berthoud Pass Diversion (0704625)		BerthoudPln	29
PlnSpill.72	1.00009	Berthoud Pass Diversion (0704625)		Berthoud_C	29
PlnSpill.73	0.99998	Homestake Pipeline (HOMSPICO)		HomestkPln	29
PlnSpill.73	1.00009	Homestake Pipeline (HOMSPICO)		Homestk_C	29
PlnSpill.74	0.99998	Gumlick Tunnel (0704650)		GumlickPln	29
PlnSpill.74	1.00009	Gumlick Tunnel (0704650)		Gumlick_C	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
PlnSpill.75	0.99998	Roberts Tunnel (8000653)		RobTunPln	29
PlnSpill.75	26000.00009	Roberts Tunnel (8000653)		RobTun_C	29
PlnSpill.76	0.99998	Straight Creek Tunnel (0700903)		StratCkPln	29
PlnSpill.76	46171.00005	Straight Creek Tunnel (0700903)		StratCk_C	29
PlnSpill.77	0.99998	Vidler Tunnel (0704626)		VidlerPln	29
PlnSpill.77	48213.00009	Vidler Tunnel (0704626)		Vidler_C	29
PlnSpill.78	54055.00002	Moffat Import (06_MOF_IMP)		06_MOF_ACC	29
PlnSpill.79	1.00009	Martson WTP (0901700)		BearCkPln	29
PlnSpill.90	1.00009	(WD2 Agg Wells 4) 02_AWP004		SandHillPln	29
SPRAurSp.71	18774.00009	Antero Reservoir (2303904)		2302900_Pln	29
SPRAurSp.72	14537.00009	Harstel Computed ADMIN Gage (2302922)		2302901_Pln	29
SPRAurSp.73	23153.00009	South Platte above Spinney Mtn Admin Gage (2302903)		2302902_Pln	29
SPRAurSp.74	12707.00009	WD23 Upper Agg Muni Inside Use (23_AMP001_I)		2302903_Pln	29
SPRAurSp.75	9983.00009	Fourmile Ck nr Harstel Admin Gage (2302901)		2302904_Pln	29
SPRAurSp.76	4565.00009	Middle Fork SPR at Santa Maria Admin Gage (2302902)		2302911_Pln	29
SPRAurSp.77	10774.00009	Middle Fork SPR ISF (2302148_Dwn)		2302912_Pln	29
SPRAurSp.78	11867.00009	Middle Fork SPR at Santa Maria Admin Gage (2302902)		2302913_Pln	29
TarAurSp.71	23153.00009	Petrie Ditch (2300902)		2302906_Pln	29
TarAurSp.72	23153.00009	Taylor Ditch (2300991)		2302907_Pln	29
TarAurSp.73	23153.00009	Jefferson Ck blw Snyder Admin Gage (2302917)		2302908_Pln	29
TarAurSp.74	23153.00009	Holst Ditch 2 (2300922)		2302909_Pln	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
TarAurSp.75	23153.00009	Jefferson Ck blw Snyder Admin Gage (2302917)		2302910_Pln	29
TarAurSp.76	23153.00009	Michigan abv Jefferson Admin Gage (2302907)		2302914_Pln	29
TarAurSp.77	23153.00009	Tarryall at Borden Ditch Admin Gage (2302909)		2302915_Pln	29
TarAurSp.78	23153.00009	Michigan abv Jefferson Admin Gage (2302907)		2302916_Pln	29
TarAurSp.79	23153.00009	Jefferson Ck ISF (2302116_Dwn)		2302917_Pln	29
TarAurSp.80	23153.00009	Petrie Ditch (2300902)		2302918_Pln	29
TarySpil.71	90000.00000	Holst Packerr Ditch (2300923)		TaryTempPln	29
AurPlnSp.71	6637.00009	Aurora Intake (0801001)		AurIntPln1	29
AurPlnSp.72	6637.00009	Aurora Intake (0801001)		AurIntPln2	29
AurPlnSp.73	50029.00005	Aurora Intake (0801001)		AurIntPln3	29
DenPlnSp.71	4184.00009	Beery Ditch (2302905)		2302201	29
DenPlnSp.73	22254.00009	Denver Conduit 20 (0801002_D)		Cnd20DirPln	29
DenPlnSp.72	57000.00009	Denver Conduit 20 (0801002_D)		Cond20Pln	29
FHLSpill.72	16549.00009	FHL Canal (0700569)		FHL_IrrPln	29
FHLSpill.75	16549.00009	FHL Canal (0700569)		ThFHLPln	29
FHLSpill.76	16549.00009	FHL Canal (0700569)		WestyFHLPln	29
FshSpill.71	4198.00009	Fisher Ditch (0700570)		FishSplPln	29
FshSpill.72	4198.00009	Fisher Ditch (0700570)		FishIrrPln	29
FshSpill.73	4198.00009	Fisher Ditch (0700570)		PSCoFishPln	29
FshSpill.74	55835.00009	Kershaw Ditch (0700597)		ThFishPln	29
KerSpill.76	50350.00009	Kershaw Ditch (0700597)		ThKerPln	29
LSESpill.77	50711.00009	LSE Ditch (0700601)		ConM_LS2Pln	29
RkySpill.72	10302.00009	LSE Ditch (0700601)		RM_IrrPln	29
RkySpill.73	10302.00009	LSE Ditch (0700601)		ConM_RM_Pln	29
RJSpill.71	10288.00009	Reno Juchem Ditch (0700647)		RJ_SplPln	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
RJSpill.72	10288.00009	Reno Juchem Ditch (0700647)		RJ_IrrPln	29
RJSpill.73	10288.00009	Reno Juchem Ditch (0700647)		CoorsRJPln	29
SluSpill.71	8891.00009	Slough Ditches (0700527_D)		SluSplit1	29
SluSpill.72	5625.00009	Slough Ditches (0700527_D)		SluSplit2	29
SluSpill.73	5261.00009	Slough Ditches (0700527_D)		SluSplit3	29
SluSpill.74	3788.00009	Slough Ditches (0700527_D)		SluSplit4	29
SluSpill.75	5785.00009	Slough Ditches (0700527_D)		SluSplit5	29
SluSpill.76	8891.00009	Slough Ditches (0700527_D)		ArvSluPln	29
SluSpill.77	8891.00009	Slough Ditches (0700527_D)		CoorsSluPln	29
SluSpill.78	8891.00009	Slough Ditches (0700527_D)		GoldSluPln	29
SouthSid.71	8891.00009	South Side Ditch (0700669)		SouthSidPln	29
WannSpil.73	6884.00009	Wannamaker Ditch (0700698)		WannIrrPln	29
Stan.57	99999.00009	Croke Canal (0700553)		PhantomStand	29
Stan.58	99999.00009	Croke Canal (0700553)		PhantomStand	29
Stan.59	99999.00009	Croke Canal (0700553)		PhantomStand	29
Stan.60	99999.00009	Croke Canal (0700553)		PhantomStand	29
Stan.61	99999.00009	Croke Canal (0700553)		PhantomStand	29
CosmcSpl.72	19054.99999	Coors Industrial Ditch (0700725)		CosmcPln2	29
CosmcSpl.73	19055.00009	Reno Juchem Ditch (07006470		0702318	29
CosmcSpl.74	19055.00009	Coors Guarantee Water (CoorsGuaPln)		Gold_WWTP	29
CosmcSpl.75	19055.00009	Croke Canal (0700553)		CosCoExcPln	29
CosmcSpl.80	19055.00009	Croke Canal (0700553)		CosGoExcPln	29
BriSpill.71	7975.00009	Brighton Ditch (0200810)		BriSplPln	29
BriSpill.72	7975.00009	Brighton Ditch (0200810)		BriIrrPln	29
BriSpill.73	55498.90009	Brighton Ditch (0200810)		SAC_BriPln	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BriSpill.74	62001.00009	Brighton Ditch (0200810)		CenBriPln	29
BurSpill.72	5205.00009	Burlington Canal (0200802)		SABur10Pln	29
BurSpill.73	51864.50699	Burlington Canal (0200802)		ThBur10Pln	29
BurSpill.76	5205.00009	Burlington Canal (0200802)		SASanstPln	29
BurSpill.77	51864.50699	Burlington Canal (0200802)		ThSanstPln	29
BurSpill.80	5205.00009	Burlington Canal (0200802)		SAWell7Pln	29
BurSpill.81	51864.50699	Burlington Canal (0200802)		ThWell7Pln	29
BurSpill.84	13108.00009	Burlington Canal (0200802)		SA200_85Pln	29
BurSpill.85	51864.50699	Burlington Canal (0200802)		Th200_85Pln	29
FarmSpill.71	9821.00009	Farmers Independent Ditch (0200824)		FarmSplPln	29
FarmSpill.72	9821.00009	Farmers Independent Ditch (0200824)		FarmIrrPln	29
FarmSpill.73	65001.00000	Farmers Independent Ditch (0200824)		CenFarmPln	29
FGSpill.71	8857.00009	Farmers & Gardeners Ditch (0200800)		FandGSplPln	29
FGSpill.72	8857.00009	Farmers & Gardeners Ditch (0200800)		FandGIrrPln	29
FGSpill.73	8857.00009	0200800 Farmers & Gardeners Ditch (0200800)		FandGIndPln	29
FulSpill.71	10901.00009	Fulton Ditch (0200808)		FulSplPln	29
FulSpill.72	10901.00009	Fulton Ditch (0200808)		FulIrrPln	29
FulSpill.73	55498.90009	Fulton Ditch (0200808)		SAC_FulPln	29
FulSpill.74	45655.70009	Fulton Ditch (0200808)		BriFulPln	29
FulSpill.76	66001.00009	Fulton Ditch (0200808)		CenFulPln	29
HewsSpill.71	90000.00009	Hewes Cook (0200825)		HewesSplPln	29
HewsSpill.72	90000.00009	Hewes Cook (0200825)		HewesIrrPln	29
HewsSpill.73	90000.00009	Hewes Cook (0200825)		PSCoHewsPln	29
HighSpill.71	7944.00009	Highland Ditch (0200837)		HighSplPln	29
HighSpill.72	7944.00009	Highland Ditch (0200837)		HighIrrPln	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
HighSpill.73	80001.00000	Highland Ditch (0200837)		CenHighPln	29
LB_Spill.71	8659.00009	Lupton Bottom Ditch (0200812)		LB_SplPln	29
LB_Spill.72	8659.00009	Lupton Bottom Ditch (0200812)		LB_IrrPln	29
LB_Spill.74	8659.00009	Lupton Bottom Ditch (0200812)		PSCoLBPln	29
LB_Spill.75	55498.90009	Lupton Bottom Ditch (0200812)		SAC_LBPln	29
LB_Spill.76	64001.00000	Lupton Bottom Ditch (0200812)		CenLBPln	29
LM_Spill.71	7739.00009	Lupton Bottom Ditch (0200812)		LM_SplPln	29
LM_Spill.72	55498.90009	Lupton Bottom Ditch (0200812)		SAC_LMPln	29
LM_Spill.73	7739.00009	Lupton Bottom Ditch (0200812)		PSCoLMPln	29
LM_Spill.74	61001.00000	Lupton Bottom Ditch (0200812)		CenLMPln	29
MI1Spill.71	11807.00009	Meadow Island No. 1 (0200821)		MI1SplPln	29
MI1Spill.72	11807.00009	Meadow Island No. 1 (0200821)		MI1IrrPln	29
MI1Spill.73	55498.90009	Meadow Island No. 1 (0200821)		SAC_MI1Pln	29
MI2Spill.71	9597.00009	Meadow Island No. 2 (0200822)		M2SenSplPln	29
MI2Spill.72	10215.00009	Meadow Island No. 2 (0200822)		M2JunSplPln	29
MI2Spill.73	10215.00009	Meadow Island No. 2 (0200822)		MI2IrrPln	29
MI2Spill.74	9597.00009	Meadow Island No. 2 (0200822)		PSCoMI2Pln1	29
MI2Spill.75	10215.00009	Meadow Island No. 2 (0200822)		PSCoMI2Pln2	29
PVSpill.71	8589.00009	Platteville Ditch (0200813)		PVSplPln	29
PVSpill.72	8589.00009	Platteville Ditch (0200813)		PV_IrrPln	29
PVSpill.73	63001.00000	Platteville Ditch (0200813)		CenPVPln	29
SN3Spill.71	8475.00009	Section No. 3 Ditch (0200830)		SN3SplPln	29
SN3Spill.72	8475.00009	Section No. 3 Ditch (0200830)		SN3IrrPln	29
SN3Spill.73	70001.00000	Section No. 3 Ditch (0200830)		CenSN3Pln	29

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
BiCitSpl.71	90000.00000	Bi-City WWTP (0802300)		0802300DW	29
MetPumps.71	1.00009	Metro Pumps Pipeline (MetPump_PL)		MetPumpsPln	29
MetSpill.71	30000.00009	Metro WWTP (Metro_WWTP)		MetroDW	29
MetSpill.72	90000.00000	Metro WWTP (Metro_WWTP)		MetroArv	29
MetSpill.73	90000.00000	Metro WWTP (Metro_WWTP)		MetroAur	29
MetSpill.75	90000.00000	Metro WWTP (Metro_WWTP)		MetroWesty	29
MetSpill.76	90000.00000	Metro WWTP (Metro_WWTP)		MetroGold	29
SndCkSpl.71	90000.00000	Aurora Sand Ck WWTP (SandCk_WWTP)		AurSC_Reuse	29

5.10.8.22 Transmountain Imports

The following rules are used to import transmountain supplies into the appropriate plan type for distribution and use throughout the model. A Type 35 rule is designed to import the water into a plan, however if the imported supplies are reusable, it was necessary to release them from the import plan and re-divert them into a changed water rights plan type using a Type 26 rule. From there, the imported supplies can be released to meet various demands. See specific user sections for more information on the uses of the supplies (e.g. City of Englewood for Boreas Pass uses).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Xbasin.01a	0.99997	Boreas Pass D Plan (BoreasPln)		Boreas Pass Ditch (2304611)	35
Xbasin.01b	0.99999	Boreas Pass Carrier (Boreas_C)		2304611_C.01	26
Xbasin.02a	0.99997	Berthoud Pass Plan (BerthoudPln)		Berthoud Pass Diverrsion (0704625)	35
Xbasin.02b	0.99999	Berthoud Pass Carrier (Berthoud_C)		0704625_C.01	26
Xbasin.03a	0.99997	Homestake Pipeline Plan (HomestkPln)		Homestake Pipeline (HOMSPICO)	35
Xbasin.03b	0.99999	Homestake Carrier (Homestk_C)		HOMSPICOC.01	26
Xbasin.04a	0.99997	Gumlick Tunnel Plan (GumlickPln)		Berthoud Pass Imports (0704650)	35

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
Xbasin.04b	0.99999	Gumlick Carrier (Gumlick_C)		0704650_C.01	26
Xbasin.05a	0.99997	Roberts Tunnel Plan (RobTunPln)		Roberts Tunnel (8000653)	35
Xbasin.05b	0.99999	Roberts Tunnel Carrier (RobTun_C)		8000653_C.01	26
Xbasin.06a	0.99997	Straight Creek Tunnel Plan (StratCkPln)		Straight Ck Tunnel (0700903)	35
Xbasin.06b	0.99999	Straight Creek Carrier (StratCk_C)		0700903_C.01	26
Xbasin.07a	0.99997	Vidler Tunnel Plan (VidlerPln)		Vidler Tunnel (0704626)	35
Xbasin.07b	0.99999	Vidler Tunnel Carrier (Vidler_C)		0704626_C.01	26
Xbasin.08	0.99997	Moffat Import (06_MOF_ACC)		06_MOF_IMP	35
Xbasin.10	1.00000	Sand Hill Plan (SandHillPln)		SandHill_C	35

5.10.8.23 Flood Control

The following rules operate Cherry Creek Reservoir and Bear Creek Reservoir for flood control purposes. These two reservoirs are soley Army Corps of Engineer Projects and are operated for flood control to mimic historic releases to target. Chatfield Reservoir is another flood control reservoir in which Denver Water owns supply (see Section 5.10.8.1).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
CherryCk.01	40258.00001	NA		Cherry Ck Reservoir (0803532)	9
BearCk.01	47116.44105	NA		Bear Ck Lake (0903999)	9

5.10.9 Water Districts 1 and 64 (Lower South Platte) Operations

The Lower South Platte encompasses Water Districts 1 and 64, and the predominant operations in the basin are large off-channel irrigation and reservoir systems, augmentation and recharge operations, and the South Platte Compact. The following sections discuss the operations used to represent these complex systems.

Where to find more information

- SPDSS Task Memorandum 3, "Identify Key Diversion Structures Notes from Water District 64 Meeting," available on the CDSS website.
- SPDSS Task Memorandum 3, "Identify Key Diversion Structures Notes from Water District 1 Meeting," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, Bijou Irrigation System," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, Riverside Irrigation System," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, Jackson Lake & Fort Morgan Canal System," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, North Sterling Irrigation District," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, Prewitt Reservoir System," available on the CDSS website.
- SPDSS Task Memorandum 5, "Key Structure, Julesburg Irrigation System," available on the CDSS website.

5.10.9.1 Bijou Irrigation System

The Bijou Irrigation System is comprised of two entities, the Bijou Irrigation Company and the Bijou Irrigation District. The system is operated to meet the irrigation demand first with direct diversion water rights and then water from storage. Ground water can also be used to meet irrigation demand. Well users are primarily included in the Bijou Augmentation Plan (0103339 - see Augmentation Plan section). The system includes Empire Inlet Canal (0100501), Bijou Canal (0100507_D), Bijou Irrigation Demand (0100507_I), Empire Reservoir (0103816), and Bijou No. 2 Reservoir (0103507). Empire Reservoir is an off-channel reservoir. It is filled with diversions from the South Platte River at the Empire Inlet Canal. Bijou Reservoir is an off-channel reservoir that receives South Platte River water from the Bijou Canal. The Empire Reservoir storage water is released to the Empire Outlet Canal, which discharges to the Bijou Canal and is used to meet the irrigation demand. Irrigators under Bijou Canal also own C-BT shares and are entitled to Adams Tunnel imports. Note that Empire Inlet Canal also has water rights for direct irrigation, but discussions with the Water Commission indicate these are rarely used and are therefore excluded from the model. Bijou Reservoir releases water to the Bijou Canal directly for irrigation use and also to meet augmentation plan demands. Bijou No.2 historically released for irrigation, but due to its high seepage losses, was converted over to a recharge reservoir. These recharge operations are included with the Bijou Augmentation Plan (0103339) operations below. As presented in **Section 5.6** both reservoirs have one account. Empire Reservoir has a total capacity of 37,800 af while Bijou No. 2 has a total capacity of 7,600 af. The system is also responsible for diverting the direct flow rights for the Corona Ranch and the Putnam Ditch Company via the Bijou Canal. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01038160.01	20226.00000	Empire Res (0103816), Account 1	Empire Ditch (0100501)	0103816.01	45
01038160.02	26302.20226	Empire Res (0103816), Account 1	Empire Ditch (0100501)	0103816.02	45
01038160.03	31423.29219	Empire Res (0103816), Account 1	Empire Ditch (0100501)	0103816.03	45
01038160.06	18353.20000	Bijou Irrigation (0100507_I)	Account 1	Empire Res (0103816)	2
01005070.01	7944.00000	Bijou Irrigation (0100507_I)	Bijou Div Sys (0100507_D)	0100507_D.01	45
01005070.02	8511.00000	Bijou Irrigation (0100507_I)	Bijou Div Sys (0100507_D)	0100507_D.02	45
01005070.03	9283.00000	Bijou Irrigation (0100507_I)	Bijou Div Sys (0100507_D)	0100507_D.03	45
01005070.04	11049.00000	Bijou Irrigation (0100507_I)	Bijou Div Sys (0100507_D)	0100507_D.04	45
01005070.05	11804.00000	Bijou Irrigation (0100507_I)	Bijou Div Sys (0100507_D)	0100507_D.05	45
01005070.06	13468.00000	Bijou Irrigation (0100507_I)	Bijou Div Sys (0100507_D)	0100507_D.06	45
01005070.07	14154.00000	Bijou Irrigation (0100507_I)	Bijou Div Sys (0100507_D)	0100507_D.07	45
01005070.08	18353.00000	Bijou Irrigation (0100507_I)	Bijou Div Sys (0100507_D)	0100507_D.08	45
AdamsTun.21	59169.56618	Bijou Irrigation (0100507_I)	Olympus Tunnel (040100), Olympus Tunnel Return Point (040100_R), Bijou Div Sys (0100507_D)	AdamsTunPln	27

5.10.9.2 Meadow Rights

Water rights decreed as meadow rights are limited to irrigate during the meadow season (April 10 – July 10). Meadow rights were identified by querying action comments in HydroBase containing "Meadow" or "4/10". Diversions decreed as meadow rights were limited by monthly switches and are listed below. Corona Ranch Meadow Right is included in Bijou Irrigation Diversion System, and diversions under this right were limited by monthly switches in 01005070.03 (above).

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type

Opr_Mead.01	7762.00000	Deuel Snyder Canal (0100517)		0100517.01	36
Opr_Mead.02	8948.00000	Deuel Snyder Canal (0100517)		0100517.02	36
Opr_Mead.04	8501.00000	Schneider Ditch (6400531)		6400531.01	36
Opr_Mead.05	8866.00000	Davis Bros Ditch (6400532)		6400532.01	36

5.10.9.3 Riverside Irrigation System

The Riverside Irrigation System is comprised of two entities, the Riverside Reservoir and Land Company and the Riverside Irrigation District. Riverside Diversion System (0100503_D) diverts water from the South Platte River for irrigation under the Riverside Irrigation Demand (0100503_I); storage in the Riverside Reservoir system (0103651); and recharge operations associated with Riverside Augmentation Plan (0102522 - see Augmentation Plan section). The reservoir system includes both Riverside Reservoir (0103651) and Vancil Reservoir (0103400). Vancil Reservoir was constructed on lower Riverside Canal to mitigate fluctuations in flow throughout the irrigation season and to make supplemental irrigation releases to the lower portion of the Riverside system. As presented in **Section 5.6,** the reservoir has two accounts; a 66,500 af active pool for irrigation and a 7,400 af inactive pool. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01036510.01	19083.00000	Riverside Res (0103651), Accounts 1 and 2	Riverside Div System (0100503_D)	0103651.01	45
01036510.02	21031.00000	Riverside Res (0103651), Accounts 1 and 2	Riverside Div System (0100503_D)	0103651.02	45
01036510.03	22212.00000	Riverside Res (0103651), Accounts 1 and 2	Riverside Div System (0100503_D)	0103651.03	45
01036510.04	31423.29219	Riverside Res (0103651), Accounts 1 and 2	Riverside Div System (0100503_D)	0103651.04	45
01036510.05	50466.00000	Riverside Res (0103651), Accounts 1 and 2	Riverside Div System (0100503_D)	0103651.05	45
01036510.06	50769.49378	Riverside Res (0103651), Accounts 1 and 2	Riverside Div System (0100503_D)	0103651.06	45
01036510.07	51356.00000	Riverside Res (0103651), Accounts 1 and 2	Riverside Div System (0100503_D)	0103651.07	45
01036510.08	49841.00000	Riverside Res (0103651), Accounts 1 and 2	Riverside Div System (0100503_D)	0103651.08	45
01036510.09	50403.49841	Riverside Res (0103651), Accounts 1 and 2	Riverside Div System (0100503_D)	0103651.09	45
01036510.10	20969.20000	Riverside Irrigation System (0100503_I)	Account 1	Riverside Res (0103651)	2
01036510.11	9497.00000	Riverside Irrigation System (0100503_I)	Riverside Div System (0100503_D)	0100503_D.01	45
01036510.12	13482.00000	Riverside Irrigation System (0100503_I)	Riverside Div System (0100503_D)	0100503_D.02	45

01036510.13	20969.00000	Riverside Irrigation System (0100503_I)	Riverside Div System (0100503_D)	0100503_D.04	45
01036510.14	59901.00000	Riverside Irrigation System (0100503_I)	Riverside Div System (0100503_D)	0100503_D.14	45

5.10.9.4 Jackson Lake Reservoir System

Jackson Lake provides supplemental irrigation supplies to several ditches along the South Platte River, as well as releases for augmentation demands. Water is conveyed to the off-channel reservoir via the Jackson Lake Inlet Canal (0100513), and released back to the South Platte River via the Jackson Lake Outlet Canal. Storage releases are either exchanged upstream or delivered downstream to irrigation water providers that have ownership in the reservoir. The reservoir also releases directly to meet a small irrigation demand (0103817_I) located off of the outlet canal. As presented in **Section 5.6,** the reservoir has 8 accounts, including 7 user accounts and a 2,500 af inactive pool, and a total capacity of 36,200 af. Fort Morgan Ditch (0100514) owners have majority ownership in the reservoir and utilize its storage supply to supplement direct flow diversions via the Fort Morgan Canal. The ditch system operations are captured using the operating rules in the table below.

Right ID	**Admin #**	**Destination**	**Account, Carrier, Return Location (R), or % Split**	**Source**	Right Type
01038170.01	18765.00000	Jackson (0103817), Accounts 1-8	Jackson Lake Inlet (0100513)	0103817.01	45
01038170.02	31423.29219	Jackson (0103817), Accounts 1-8	Jackson Lake Inlet (0100513)	0103817.02	45
AdamsTun.22	59169.56619	Jackson (0103817), Accounts 1-8	Olympus Tunnel (040100), Olympus Tunnel Return Point (040100_R), Jackson Lake Inlet (0100513)	AdamsTunPln	27
01038170.04	11979.00001	Ft Morgan Div System (0100514)	Account 1	Jackson (0103817)	2
01038170.04	13985.00001	Lower Platte Beaver Ditch (0100518)	Account 2	Jackson (0103817)	2
01038170.05	13985.00001	Upper Platte Beaver Canal (0100515)	Account 3	Jackson (0103817)	2
01038170.06	31423.29220	Jackson Lake Irrigation Demand (0103817_I)	Account 4	Jackson (0103817)	2
01038170.07	20969.30000	Riverside Irrigation Demand via carrier (01036510.13)	Account 5	Jackson (0103817)	7
01038170.08	14185.00001	Deuel Snyder Canal (0100517)	Account 6	Jackson (0103817)	2
01038170.09	18353.30000	Bijou Irrigation Demand via carrier (01005070.08)	Account 7	Jackson (0103817)	7

5.10.9.5 North Sterling Irrigation System

The North Sterling Irrigation System diverts water from the South Platte River for irrigation under the North Sterling Irrigation Demand (0100687_I); storage in North Sterling Reservoir (6403551, aka Point of Rocks); and recharge operations associated with North Sterling Augmentation Plan (6403392). North Sterling Reservoir is an off-channel reservoir in Water District 64 that diverts water from the South Platte River via the North Sterling Canal, which originates in Water District 1. Storage water is released to the North Sterling Outlet Canal for irrigation of lands within the irrigation district. As presented in Section 5.6, the reservoir has three accounts; a 55,590 af account for irrigation releases, a15,000 af account for recharge and augmentation operations, and a 4,000 af inactive account, for a total capacity of 74,590 af. The ditch system operations are captured using the operating rules in the table below. Recharge operations are documented under the North Sterling Augmentation Plan (6403392) section below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64035510.01	21350.00000	North Sterling Res (6403551), Accounts 1-3	North Sterling Div Sys (0100687)	6403551.01	45
64035510.02	26298.23953	North Sterling Res (6403551), Accounts 1-3	North Sterling Div Sys (0100687)	6403551.02	45
64035510.03	23172.21350	North Sterling Res (6403551), Accounts 1-3	Pawnee to Sterling (6403551_Paw)	6403551.03	45
64035510.04	23172.21350	North Sterling Res (6403551), Accounts 1-3	Cedar to Sterling (6403551_Ced)	6403551.04	45
64035510.05	26302.23524	N Sterling Irrig (0100687_I)	Account 1	North Sterling Res (6403551)	2
64035510.06	26302.23525	N Sterling Irrig (0100687_I)	Account 2	North Sterling Res (6403551)	2
64035510.07	26302.23522	N Sterling Irrig (0100687_I)	North Sterling Div Sys (0100687)	0100687.02	45

5.10.9.6 Prewitt Reservoir System

Prewitt Reservoir (6403552) is an off-channel reservoir located on the south side of the Lower South Platte River. Water is conveyed to the reservoir for storage through the Prewitt Inlet Canal (0100829), which originates in Water District 1. Water from the reservoir is released into the Prewitt Outlet Canal for either delivery to downstream ditches via the South Platte River or delivery to the South Platte Ditch via the Highline Canal. As presented in Section 5.6, the reservoir has 20 total accounts, including 19 user accounts and one account for augmentation releases, and a total capacity of 32,164 af. User accounts were based on share ownership under the Logan Irrigation District, Iliff Irrigation District, and Morgan-Prewitt Reservoir Company, as provided by Prewitt Reservoir staff. Releases for augmentation are described in the Augmentation Plan section below. The ditch system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or	Source	Right Type

			% Split		
64035520.01	22059.00000	Prewitt Res (6403552), Accounts 1-20	Prewitt Res Inlet (0100829)	0103552.01	45
64035520.02	31423.29219	Prewitt Res (6403552), Accounts 1-20	Prewitt Res Inlet (0100829)	0103552.02	45
64035520.11	16893.10000	South Platte Ditch (6400535)	Account 1	Prewitt Res (6403552)	3
64035520.12	55995.10000	Pawnee Ditch (6400533)	Account 2	Prewitt Res (6403552)	2
64035520.13	54296.10000	Davis Bros Ditch (6400532)	Account 3	Prewitt Res (6403552)	2
64035520.14	55882.65745	Springdale Ditch (6400530)	Account 4	Prewitt Res (6403552)	2
64035520.15	55941.10000	Schneider Ditch (6400531)	Account 5	Prewitt Res (6403552)	2
64035520.21	53558.10000	Bravo Div Sys (6400522_D)	Account 7	Prewitt Res (6403552)	2
64035520.22	55882.65874	Iliff Platte Valley Ditch (6400520)	Account 8	Prewitt Res (6403552)	2
64035520.23	47918.10000	Lone Tree Ditch (6400518)	Account 9	Prewitt Res (6403552)	2
64035520.25	45289.10000	Powell Blair Ditch (6400516)	Account 10	Prewitt Res (6403552)	2
64035520.27	56088.10000	Harmony Irrigation (6400511_I)	Account 11, via Harmony Div Sys (6400511_D)	Prewitt Res (6403552)	2
64035520.26	42034.10000	Ramsey Ditch (6400514)	Account 12	Prewitt Res (6403552)	2
64035520.31	44628.10000	Sterling Irrigation Ditch No 2 (6400526)	Account 13	Prewitt Res (6403552)	2
64035520.32	47572.48465	Bijou Irrigation (0100507_I)	Account 14, via Bijou Div Sys (0100507_D)	Prewitt Res (6403552)	2
64035520.33	51488.00000	Upper Platte Beaver Canal (0100515)	Account 15	Prewitt Res (6403552)	2
64035520.34	56613.48471	Lower Platte Beaver Ditch (0100518)	Account 16	Prewitt Res (6403552)	2
64035520.35	41515.10000	Johnson Edwards Ditch (0100526)	Account 17	Prewitt Res (6403552)	2
64035520.36	42079.10000	Deuel Snyder Canal (0100517)	Account 18	Prewitt Res (6403552)	2

5.10.9.7 Julesburg Irrigation System – Harmony Ditch System (6400511_D), Julesburg Reservoir (6403906), Harmony Irrigation Demand (6400511_I), Harmony recharge area (6402518_R), and Lower Logan Upper Harmony Ditch recharge area (6402536_RH)

Julesburg Irrigation District is an irrigation provider that includes Julesburg Reservoir storage water and direct flow diversions from the Harmony Ditch No. 1, Settlers Ditch, and Petersen Ditch. Stockholders that own land within the district boundary have shared ownership, and are equally entitled, to the irrigation water under the direct irrigation rights and Julesburg Reservoir water (6403906). The District was formed in 1904 as an extension of the irrigation system under the Harmony Ditch No. 1. Julesburg Reservoir and the Highline Canal were completed in 1906. In the same year, the District purchased water rights in Settlers Ditch and approximately 80% of the rights in the Petersen Ditch, and expanded its boundary to include the ditches' service areas.

Harmony Ditch System (6400511_D) diverts water from the lower South Platte River for irrigation, storage in Julesburg Reservoir, and recharge areas. Julesburg Reservoir, also known as Jumbo Reservoir, is an off-channel reservoir located on the north side of the lower South Platte River. Water is conveyed to the reservoir for storage through Harmony Ditch No. 1. Irrigation water is then released from the reservoir via the Highline Canal. The Highline Canal directly serves irrigated land within the Julesburg Irrigation District, represented by the Harmony Irrigation Demand (6400511_I) and also conveys water to both Settlers Ditch and Petersen Ditch. As presented in **Section 5.6,** the reservoir has 1 account and a total capacity of 28,200 af. The irrigation system operations are captured using the operating rules in the table below.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64039060.01	19765.00000	Julesburg Res (6403906), Account 1	Harmony Div System (6400511_D)	6403906.01	45
64039060.03	19765.10000	Harmony Irrigation (6400511_I)	Account 1	Julesburg Res (6403906)	2
64039060.04	17846.27846	Settlers Ditch (6400508)	Account 1	Julesburg Res (6403906)	3
64039060.05	17846.27496	Peterson Ditch (6400504)	Account 1	Julesburg Res (6403906)	3
64039060.06	16554.00000	Harmony Irrigation (6400511_I)	Harmony Div System (6400511_D)	6400511_D.01	45
64039060.07	17290.00000	Harmony Irrigation (6400511_I)	Harmony Div System (6400511_D)	6400511_D.02	45
64039060.08	19490.00000	Harmony Irrigation (6400511_I)	Harmony Div System (6400511_D)	6400511_D.03	45
64039060.09	19765.00000	Harmony Irrigation (6400511_I)	Harmony Div System (6400511_D)	6400511_D.04	45

5.10.10Augmentation Plan Operations

The State of Colorado defines augmentation plans as "a court-approved document which is designed to protect existing water rights by replacing water depleted under a new project" (DWR website). In general, augmentation plans describe how out-of-priority well pumping depletions are going to be "augmented" in order to protect senior water rights. Augmentation plans use various sources to replace depletions, either through direct releases or lagged accretions to the river. In StateMod, the simulation of augmentation plan demand and supplies requires several operations. First, StateMod internally determines if any depletions occurred in-priority in the same time-step based on the priority in the well rights file. A Type 43 rule is generally included to determine if any lagged depletions occur in-priority based on the administration number of the rule. The priority of the Type

43 is based on either the decreed augmentation plan priority, or based on the most junior well right included in the plan. Once the depletion is determined to be out-of-priority, an augmentation plan demand is generated. Each augmentation plan has supplies unique to their plan, however many augmentation plans in the South Platte Basin rely on in-ditch and recharge area seepage, then supplement those supplies as needed by changed water rights, reservoir releases, and augmentation/recharge well pumping. Example operations include:

- A type 45 rule makes surface water diversions to a recharge area under a user-specified recharge/augmentation water right.
- A type 47 rule limits the amount of water that can be supplied to a recharge area based on monthly or annual volumes.
- A type 48 rule applies canal seepage, reservoir seepage, or a reservoir release to meet the augmentation plan demand.
- A type 49 rule applies water by exchange from a canal seepage plan, a reservoir seepage plan, or a reservoir to meet the augmentation plan demand.
- A type 44 rule pumps ground water from a recharge well to the recharge area and a type 37 rule pumps ground water from an augmentation well to directly meet the augmentation plan demand in the river.

StateMod does not currently support the release of historical consumptive use credits in a changed water rights plan directly to meet an augmentation demand using a Type 48 or 49 operating rule. Therefore, the changed water rights were stored in recharge areas with an "immediate" seepage pattern in order for the credits to be applied to the augmentation demand.

As discussed in the calibration section, the model does not curtail pumping if supplies are not sufficient to meet the augmentation plan demand. It is the user's responsibility to ensure sufficient supplies are provided.

5.10.10.1 Central Colorado Water Conservancy District Augmentation Plans (GMS/WAS)

Central Colorado Water Conservancy District (Central) is an umbrella organization that covers well users under multiple ditch systems and ground water-only wells in Adams, Weld, and Morgan Counties. Central is composed of the following two subdistricts that extend from about the City of Brighton down to the City of Fort Morgan, including significant portions of the Beebe Draw and Boxelder Creek drainages:

- Groundwater Management Subdistrict (GMS)
- Well Augmentation Subdistrict (WAS)

The GMS subdistrict operated since 1973 under an SWSP until its augmentation plan (Case No. 02CW335) was decreed in May 2005. The Groundwater Appropriators of the South Platte (GASP), formed in 1973, was dissolved in 2004 because of subsequent years of full-time river calls and insufficient replacement supplies to replace its member wells' depletions. A number of GASP wells developed the WAS subdistrict along with other augmentation plans in the lower basin. The WAS augmentation plan (Case No. 03CW99) was decreed in May 2008.

Well Depletions for GMS and WAS are defined in the 02CW335 and 03CW99 decrees, respectively. Replacement operations for both GMS and WAS are broken into six administrative reaches with WAS being further divided into 10 administrative sub-reaches. The GMS reaches are defined as follows:

- Reach F - The headgate of the Fulton Ditch to the headgate of the Jay Thomas Ditch
- Reach C - From the headgate of the Jay Thomas to the headgate of the Lower Latham Ditch
- Reach B - From the headgate of the Lower Latham Ditch to the headgate of the Riverside Inlet Canal
- Reach A - From the headgate of the Riverside Inlet Canal to the headgate of the Upper Platte and Beaver Canal.
- Reach D - Confluence of Beebe Draw and the South Platte River
- Reach E - Confluence of Box Elder Creek and the South Platte River

In GMS, replacements are owed above the calling right located either within or below a specific Reach. To simplify the representation of the GMS Well Aug Plans, the following Plan nodes are included in the model network above the ditches that historically place calls within the specific reaches:

- Reach F - Above Hewes Cook Ditch (Western Mutual)
- Reach C - Above Lower Latham Ditch
- Reach B - Confluence of Cache la Poudre River and the South Platte River (consistent with location of replacements for WAS Reach B, as discussed below)\
- Reach A - Above Bijou Canal
- Reach D - Confluence of the Beebe Draw and South Platte River
- Reach E - Confluence of Box Elder Creek and the South Platte River

WAS Replacements are modeled at the same locations as GMS listed above with the following reaches further divided to address the wells that impact those sub-reaches. To maintain consistency between representation of the GMS and WAS plans, the WAS sub-reaches are not incorporated into the SPDDS model.

- Reach F sub-reaches
    - F2 - 9% above the headgate of the Platteville Irrigating and Milling Ditch

  - F3 - 91% to the Western Mutual Ditch ==>> We are simplifying by representing 100% replacements owed above Western Mutual Ditch.
- Reach C sub-reaches
  - C1 - 49% to mid-point of Reach C - generally defined as the Union Ditch
  - C2 - 51% to end of Reach C (Lower Latham Ditch)
- Reach A sub-reaches
  - A1 - 50% is owed to immediately above the headgate of the Fort Morgan Canal
  - A2 - 50% is owed to the end of the reach considered to be the headgate of the Upper Platte and Beaver Canal

The Well Augmentation Plans are assigned Plan IDs 9903394_A, _B, _C, _D, _E, and _F for GMS and 9903334_A, _B, _C, _D, _E, and _F for WAS based on information from the augmentation plan decrees. Wells are assigned to each plan in the well to plan file (*plw) based first on their association with either the WAS or GMS well in HydroBase, then assigned to reaches based on the location of the irrigated acreage with respect to the defined reaches (see Section 5.8.2 and Section 7.9)

Central uses numerous gravel pit storage units, recharge projects, ditch company and reservoir company shares, augmentation wells, and leased reusable supplies in its plan. The storage, recharge, and changed shares are the primary replacements that are included in the SPDSS model. The augmentation wells and leased water is less frequently used and are not included in the model. Administratively, the Central out-of-priority depletions are replaced above the calling water right. For example, depletions in Reach F and Reach C are owed, in aggregate, to the Lower Latham Ditch when the Lower Latham Ditch has placed a call on the river. The StateMod algorithm is unable to make this kind of determination during simulation; therefore, the well depletions assigned to the well augmentation plan nodes are replaced based on their respective locations in the model network.

The first set of rules to meet the well depletions are the Type 43 In Priority rules based on the most junior water right assigned to the well augmentation plans. Lagged depletions not met by these rules indicate the depletions are out-of-priority to downstream senior water rights.

GMS and WAS Aug Plan In-Priority Replacements

Right ID	Admin	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
GMS_A.01	50661.00000	GMS Reach A Aug Pln (9903334_A)			43
GMS_B.01	43955.00000	GMS Reach B AugPln (9903334_B)			43
GMS_C.01	46751.35990	GMS Reach C Aug Pln (9903334_C)			43

GMS_D.01	54126.00000	GMS Reach D Aug Pln (9903334_D)			43
GMS_E.01	45655.39523	GMS Reach E Aug Pln (9903334_E)			43
GMS_F.01	49308.45580	GMS Reach F Aug Pln (9903334_F)			43
WAS_A.01	42519.00000	9903394_A			43
WAS_B.01	38948.00000	9903394_B			43
WAS_C.01	47481.38551	9903394_C			43
WAS_D.01	47481.38551	9903394_D			43
WAS_E.01	47847.40293	9903394_E			43
WAS_F.01	46386.30194	9903394_F			43

Three recharge plans for the Hewes Cook recharge (0200824_PlC, 0200824_R, and 0200824_PlR) and three recharge plans for the Farmers Independent recharge (0200825_PlC, 0200825_R, and 0200825_PlR) are used to track the in-ditch, reservoir, and recharge area seepage, which is used to meet the augmentation plan demand. Plan limitations are used to limit diversions to recharge to historical diversions. Multiple recharge sites are aggregated, by ditch, to simplify representation of the recharge projects. As presented in the table below, the following operating rules were used to simulate the recharge projects.

Recharge Projects

Right ID	**Admin**	**Destination**	**Account, Carrier, Return Location (R), or % Split**	**Source**	**Right Type**
02008250.99	1.00000			Hewes Cook Release Limit (0200825_RL)	47
02008240.99	1.00000			Farmers Independent RL (0200824_RL)	47
02008250.01	50114.00000	Hewes Cook Recharge Area (0200825_R)	Hewes Cook Ditch (0200825)	0200825.04	45
02008240.01	49631.00000	Farmer Independent Recharge Area (0200824_R)	Farmers Independent Ditch (0200824)	0200824.03	45

The table below includes the various operating rules used to meet WAS and GMS depletions from the Hewes Cook and Farmers Independent recharge projects.

Right ID	**Admin**	**Destination**	**Account, Carrier, Return Location (R), or % Split**	**Source**	**Right Type**

02008250.08	60000.50000	9903394_F		Hewes Cook RA Recharge (0200825_PIR)	49
02008250.09	60000.50001	9903394_C		Hewes Cook RA Recharge (0200825_PIR)	48
02008250.11	60000.50003	9903394_B		Hewes Cook RA Recharge (0200825_PIR)	48
02008250.12	60000.50004	9903394_D		Hewes Cook RA Recharge (0200825_PIR)	48
02008250.13	60000.50005	9903394_E		Hewes Cook RA Recharge (0200825_PIR)	48
02008250.14	60000.50006	9903394_A		Hewes Cook RA Recharge (0200825_PIR)	48
02008250.21	60000.50007	9903394_F		Hewes Cook Canal Recharge (0200825_PIC)	49
02008250.22	60000.50008	9903394_C		Hewes Cook Canal Recharge (0200825_PIC)	48
02008250.24	60000.50010	9903394_B		Hewes Cook Canal Recharge (0200825_PIC)	48
02008250.25	60000.50011	9903394_D		Hewes Cook Canal Recharge (0200825_PIC)	48
02008250.26	60000.50012	9903394_E		Hewes Cook Canal Recharge (0200825_PIC)	48
02008250.27	60000.50013	9903394_A		Hewes Cook Canal Recharge (0200825_PIC)	48
02008240.08	60000.50014	9903394_F		Farmers Independent RA Recharge (0200824_PIR)	48
02008240.09	60000.50015	9903394_C		Farmers Independent RA Recharge (0200824_PIR)	48
02008240.11	60000.50017	9903394_B		Farmers Independent RA Recharge (0200824_PIR)	48
02008240.12	60000.50018	9903394_D		Farmers Independent RA Recharge (0200824_PIR)	48
02008240.13	60000.50019	9903394_E		Farmers Independent RA Recharge (0200824_PIR)	48
02008240.14	60000.50019	9903394_A		Farmers Independent RA Recharge (0200824_PIR)	48
02008240.21	60000.50020	9903394_F		Farmers Independent Canal Recharge (0200824_PIC)	48
02008240.22	60000.50021	9903394_C		Farmers Independent Canal Recharge (0200824_PIC)	48
02008240.24	60000.50023	9903394_B		Farmers Independent Canal Recharge (0200824_PIC)	48
02008240.25	60000.50024	9903394_D		Farmers Independent Canal Recharge (0200824_PIC)	48
02008240.26	60000.50025	9903394_E		Farmers Independent Canal Recharge (0200824_PIC)	48

02008240.27	60000.50026	9903394_A		Farmers Independent Canal Recharge (0200824_PIC)	48

Consumptive Use Credits

Consumptive use credit from changed water rights are used to replace well pumping depletions The use of changed water rights to meet demands is discussed in Section 4.9. StateMod algorithm is currently not set up to use changed water rights to meet well depletions. Therefore, an approach was developed where ditch credits in Central's various sub-plan IDs (IDs CenFulPln, CenBriPln, CenLMPln, CenLBPln, CenPVPln, CenFarmPln, CenSN3Pln, CenHighPln) are released to recharge reservoirs (IDs 0200808_RS, 0200810_RS, 0200812_RS, and 0200821_RS) and canal recharge plans (IDs 0200808_RC, 0200810_RC, 0200812_RC, 0200813_RC, 0200824_RC, 0200830_RC, and 0200837_RC) that create immediate accretions to Plan recharge nodes (IDs 9903394_PlR and 9903344_PlR).

As presented in the table below, the following operating rules were used to simulate the use limits on Central's ownership in the Fulton Ditch, Brighton Ditch, Lupton Bottom Ditch, Lupton Meadows Ditch, Platteville Ditch, Farmers Independent Ditch, Section No. 3 Ditch, and Highland Ditch.

Right ID	Admin	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
CCWCDFul.99	1.0000			Central Fulton RL (CenFul_RL)	47
GMS_Ful.01a-f	66000.00000	CCWCD Fulton HCU Sto (0200808_RC)	Fulton Ditch (0200808) Fulton Aug Station (0200808_A)	CenFulPln	27
CCWCDBri.99	1.00000			Central Brighton RL (CenBri_RL)	47
GMS_Bri.01a-g	62000.00000	CCWCD Brighton HCU Sto (0200810_RC)	Brighton Ditch (0200810) Brighton Aug Stn (0200810_A)	CenBriPln	27
CCWCDLB.99	1.00000			Central LB RL (CenLB_RL)	47
GMS_LB.01a-g	64000.00000	CCWCD LuptBtm HCU Sto (0200812_RC)	Lupton Bottom Ditch (0200812) Lupt Btm Aug Stn (0200812_A)	CenLBPln	27
CCWCDLM.99	1.00000			Central LM RL (CenLM_RL)	47
WAS_LM.01a-g	61000.50000	CCWCD LuptBtm HCU Sto (0200812_RC)	Lupton Bottom Ditch (0200812) Lupt Btm Aug Stn (0200812_A)	CenLMPln	27
CCWCDFI.99	1.00000			Central FI RL (CenFI_RL)	47

GMS_FI.01a-g	65000.00000	CCWCD FIDCo HCU Sto (0200824_RC)	Farmers Independent Ditch (0200834) Farm Ind Aug Stn (0200834_A)	CenFarmPln	27
CCWCDSN3.99	1.00000			Central Sec No. 3 RL (CenSN3_RL)	47
GMS_SN3.01a-g	70000.00000	CCWCD Sec No. 3 HCU Sto (0200830_RC)	Section No. 3 Ditch (0200830) Sec No 3 Aug Stn (0200830_A)	CenSN3RFs	27
CCWCDHi.99	1.00000			Central Highland RL (CenHigh_RL)	47
GMS_Hi.01a-e	80000.00000	CCWCD Highland HCU Sto (0200837_RC)	Highland Ditch (0200837) Highland Aug Stn (0200837_A)	CenHighPln	27

Consumptive use credits from the various ditch systems in which Central owns shares are discussed in the documentation related to the various other owners. Central is the only user with shares in the Section No. 3 Ditch that have been changed. The rules in the following table are used to represent the changed water rights in the Section No. 3 Ditch, consistent with the approach discussed in Section 4.9. Although Central's prorata share ownership is represented in the model, the use of those credits to meet well depletions is not represented since the credits have not yet been used for that purpose.

Section No. 3 Ditch

Right ID	Admin	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
SectNo3.01	7374.00000	SN3SplPln	100%	0200830.01	26
SectNo3.02	8475.00000	SN3SplPln	100%	0200830.02	26
SectNo3.03	8475.00002	SN3IrrPln CenSN3Pln	96.9% 3.1%	SN3SplPln	46
SectNo3.04	8475.00003	Section No. 3 Ditch (0200830)		SN3IrrPln	27
CCWCDSN3.01	70000.99999	Section No. 3 Ditch (0200830)		CenSN3Pln	27

The consumptive use credits from the various ditches accounted in the Plan recharge nodes are then used to meet WAS and GMS well depletions via the rules in the following table.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
CenRepl.01	82000.00000	9903394_F		9903394_PIR	48

CenRepl.02	82000.00001	9903334_F		9903394_PlR	48
CenRepl.03	82000.00002	9903394_C		9903394_PlR	48
CenRepl.05	82000.00004	9903334_C		9903394_PlR	48
CenRepl.06	82000.00005	9903394_B		9903394_PlR	48
CenRepl.07	82000.00006	9903334_B		9903394_PlR	48
CenRepl.08	82000.00007	9903394_D		9903394_PlR	48
CenRepl.09	82000.00008	9903334_D		9903394_PlR	48
CenRepl.10	82000.00009	9903394_E		9903394_PlR	48
CenRepl.11	82000.00010	9903334_E		9903394_PlR	48
CenRepl.12	82000.00011	9903394_A		9903394_PlR	48
CenRepl.13	82000.00012	9903334_A		9903394_PlR	48
CenRepl.01	82000.00000	9903394_F		9903394_PlR	48

Gravel Pit Storage Units

Recharge accretions from the Bijou Augmentation Plan are used to meet WAS and GMS well depletions via the rules in the following table.

Right ID	Admin	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01033390.15	82000.00014	9903334_F		Bijou Aug Plan Canal Recharge (0103339_PlC)	49
01033390.16	82000.00014	9903334_C		Bijou Aug Plan Canal Recharge (0103339_PlC)	49
01033390.17	82000.00014	9903334_B		Bijou Aug Plan Canal Recharge (0103339_PlC)	49
01033390.18	82000.00014	9903334_D		Bijou Aug Plan Canal Recharge (0103339_PlC)	49
01033390.19	82000.00014	9903334_E		Bijou Aug Plan Canal Recharge (0103339_PlC)	49
01033390.20	82000.00014	9903334_A		Bijou Aug Plan Canal Recharge (0103339_PlC)	49
01033390.28	82000.00014	9903334_F		Bijou Aug Plan RA Recharge (0103339_PlR)	49
01033390.29	82000.00014	9903334_C		Bijou Aug Plan RA Recharge (0103339_PIR)	49

4901033390.30	82000.00014	9903334_B		Bijou Aug Plan RA Recharge (0103339_PIR)	49
01033390.31	82000.00014	9903334_D		Bijou Aug Plan RA Recharge (0103339_PIR)	49
01033390.32	82000.00014	9903334_E		Bijou Aug Plan RA Recharge (0103339_PIR)	49
01033390.33	82000.00014	9903334_A		Bijou Aug Plan RA Recharge (0103339_PIR)	49
01033390.21	82000.00014	9903334_F		Bijou Aug Plan Canal Recharge (0103339_PIC)	49
01033390.22	82000.00014	9903334_C		Bijou Aug Plan Canal Recharge (0103339_PIC)	49
01033390.24	82000.00014	9903334_B		Bijou Aug Plan Canal Recharge (0103339_PIC)	49
01033390.25	82000.00014	9903334_D		Bijou Aug Plan Canal Recharge (0103339_PIC)	49
01033390.34	82000.00014	9903334_E		Bijou Aug Plan Canal Recharge (0103339_PIC)	49
01033390.35	82000.00014	9903334_F		Bijou Aug Plan RA Recharge (0103339_PIR)	49
01033390.36	82000.00014	9903334_C		Bijou Aug Plan RA Recharge (0103339_PIR)	49
01033390.37	82000.00014	9903334_B		Bijou Aug Plan RA Recharge (0103339_PIR)	49
01033390.38	82000.00014	9903334_D		Bijou Aug Plan RA Recharge (0103339_PIR)	49
01033390.39	82000.00014	9903334_E		Bijou Aug Plan RA Recharge (0103339_PIR)	49
01033390.34	82000.00014	9903334_A		Bijou Aug Plan RA Recharge (0103339_PIR)	49

Storage Releases

Releases from Union Reservoir are used to meet WAS and GMS depletions via the rules in the following table.

Right ID	Admin	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
0503905_C8	82000.00013	9903334_A		Union Res (0503905), Account 2	2
0503905_C9	82000.00013	9903334_B		Union Res (0503905), Account 2	2
0503905_C10	82000.00013	9903334_C		Union Res (0503905), Account 2	2
0503905_C11	82000.00013	9903394_A		Union Res (0503905), Account 2	2
0503905_C12	82000.00013	9903394_B		Union Res (0503905), Account 2	2
0503905_C13	82000.00013	9903394_C		Union Res (0503905), Account 2	2

Return Flow Obligations

Use of the changed water rights creates return flow obligations. The following rules are used to meet those return flow obligations with excess recharge credits from the Hewes Cook and Farmers Independent recharge projects.

Right ID	Admin	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
02008250.28	81000.00001	CenFulRFs		Hewes Cook RA Recharge (0200825_PIR)	49
02008250.29	81000.00002	CenFulRFs		Hewes Cook Canal Recharge (0200825_PIC)	49
02008250.30	81000.00003	CenBriRFs		Hewes Cook RA Recharge (0200825_PIR)	49
02008250.31	81000.00004	CenBriRFs		Hewes Cook Canal Recharge (0200825_PIC)	49
02008250.32	81000.00005	CenLBRFs		Hewes Cook RA Recharge (0200825_PIR)	49
02008250.33	81000.00006	CenLBRFs		Hewes Cook Canal Recharge (0200825_PIC)	49
02008250.34	81000.00007	CenPVRFs		Hewes Cook RA Recharge (0200825_PIR)	49
02008250.35	81000.00008	CenPVRFs		Hewes Cook Canal Recharge (0200825_PIC)	49
02008250.36	81000.00009	CenFarmRFs		Hewes Cook RA	48

				Recharge (0200825_PIR)	
02008250.37	81000.00010	CenFarmRFs		Hewes Cook Canal Recharge (0200825_PIC)	48
02008250.38	81000.00011	CenSN3RFs		Hewes Cook RA Recharge (0200825_PIR)	48
02008250.39	81000.00012	CenSN3RFs		Hewes Cook Canal Recharge (0200825_PIC)	48
02008250.40	81000.00013	CenHighRFs		Hewes Cook RA Recharge (0200825_PIR)	48
02008250.41	81000.00014	CenHighRFs		Hewes Cook Canal Recharge (0200825_PIC)	48

Excess consumptive use credits in the Plan recharge nodes are then used to meet return flow obligations via the rules in the following table.

Right ID	Admin	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
CenRepl.22	83000.00013	CenFulRFs		9903394_PlR	49
CenRepl.23	83000.00014	CenBriRFs		9903394_PlR	49
CenRepl.24	83000.00015	CenLBRFs		9903394_PlR	49
CenRepl.25	83000.00016	CenPVRFs		9903394_PlR	49
CenRepl.26	83000.00017	CenFarmRFs		9903394_PlR	48
CenRepl.27	83000.00018	CenSN3RFs		9903394_PlR	48
CenRepl.28	83000.00019	CenHighRFs		9903394_PlR	48

Right ID	Admin	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
WAS_LM.01a-g	61000.50000	Central LuptBtm HCU Sto (0200812_RC)	Lupton Bottom Ditch (0200812) Lupt Btm Aug Stn (0200812_A)	CenLMPln	27

5.10.10.2 City of Fort Morgan Augmentation Plan (0102456)

The City of Fort Morgan municipal demand was represented in the model by the aggregated Water District 1 municipal demand (01_AMP001_I and 01_AMP001_O). The City receives direct C-BT supplies and pumps ground water to meet municipal demands; however these municipal demands in the model are represented only as a ground water demand. Out-of-priority depletions are included in the City of Fort Morgan Augmentation Plan (0102456). Supplies to offset the depletions include deliveries from CBT, excess augmentation supplies from the Fort Morgan Augmentation Plan (0102528), and direct releases from Jackson Reservoir. Note that the augmentation plan can use the City's sewer return flows and lawn irrigation return flows as a supply for the plan as well. These supplies are inherently represented in the model because the augmentation plan demand is based on the total well pumping less the return flows from the indoor and outdoor municipal demands. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01024560.01	59169.56615	City Ft. Morgan Aug Plan - 0102456			43
AdamsTun.20	59169.56616	City Ft. Morgan Aug Plan - 0102456		AdamsTunPln	48
01024560.02	59169.56616	City Ft. Morgan Aug Plan - 0102456		City Ft. Morgan Aug Plan Canal Seepage - 0102528_PlC	48
01024560.03	59169.56617	City Ft. Morgan Aug Plan - 0102456		City Ft. Morgan Aug Plan Reservoir Seepage - 0102528_PlR	48
01024560.04	59169.56618	City Ft. Morgan Aug Plan - 0102456	Account 1	Jackson Reservoir - 0103817	48

5.10.10.3 Rothe Augmentation Plan (0102513)

The Rothe Augmentation Plan is generally operated based on recharge wells that fill numerous recharge areas located off of Bijou Canal and Riverside Canal. Recharge areas can also be filled by and shared with Bijou Augmentation Plan and Riverside Augmentation Plan, but these are measured and modeled separately (see descriptions below). Case No. 09CW7 was primarily used to support the representation of this plan in the model. Recharge area accretions primarily offset augmentation requirements, and are supplemented with excess recharge supplies from Fort Morgan Augmentation Plan, Riverside Augmentation Plan, and Bijou Augmentation Plan. A decreed pump station to divert surface water to the recharge areas has not been constructed yet. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01025130.01	58925.00001	Rothe Aug Plan - 0102513			43
01025130.02	58074.56110	Rothe Southern Recharge Area – 0102513_Rs		0102513Re1	44

01025130.03	58074.56095	Rothe Northern Recharge Area - 0102513_Rn		0102513Re2	44
01025130.04	58074.56095	Rothe Southern Recharge Area - 0102513_Rs		0102513Re3	44
01025130.05	58074.56095	Rothe Southern Recharge Area - 0102513_Rs		0102513Re4	44
01025130.06	58925.00002	Rothe Aug Plan - 0102513		Rothe Aug Plan Reservoir Seepage - 0102513_PlR	48
01025130.06	58925.00003	Rothe Aug Plan – 0102513		Ft. Morgan Aug Plan Canal Seepage - 0102528_PlC	49
01025130.08	58925.00004	Rothe Aug Plan – 0102513		Ft. Morgan Aug Plan Reservoir Seepage - 0102528_PlR	49
01025130.09	58925.00003	Rothe Aug Plan – 0102513		Riverside Aug Plan Canal Seepage - 0102522_PlC	48
01025130.10	58925.00004	Rothe Aug Plan – 0102513		Riverside Aug Plan Reservoir Seepage - 0102522_PlR	48
01025130.11	58925.00003	Rothe Aug Plan – 0102513		Bijou Aug Plan Canal Seepage - 0103339_PlC	48
01025130.12	58925.00004	Rothe Aug Plan - 0102513		Bijou Aug Plan Reservoir Seepage - 0103339_PlR	48

5.10.10.4 Pioneer Augmentation Plan (0102518)

The Pioneer Augmentation Plan is generally operated based on junior water rights that fill numerous recharge areas located off Tremont Ditch. Based on information from 03CW96, the model includes operations to divert a junior Tremont Ditch water right to an aggregated recharge area, tracking the in-ditch and recharge area seepage as an augmentation supply. A plan limitation was used to limit diversions to recharge to historical diversions. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01025180.01	42093.00001	Pioneer Aug Plan - 0102518			43
01025180.02	1.00000			Pioneer Aug Plan Release Limit - 0102518_RL	47
01025180.03	47847.46567	Pioneer Recharge Area - 0102518_R	Tremont Ditch - 0100519_D	0102518_D.05	45
01025180.04	47847.46568	Pioneer Aug Plan - 0102518		Pioneer Aug Plan Canal Seepage - 0102518_PlC	48
01025180.05	47847.46569	Pioneer Aug Plan - 0102518		Pioneer Aug Plan Reservoir Seepage - 0102518_PlR	48
01025180.06	59169.56620	Pioneer Aug Plan - 0102518	Account 4	Jackson Reservoir - 0103817	48

5.10.10.5 Riverside Augmentation Plan (0102522)

The Riverside Augmentation plan represents an aggregated augmentation plan including Headley (0102525), Goodrich Farms (0102536), Equus (0102581), and Sublette (0102725) plans. The Riverside Augmentation Plan is generally operated based on direct water rights off Riverside Canal that fill numerous recharge areas. Based on information from 02CW86, the model includes operations to divert junior Riverside Canal water rights to an aggregated recharge area, tracking the in-ditch and recharge area seepage as an augmentation supply. A plan limitation was used to limit diversions to recharge to historical diversions. This supply is supplemented with releases from Riverside Reservoir directly to the river. The decree allows Riverside Reservoir releases to be stored in recharge areas; however a simplified approach was taken in the model in order to limit the releases from the reservoir to only meet remaining augmentation demand. Note that the decree also allows excess recharge credits to be exchanged back up to Riverside Canal, however these operations are not currently supported by StateMod and therefore excluded. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01025220.01	53691.45807	Riverside Aug Plan – 0102522			43
01025220.02	1.00000			Riverside Aug Plan Release Limit - 0102522_RL	47
01025220.03	46751.45836	Riverside Aug Plan Recharge Reservoir - 0102522_R	Riverside Div System - 0100503_D	0100503_D.08	45
01025220.04	50466.00000	Riverside Aug Plan Recharge Area - 0102522_R	Riverside Div System - 0100503_D	0100503_D.10	45
01025220.05	50712.00000	Riverside Aug Plan Recharge Area - 0102522_R	Riverside Div System - 0100503_D	0100503_D.11	45
01025220.06	50769.49378	Riverside Aug Plan Recharge Reservoir - 0102522_R	Riverside Div System - 0100503_D	0100503_D.12	45
01025220.07	51356.00000	Riverside Aug Plan Recharge Area - 0102522_R	Riverside Div System - 0100503_D	0100503_D.13	45
01025220.08	53691.45808	Riverside Aug Plan – 0102522		Riverside Aug Plan Canal Seepage - 0102522_PlC	48
01025220.09	53691.45809	Riverside Aug Plan – 0102522		Riverside Aug Plan Reservoir Seepage - 0102522_PlR	48
01025220.10	53691.45810	Riverside Aug Plan – 0102522	Account 1	Riverside Reservoir -0103651	49

5.10.10.6 Ft. Morgan Canal Aug Plan (012528)

The Ft. Morgan Canal Augmentation Plan is generally operated based on junior water rights that fill numerous recharge areas located off of Fort Morgan Canal. Based on information from 02CW345, the model includes operations to divert junior Fort Morgan Canal water rights to an aggregated recharge area, tracking the in-ditch and recharge area seepage as an augmentation supply. A plan limitation was used to limit diversions to recharge to historical diversions. This supply is supplemented with releases from Jackson Reservoir directly to the river. The decree allows Jackson Reservoir releases to be stored in recharge areas; however a simplified approach was taken in the model in order to limit the releases from the reservoir to only meet remaining augmentation demand. Additionally the decree indicates only 42 percent of the Jackson Reservoir releases should be applied to the augmentation supply as they reflect changed water rights. These limitations are not supported using the Type 48 or 49 rules, therefore releases to the river are applied to the augmentation demand in full. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01025280.01	55595.51864	Ft. Morgan Canal Aug Plan - 0102528			43
01025280.02	1.00000			Ft. Morgan Canal Aug Plan Release Limit - 0102528_RL	47
01025280.03	44699.00000	Ft. Morgan Canal Aug Plan Recharge Area - 0102528_R	Ft. Morgan Div Sys - 0100514	0100514.02	45
01025280.04	55150.00000	Ft. Morgan Canal Aug Plan Recharge Area - 0102528_R	Ft. Morgan Div Sys - 0100514	0100514.03	45
01025280.05	52595.51866	Ft. Morgan Canal Aug Plan - 0102528		Ft. Morgan Canal Aug Plan Canal Seepage - 0102528_PlC	48
01025280.06	52595.51867	Ft. Morgan Canal Aug Plan - 0102528		Ft. Morgan Canal Aug Plan Reservoir Seepage - 0102528_PlR	48
01025280.07	52595.51868	Ft. Morgan Canal Aug Plan - 0102528	Account 1	Jackson Reservoir - 0103817	48

5.10.10.7 Upper Platte and Beaver Augmentation Plan (0102529)

The Upper Platte and Beaver Augmentation Plan is generally operated based on junior water rights that fill numerous recharge areas located off of Upper Platte and Beaver Canal. Based on information from 02CW401, the model includes operations to divert junior Upper Platte and Beaver Canal water rights to an aggregated recharge area, tracking the in-ditch and recharge area seepage as an augmentation supply. A plan limitation was used to limit diversions to recharge to historical diversions. This supply is supplemented with releases from Jackson Reservoir, Prewitt Reservoir, and Riverside Reservoir directly to the river, and excess recharge credits from Riverside Augmentation Plan. The decree allows reservoir releases to be stored in recharge areas; however a simplified approach was taken in the model in order to limit the releases from the reservoir to only meet remaining augmentation demand. Additionally the decree indicates only 54 percent of the reservoir releases should be applied to the augmentation supply. These limitations are not supported using the Type 48 or 49 rules, therefore releases to the river are applied to the augmentation demand in full. Note that the decree also allows excess recharge credits to be exchanged back up to Upper Platte and Beaver Canal, however these operations are not currently supported by StateMod and therefore excluded. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01025290.01	56613.38472	UPB Aug Plan - 0102529			43
01025290.02	1.00000			UPB Aug Plan Release Limit - 0102529_RL	47
01025290.03	44723.00000	UPB Aug Plan Recharge Area - 0102529_R	Upper Platte Beaver Canal - 0100515	0100515.05	45
01025290.04	56613.38473	UPB Aug Plan - 0102529		UPB Aug Plan Canal Seepage - 0102529_PlC	48
01025290.05	56613.38474	UPB Aug Plan - 0102529		UPB Aug Plan Reservoir Seepage - 0102529_PlR	48
01025290.06	56613.38475	UPB Aug Plan - 0102529	Account 3	Jackson Reservoir - 0103817	48
01025290.07	56613.38476	UPB Aug Plan – 0102529	Account 15	Prewitt Reservoir - 6403552	49
01025290.08	56613.52828	UPB Aug Plan – 0102529		Riverside Aug Plan Canal Seepage - 0102522_PlC	48
01025290.09	56613.52829	UPB Aug Plan – 0102529		Riverside Aug Plan Reservoir Seepage - 0102522_PlR	48
01025290.10	56613.52830	UPB Aug Plan – 0102529	Account 1	Riverside Reservoir - 0103651	49

5.10.10.8 Lower Platte and Beaver Augmentation Plan (0102535)

The Lower Platte and Beaver Augmentation Plan is generally operated based on junior water rights that fill numerous recharge areas located off of Lower Platte and Beaver Canal. Based on information from 03CW443, the model includes operations to divert junior Lower Platte and Beaver Canal water rights to an aggregated recharge area, tracking the in-ditch and recharge area seepage as an augmentation supply. A plan limitation was used to limit diversions to recharge to historical diversions. The aggregate recharge area can also be filled using a recharge well, based on historical pumping data in HydroBase. This supply is supplemented with releases from Jackson Reservoir, Prewitt Reservoir, and Riverside Reservoir directly to the river, and excess recharge credits from

Riverside Augmentation Plan. The decree allows reservoir releases to be stored in recharge areas; however a simplified approach was taken in the model in order to limit the releases from the reservoir to only meet remaining augmentation demand. Due to the limited reservoir releases that are simulated in the model, the return flow obligations associated with the releases were not explicitly modeled. Note that the decree also allows excess recharge credits to be exchanged back up to Lower Platte and Beaver Canal, however these operations are not currently supported by StateMod and therefore excluded. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01025350.01	55890.00001	LPB Aug Plan – 0102535			43
01025350.02	1.00000			LPB Aug Plan Release Limit - 0102535_RL	47
01025350.03	44723.00000	LPB Aug Plan Recharge Area - 0102535_R	Lower Platte Beaver Ditch - 0100518	0100518.03	45
01025350.04	47224.00000	LPB Aug Plan Recharge Area - 0102535_R	Lower Platte Beaver Ditch - 0100518	0100518.06	45
01025350.06	55890.00002	LPB Aug Plan – 0102535		LPB Aug Plan Canal Seepage - 0102535_PlC	48
01025350.07	55890.00003	LPB Aug Plan – 0102535		LPB Aug Plan Reservoir Seepage - 0102535_PlR	48
01025350.08	55890.00000	LPB Aug Plan Recharge Area - 0102535_R		0102535Re1	44
01025350.09	55890.00004	LPB Aug Plan – 0102535	Account 2	Jackson Reservoir - 0103817	48
01025350.10	55890.00005	LPB Aug Plan – 0102535	Account 16	Prewitt Reservoir - 6403552	49
01025350.11	56613.52828	LPB Aug Plan – 0102535		Riverside Aug Plan Canal Seepage - 0102522_PlC	48
01025350.12	56613.52829	LPB Aug Plan – 0102535		Riverside Aug Plan Reservoir Seepage - 0102522_PlR	48
01025350.13	56613.52830	LPB Aug Plan – 0102535	Account 1	Riverside Reservoir - 0103651	49

5.10.10.9 Brush Augmentation Plan (0102662)

The Brush Augmentation Plan is generally operated based on junior water rights that fill Bollinger Recharge Areas located off of Fort Morgan Canal, Town of Brush Sewer, lawn irrigation return flows, and augmentation credits from Ft. Morgan Canal and Riverside Augmentation Plans. The Town of Brush municipal demands were not explicitly modeled; they are included in the aggregated municipal demand in Water District 1 (01_AMP001_I and 01_AMP001_O). As this is the primary demand under the City of Fort Morgan Augmentation Plan (0102456), the augmentation plan supplies for the Brush plan are modeled similar to the City of Fort Morgan Augmentation Plan supplies. This includes excess recharge supplies from the Fort Morgan Augmentation Plan (0102528) and Riverside Augmentation Plan (0102522), and releases from Jackson Reservoir. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01025350.01	59169.56615	Brush Aug Plan – 0102662			43
01026620.02	59169.56616	Brush Aug Plan – 0102662		Ft. Morgan Canal Aug Plan Canal Seepage - 0102528_PlC	48
01026620.03	59169.56617	Brush Aug Plan – 0102662		Ft. Morgan Reservoir Aug Plan Canal Seepage - 0102528_PlR	48
01026620.04	59169.56618	Brush Aug Plan – 0102662		Riverside Aug Plan Canal Seepage - 0102522_PlC	48
01026620.05	59169.56619	Brush Aug Plan – 0102662		Riverside Aug Plan Reservoir Seepage - 0102522_PlR	48
01026620.06	59169.56620	Brush Aug Plan – 0102662	Account 1	Jackson Reservoir – 0103817	48

5.10.10.10 Bijou Augmentation Plan (0103339)

The Bijou Augmentation Plan is generally operated based on junior water rights that fill numerous recharge areas located off of Bijou Canal and seepage from Bijou No. 2 Reservoir. Bijou No. 2 Reservoir was originally built for irrigation, but due to excessive seepage, it was changed over to recharge operations. The reservoir stores under its own storage rights; the junior recharge rights are carried to an aggregate recharge area (0103339_R) located on Bijou Canal. Note that Godert Recharge Area did not have sufficient reservoir content records to be modeled explicitly and is included in the aggregate recharge area. Three recharge plans (0103339_PlC, 0103570_PlR, and 0103339_PlR) are used to track the in-ditch, reservoir, and recharge area seepage, which is used to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
01033390.19	47847.42073	Bijou Aug Plan – 0103339			43
01033390.01	21564.00000	Bijou Reservoir No. 2 – 0103570	Bijou Div System - 0100507_D	0103570.01	45
01033390.02	31423.29219	Bijou Reservoir No. 2 – 0103570	Bijou Div System - 0100507_D	0103570.02	45
01033390.03	44706.00000	Bijou Reservoir No. 2 – 0103570	Bijou Div System - 0100507_D	0100507_D.11	45
01033390.04	1.00000			Bijou Aug Plan Release Limit -	47

				0103339_RL	
01033390.05	44706.10000	Bijou Aug Plan Recharge Area - 0103339_R	Bijou Div System - 0100507_D	0100507_D.11	45
01033390.06	49733.00000	Bijou Aug Plan Recharge Area - 0103339_R	Bijou Div System - 0100507_D	0100507_D.12	45
01033390.07	49826.00000	Bijou Aug Plan Recharge Area - 0103339_R	Bijou Div System - 0100507_D	0100507_D.13	45
01033390.08	52633.00000	Bijou Aug Plan Recharge Area - 0103339_R	Bijou Div System - 0100507_D	0100507_D.14	45
01033390.09	53300.00000	Bijou Aug Plan Recharge Area - 0103339_R	Bijou Div System - 0100507_D	0100507_D.15	45
01033390.10	53300.00000	Bijou Aug Plan Recharge Area - 0103339_R	Bijou Div System - 0100507_D	0100507_D.16	45
01033390.11	53300.00000	Bijou Aug Plan Recharge Area - 0103339_R	Bijou Div System - 0100507_D	0100507_D.17	45
01033390.12	53300.00001	Bijou Aug Plan – 0103339		Bijou Aug Plan Canal Seepage - 0103339_PlC	48
01033390.13	53300.00002	Bijou Aug Plan – 0103339		Bijou Aug Plan Reservoir Seepage - 0103339_PlR	48
01033390.14	53300.00003	Bijou Aug Plan – 0103339		Bijou No. 2 Reservoir Seepage - 0103570_PlR	49

5.10.10.11 Sedgwick County Aug Plan (6402517)

The Sedgwick County Augmentation Plan consists of five recharge projects; two of which generally operate based on augmentation and recharge wells that pump to aggregated recharge areas (Fender Recharge Project, Glenn Toyne Platteview Ranch Recharge Project) and three which include junior water rights carried to aggregated recharge areas on Cottonwood Creek, Peterson Ditch, and South Reservation Ditch (Cottonwood Creek Recharge Project, Sedgwick Julesburg Irrigation District Recharge Project, and South Reservation Ditch Recharge Project). Based on information from 03CW209, the model includes operations to divert junior Cottonwood Creek, Peterson Ditch, and South Reservation Ditch water rights to aggregated recharge areas located on each ditch or creek, tracking the in-ditch and recharge area seepage as an augmentation supply. Historical diversions indicate that Cottonwood Creek pump is only operated from December to May; therefore diversions were limited with monthly switches. Note that the conditional junior right on Settlers Ditch was excluded as its supply consists of irrigation return flows that accrued to the Highline Canal downstream of Julesburg Reservoir. A plan limitation was used to limit diversions to recharge to historical diversions. Note that the decree also allows excess recharge credits to be exchanged back up to Peterson Ditch, South Reservation Ditch and the recharge wells at a maximum of 30 cfs, however these operations are not currently supported by StateMod and therefore excluded. This supply is supplemented by pumping under two recharge well rights and ten augmentation well rights. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64025170.01	56002.00001	Sedgwick City Aug Plan - 6402517			43
64025170.02	55882.55834	Sedgwick Aug Plan Recharge Area - 6402517_R	Cottonwood Crk Pump - 6400801	6400801.01	45
64025170.03	1.00000			Sedgwick City Aug Plan Release Limit 1- 6402517_R1	47
64025170.04	56002.00000	Sedgwick Peterson RA - 6402517_RP	Peterson Ditch - 6400504	6400504.04	45
64025170.05	1.00000			Sedgwick City Aug Plan Release Limit 2 - 6402517_R2	47
64025170.06	56002.00000	Sedgwick South Recharge Area - 6402517_RS	South Reservation Ditch - 6400503	6400503.02	45
64025170.07	56002.00002	Sedgwick City Aug Plan - 6402517		Sedgwick Aug Plan Peterson Canal Seepage - 6402517_PCP	48
64025170.08	56002.00003	Sedgwick City Aug Plan - 6402517		Sedgwick Aug Plan South Reservation Canal Seepage - 6402517_PCS	48
64025170.09	56002.00004	Sedgwick City Aug Plan - 6402517		Sedgwick Aug Plan Reservoir Seepage - 6402517_PlR	48
64025170.10	38061.00000	Sedgwick Aug Plan Recharge Area - 6402517_R		6402517Re2	44
64025170.11	55971.00000	Sedgwick Aug Plan Recharge Area - 6402517_R		6402517Re3	44
64025170.12	99996.00000	Sedgwick City Aug Plan – 6402517		6402517Au2	37
64025170.13	99996.00000	Sedgwick City Aug Plan – 6402517		6402517Au4	37
64025170.14	99996.00000	Sedgwick City Aug Plan – 6402517		6402517Au6	37
64025170.15	99996.00000	Sedgwick City Aug Plan – 6402517		6402517Au8	37
64025170.16	99996.00000	Sedgwick City Aug Plan – 6402517		6402517Au10	37
64025170.17	99996.00000	Sedgwick City Aug Plan – 6402517		6402517Au12	37
64025170.18	99996.00000	Sedgwick City Aug Plan – 6402517		6402517Au14	37
64025170.19	99996.00000	Sedgwick City Aug Plan – 6402517		6402517Au15	37

64025170.20	99996.00000	Sedgwick City Aug Plan – 6402517		6402517Au16	37
64025170.21	99996.00000	Sedgwick City Aug Plan – 6402517		6402517Au17	37

5.10.10.12 Harmony Ditch Company Augmentation Plan (6402518)

The Harmony Ditch Company Augmentation Plan is generally operated based on junior water rights that fill numerous recharge areas located off of Harmony Ditch No. 1. Based on information from 03CW363, the model includes operations to divert junior Harmony Ditch water rights to an aggregated recharge area, tracking the in-ditch and recharge area seepage as an augmentation supply. A plan limitation was used to limit diversions to recharge to historical diversions. This supply is supplemented with releases from Prewitt Reservoir directly to the river. The decree allows reservoir releases to be stored in recharge areas; however a simplified approach was taken in the model in order to limit the releases from the reservoir to only meet remaining augmentation demand. Additionally the decree indicates only 50 percent of the reservoir releases should be applied to the augmentation supply. These limitations are not supported using the Type 48 or 49 rules, therefore releases to the river are applied to the augmentation demand in full. Note that the decree also allows excess recharge credits to be exchanged back up to Harmony Ditch, however these operations are not currently supported by StateMod and therefore excluded. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64025180.01	44663.00001	Harmony Ditch Aug Plan - 6402518			43
64025180.02	1.00000			Harmony Ditch Aug Plan Release Limit – GMS_AL	47
64025180.03	55882.00000	Harmony Ditch Aug Plan Recharge Area - 6402518_R	Harmony Div System - 6400511_D	6400511_D.06	45
64025180.04	55882.00001	Harmony Ditch Aug Plan – 6402518		Harmony Ditch Aug Plan Canal Seepage - 6402518_PlC	48
64025180.05	55882.00002	Harmony Ditch Aug Plan – 6402518		Harmony Ditch Aug Plan Reservoir Seepage - 6402518_PlR	48
64025180.06	55882.00003	Harmony Ditch Aug Plan – 6402518	Account 8	Prewitt Reservoir - 6403552	48

5.10.10.13 Dinsdale Augmentation Plan (6402519)

The Dinsdale Augmentation Plan is generally reliant on augmentation wells and recharge wells. Case No. 01CW61 was primarily used to support the representation of the plan in the model. Lagged recharge area accretions and direct pumping from augmentation wells are applied to meet the augmentation plan demand. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64025180.01	55967.00001	Dinsdale Aug Plan – 6402519			43
64025190.02	55967.00002	Dinsdale Aug Plan – 6402519		Dinsdale Aug Plan Reservoir Seepage - 6402519_PlR	48
64025190.03	55152.54174	Dinsdale Aug Plan Recharge Area-6402519_R		6402519Re2	44
64025190.04	55882.55878	Dinsdale Aug Plan Recharge Area-6402519_R		6402519Re3	44
64025190.05	55882.55878	Dinsdale Aug Plan Recharge Area-6402519_R		6402519Re4	44
64025190.06	55152.54174	Dinsdale Aug Plan Recharge Area-6402519_R		6402519Re5	44
64025190.07	99996.00000	Dinsdale Aug Plan – 6402519		6402519Au2	37
64025190.08	99996.00000	Dinsdale Aug Plan – 6402519		6402519Au4	37
64025190.09	99996.00000	Dinsdale Aug Plan – 6402519		6402519Au5	37

5.10.10.14 Condon Augmentation Plan (6402525)

The Condon Augmentation Plan is generally reliant on augmentation and recharge wells that were decreed as alternate point of diversions to Chambers Ditch irrigation rights. Case No. 95CW053 was primarily used to support the representation of these operations in the model. Lagged recharge area accretions and direct pumping from augmentation wells are applied to meet the augmentation plan demand. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64025250.01	47116.45215	Condon Aug Plan - 6402525			43
64025250.02	47116.45215	Condon Aug Plan - 6402525		Condon Aug Plan Reservoir Seepage - 6402525_PlR	48
64025250.03	46114.00000	Condon Aug Plan Recharge Area - 6402525_R		6402525Re1	44

64025250.04	16560.00000	Condon Aug Plan Recharge Area - 6402525_R		6402525Re2	44
64025250.05	46114.00000	Condon Aug Plan Recharge Area - 6402525_R		6402525Re3	44
64025250.07	99996.00000	Condon Aug Plan - 6402525		6402525Au1	37

5.10.10.15 City of Sterling Augmentation Plan (6402526)

The City of Sterling Augmentation Plan is generally operated based on changed water rights, junior recharge rights, ownership of shares in Prewitt Reservoir, and recharge and release of Sterling WWTP effluent. The primary demand for this augmentation plan is City of Sterling's municipal well pumping, represented in the model as the aggregated municipal well demand in Water District 64 (64_AMP001_I and 64_AMP001_O). Case No. 98CW450 and 00CW253 was used to support the representation of these operations in the model. The following summarizes the operations for each component:

- The City of Sterling owns 100 percent of the two senior Henderson-Smith Ditch water rights, which it uses as a supply to meet augmentation demands. Based on recent accounting, only 35 percent of the irrigated acreage has been dried up by the City, therefore 35 percent of the two senior water rights were included in the augmentation plan operations. StateMod is unable to directly apply changed water rights to meet an augmentation plan via a Type 48 or 49 rules; therefore the changed water rights were stored in a recharge area (6400525_A) with "immediate" return pattern. These accretions were then used to meet the augmentation plan demands. The changed water rights are limited to 115 af annually based on the 2008 to 2015 average annual diversions under these rights in the accounting, distributed evenly across April through September. The changed water rights generate return flow obligations, as discussed in the Plan File section. The return flow obligations are satisfied using excess recharge credits and releases from Prewitt Reservoir.

- The junior Henderson-Smith recharge right is carried to an aggregated recharge area (6402526_R); the in-ditch and recharge area seepage are tracked as an augmentation supply. A plan limitation was used to limit diversions to recharge to historical average 2013 - 2014 diversions.

- The City of Sterling owns 9 percent of the senior Sterling No. 2 Ditch water right, which it uses as a supply to meet augmentation demands. StateMod is unable to directly apply changed water rights to meet an augmentation plan via Type 48 or 49 rules; therefore the changed water rights were stored in a recharge area (6400528_A) with "immediate" return pattern. These accretions were then used to meet the augmentation plan demands. The changed water rights are limited to 1,480 af annually and can be diverted April through September. The annual limit is based on the 2003 to 2015 average annual diversions under these rights in the accounting. The changed water rights generate return flow obligations, as discussed in the Plan File section. The return flow obligations are satisfied using excess recharge credits and releases from Prewitt Reservoir.

- The City of Sterling is able to use WWTP effluent to offset the augmentation plan demand; it generally releases half of the effluent directly to the river and stores the remaining half in Sterling Recharge Area (6402515). The Sterling Recharge Area is located directly downstream of the aggregated municipal demand and stores the effluent. The seepage pattern for the recharge area then seeps half of the effluent in the same time-step and lags the remaining half based on the decreed lagging pattern. The immediate and lagged accretions are tracked in a recharge plan and applied to the augmentation plan demand.

- These supplies can be supplemented by releases from Prewitt Reservoir to the river and pumping augmentation wells directly to the river.

- The City of Sterling also owns a small portion of senior water rights in Sterling No. 1 Ditch, Farmers Pawnee Ditch, and Springdale Ditch; however the supplies discussed above were sufficient to meet the augmentation plan demand.

As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64025260.01	55150.00000	Sterling Aug Plan - 6402526			43
64025260.02	55150.00000	Henderson-Smith Ditch Lagged Return Flows - 6400525_RF			43
64025260.03	55150.00000	Sterling No. 1 Ditch Lagged Return Flows - 6400528_RF			43
525_PLN.01	11292.00000	Henderson-Smith Changed WR - 6400525_PL		6400525.01	26
525_PLN.02	23172.19040	Henderson-Smith Changed WR - 6400525_PL		6400525.02	26
525_PLN.03	23172.19041	Henderson-Smith Plan to Immediate Recharge Area - 6400525_A	Henderson-Smith Ditch - 6400525	6400525_PL	27
525_PLN.04	23172.19042	Henderson-Smith Plan Spill - 6400525		6400525_PL	29
64025260.04	1.00000			Sterling Aug Plan -Release Limit - 6402526_RL	47

64025260.05	54237.00000	Sterling Aug Plan Recharge Area - 6402526_R	Henderson-Smith Ditch - 6400525	6400525.03	45
528_PLN.01	8597.00000	Sterling. No. 2 Changed WR - 6400528_PL		6400528.01	26
528_PLN.02	8597.00001	Sterling No. 2 Plan to Immediate Recharge Area - 6400528_A	Sterling No. 2 Ditch - 6400528	6400528_PL	27
528_PLN.03	8597.00002	Sterling No. 2 Plan Spill – 6400528		6400528_PL	29
64025260.06	55150.00002	Sterling Aug Plan - 6402526		Sterling Aug Plan Canal Recharge - 6402526_PlC	48
64025260.07	55150.00003	Sterling Aug Plan - 6402526		Sterling Aug Plan Reservoir Recharge - 6402526_PlR	48
64025260.08	55150.00004	Henderson-Smith Ditch Lagged Return Flows - 6400525_RF		Sterling Aug Plan Reservoir Recharge - 6402526_PlR	49
64025260.09	55150.00005	Sterling No. 1 Ditch Lagged Return Flows - 6400528_RF		Sterling Aug Plan Reservoir Recharge - 6402526_PlR	49
64025260.10	55150.00006	Sterling Aug Plan – 6402526	Account 8	Prewitt Reservoir - 6403552	48
64025260.11	55150.00007	Henderson-Smith Ditch Lagged Return Flows - 6400525_RF	Account 8	Prewitt Reservoir - 6403552	48
64025260.12	55150.00008	Sterling No. 1 Ditch Lagged Return Flows - 6400528_RF	Account 8	Prewitt Reservoir - 6403552	48
64025260.13	99996.00000	Sterling Aug Plan – 6402526		6402526Au2	37
64025260.14	99996.00000	Sterling Aug Plan – 6402526		6402526Au3	37

5.10.10.16 Lower Logan Well Users Augmentation Plan (6402536)

The Lower Logan Well Users Augmentation Plan is generally operated based on junior recharge rights associated with several recharge projects. Case No. 03CW208 and 04CW236 were primarily used to support the representation of the following projects:

- *Iliff Platte Valley (IPV) Recharge Project*. The junior 48.66 cfs water right on Iliff Platte Valley Canal (6400520) is carried to the on-ditch aggregated recharge area (6402536_RI). In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions.

- *Upper Harmony Ditch (UHD) Recharge Project*. The junior 9.89 cfs water right on Harmony Ditch (6400511) is carried to the on-ditch aggregated recharge area (6402536_RH). In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions.

- *Powell Blair Canal (PBC) Recharge Project*. The junior 10.10 cfs water right on Powell Blair Ditch (6400516) is carried to the aggregated recharge area on Harmony Ditch (6402536_RH). Note the full conditional recharge right is 90 cfs; it was reduced to 10.10 based on daily historical records. In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions.

- *Bravo Ditch Recharge Project*. The junior 46.4 cfs water right on Bravo Ditch (6400522_D) is carried to the on-ditch aggregated recharge area (6402536_RB). In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions.

The decree allows Prewitt Reservoir releases to be stored in recharge areas under any ditch mentioned above (changed Iliff Irrigation District and Morgan Prewitt shares); however this is not a common practice. Rather releases are made directly to the river to meet remaining augmentation demand. The decree indicates only 40 percent of the reservoir releases should be applied to the augmentation supply. These limitations are not supported using the Type 48 or 49 rules, therefore releases to the river are applied to the augmentation demand in full. Several recharge and augmentation wells are also included as a supply to the augmentation plans. Recharge wells do not pump out of priority in StateMod, so operating rules were set to the well right priority for each well. Augmentation wells can pump out of priority in StateMod, so operating rules were set as most junior operation. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64025360.01	56002.00001	Lower Logan Well Users Aug Plan - 6402536			43
64025360.02	1.00000			Lower Logan Aug Plan Release Limit 1 - 6402536_R1	47
64025360.03	55882.55874	Lower Logan Aug Plan IPV Recharge Area - 6402536_RI	Iliff Platte Valley Ditch - 6400520	6400520.02	45
64025360.04	1.00000			Lower Logan Aug Plan Release Limit 2 - 6402536_R2	47
64025360.05	55996.00000	Lower Logan Aug Plan Harmony Recharge Area - 6402536_RH	Harmony Div System - 6400511_D	6400511_D.07	45
64025360.06	55996.00000	Lower Logan Aug	Powell Blair Ditch -	6400516.02	45

		Plan Harmony Recharge Area - 6402536_RH	6400516		
64025360.07	1.00000			Lower Logan Aug Plan Release Limit 3 -6402536_R3	47
64025360.08	53558.00000	Lower Logan Aug Plan Bravo Recharge Area - 6402536_RB	Bravo Div System - 6400522_D	6400522_D.04	45
64025360.09	55996.00002	Lower Logan Well Users Aug Plan - 6402536		Lower Logan Aug Plan IPV Canal Seepage - 6402536_PCI	48
64025360.10	55996.00002	Lower Logan Well Users Aug Plan - 6402536		Lower Logan Aug Plan Harmony Canal Seepage - 6402536_PCH	48
64025360.11	55996.00002	Lower Logan Well Users Aug Plan - 6402536		Lower Logan Aug Plan Powell Blair Canal Seepage - 6402536_PCP	48
64025360.12	55996.00002	Lower Logan Well Users Aug Plan - 6402536		Lower Logan Aug Plan Bravo Canal Seepage - 6402536_PCB	48
64025360.13	55996.00003	Lower Logan Well Users Aug Plan - 6402536		Lower Logan Aug Plan Reservoir Seepage - 6402536_PlR	48
64025360.14	56088.00004	Lower Logan Well Users Aug Plan - 6402536	Account 8	Prewitt Reservoir - 6403552	48
64025360.15	55945.00000	Lower Logan Well Users Aug Plan Recharge Area - 6402536_R		6402536Re2	44
64025360.16	55882.55878	Lower Logan Well Users Aug Plan Recharge Area - 6402536_R		6402536Re4	44
64025360.17	55882.55878	Lower Logan Well Users Aug Plan Recharge Area - 6402536_R		6402536Re6	44
64025360.18	55882.55861	Lower Logan Well Users Aug Plan Recharge Area - 6402536_R		6402536Re7	44
64025360.19	55944.00000	Lower Logan Well Users Aug Plan Recharge Area - 6402536_R		6402536Re8	44
64025360.20	55882.55843	Lower Logan Well Users Aug Plan Recharge Area - 6402536_R		6402536Re9	44

64025360.21	55882.55843	Lower Logan Well Users Aug Plan Recharge Area - 6402536_R		6402536Re10	44
64025360.22	55882.55843	Lower Logan Well Users Aug Plan Recharge Area - 6402536_R		6402536Re11	44
64025360.23	55882.45752	Lower Logan Well Users Aug Plan Recharge Area - 6402536_R		6402536Re12	44
64025360.24	56779.00000	Lower Logan Well Users Aug Plan Recharge Area - 6402536_R		6402536Re13	44
64025360.25	99996.00000	Lower Logan Well Users Aug Plan - 6402536		6402536Au2	37
64025360.26	99996.00000	Lower Logan Well Users Aug Plan - 6402536		6402536Au4	37
64025360.27	99996.00000	Lower Logan Well Users Aug Plan - 6402536		6402536Au6	37
64025360.28	99996.00000	Lower Logan Well Users Aug Plan - 6402536		6402536Au8	37
64025360.29	99996.00000	Lower Logan Well Users Aug Plan - 6402536		6402536Au10	37
64025360.30	99996.00000	Lower Logan Well Users Aug Plan - 6402536		6402536Au12	37
64025360.31	99996.00000	Lower Logan Well Users Aug Plan - 6402536		6402536Au16	37
64025360.32	99996.00000	Lower Logan Well Users Aug Plan - 6402536		6402536Au17	37
64025360.33	99996.00000	Lower Logan Well Users Aug Plan - 6402536		6402536Au15	37

5.10.10.17 Logan Well Users Augmentation Plan (6402539)

The Logan Well Users Augmentation plan represents an aggregate of Logan Well Users Augmentation Plan, Smart Land/Livestock Augmentation (6402537), Pawnee Well Users (6402546), Vandemoer Augmentation (6402548), Accomasso Bros (6402554), and Riverside Pit (6402547). The Logan Well Users Augmentation Plan is generally operated based on junior recharge rights associated with several recharge projects. Case No. 03CW195 was primarily used to support the representation of the following projects:

- *Schneider Ditch Recharge Project*. The junior 14.3 cfs water right on Schneider Ditch (6400531) is carried to the on-ditch aggregated recharge area (6402539_RC). In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions. Note that portions of the senior Schneider Ditch rights have also been changed, but are currently still used for irrigation. Consider implementing the changed water rights in future refinements.

- *South Platte Ditch Recharge Project*. The three junior water rights on South Platte Ditch (6400535) are carried to the on-ditch aggregated recharge area (6402539_RP). In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions. Note that portions of the senior South Platte Ditch rights have also been changed, but are currently still used for irrigation. Consider implementing the changed water rights in future refinements. There are also decreed junior rights associated with Curlee and Quint Pump Stations (6400631 and 6400632) but there are no diversion records to support their use; they are excluded from the model.

- *Springdale Ditch Recharge Project*. The two junior water rights on Springdale Ditch (6400530) are carried to the on-ditch aggregated recharge area (6402539_RS). In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions. Note that portions of the senior Springdale Ditch rights have also been changed, but are currently still used for irrigation. Consider implementing the changed water rights in future refinements.

- *Sterling Irrigation Company Recharge Project*. The junior 22.3 cfs water right on Sterling No. 1 Ditch (6400528) is carried to the on-ditch aggregated recharge area (6402539_RT). In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions.

- *Farmers Pawnee Canal Recharge Project*. The two junior water rights on Farmers Pawnee Canal (6400533) are carried to the on-ditch aggregated recharge area (6402539_RF). In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions. Note that portions of the senior Farmers Pawnee Ditch rights have also been changed, but are currently still used for irrigation. Consider implementing the changed water rights in future refinements.

The decree allows Prewitt Reservoir releases to be stored in recharge areas under any ditch mentioned above (changed Iliff Irrigation District and Morgan Prewitt shares); however this is not a common practice. Rather releases are made directly to the river to meet remaining augmentation demand. The decree indicates only 40 percent of the reservoir releases should be applied to the augmentation supply. These limitations are not supported using the Type 48 or 49 rules, therefore releases to the river are applied to the augmentation demand in full. Several recharge and augmentation wells are also included as a supply to the augmentation plans. Recharge wells do not pump out of priority in StateMod, so operating rules were set to the well right priority for each well. Augmentation wells can pump out of priority in StateMod, so operating rules were set as most junior operation. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64025390.01	59888.00001	Logan Well Users Aug Plan - 6402539			43
64025390.02	1.00000			Logan Well Users Aug Plan Schneider Release Limit 1 - 6402539_R1	47
64025390.03	55895.00000	Logan Well Users Aug Plan Recharge Area (Schneider) - 6402539_RC	Schneider Ditch - 6400531	6400531.04	45
64025390.04	1.00000			Logan Well Users Aug Plan SPD Release Limit 2 - 6402539_R2	47
64025390.05	45364.00000	Logan Well Users Aug Plan Recharge Area (SPD) - 6402539_RP	South Platte Ditch - 6400535	6400535.06	45
64025390.06	46590.00000	Logan Well Users Aug Plan Recharge Area (SPD) - 6402539_RP	South Platte Ditch – 6400535	6400535.07	45
64025390.07	55882.53771	Logan Well Users Aug Plan Recharge Area (SPD) - 6402539_RP	South Platte Ditch – 6400535	6400535.08	45
64025390.08	1.00000			Logan Well Users Aug Plan Springdale Release Limit 3 - 6402539_R3	47
64025390.09	55888.00000	Logan Well Users Aug Plan Recharge Area (Springdale Ditch) - 6402539_RS	Springdale Ditch - 6400530	6400530.02	45
64025390.10	55888.00000	Logan Well Users Aug Plan Recharge Area (Springdale Ditch) - 6402539_RS	Springdale Ditch - 6400530	6400530.03	45
64025390.11	1.00000			Logan Well Users Aug Plan Sterling Release Limit 4 - 6402539_R4	47

64025390.12	55961.00000	Logan Well Users Aug Plan Recharge Area (Sterling) - 6402539_RT	Sterling No. 1 Ditch – 6400528	6400528.02	45
64025390.13	1.00000			Logan Well Users Aug Plan Farmers Pawnee Release Limit - 6402539_R5	47
64025390.14	47239.00000	Logan Well Users Recharge Area (Farmers Pawnee) - 6402539_RF	Pawnee Ditch - 6400533	6400533.03	45
64025390.15	53316.00000	Logan Well Users Recharge Area (Farmers Pawnee) - 6402539_RF	Pawnee Ditch - 6400533	6400533.04	45
64025390.16	59888.00002	Logan Well Users Aug Plan - 6402539		Logan Well Users Aug Plan Schneider Canal Seepage 6402539_PCC	48
64025390.17	59888.00002	Logan Well Users Aug Plan - 6402539		Logan Well Users Aug Plan South Platte Canal Seepage - 6402539_PCP	48
64025390.18	59888.00002	Logan Well Users Aug Plan - 6402539		Logan Well Users Aug Plan Springdale Canal Seepage - 6402539_PCS	48
64025390.19	59888.00002	Logan Well Users Aug Plan - 6402539		Logan Well Users Aug Plan Sterling Canal Seepage - 6402539_PCT	48
64025390.20	59888.00002	Logan Well Users Aug Plan - 6402539		Logan Well Users Aug Plan Farmers Pawnee Canal Seepage - 6402539_PCF	48
64025390.21	59888.00003	Logan Well Users Aug Plan – 6402539		Logan Well Users Aug Plan Reservoir Seepage - 6402539_PIR	48
64025390.22	59888.00004	Logan Well Users Aug Plan – 6402539	Account 4	Prewitt Reservoir - 6403552	48
64025390.23	59888.00005	Logan Well Users Aug Plan – 6402539	Account 5	Prewitt Reservoir - 6403552	48
64025390.24	55882.55870	Logan Well Users Recharge Area - 6402539_R		6402539Re3	44
64025390.25	56613.55941	Logan Well Users Recharge Area - 6402539_R		6402539Re5	44
64025390.26	56613.55966	Logan Well Users Recharge Area - 6402539_R		6402539Re7	44
64025390.27	56613.55966	Logan Well Users Recharge Area - 6402539_R		6402539Re8	44

64025390.28	56724.00000	Logan Well Users Recharge Area - 6402539_R		6402539Re9	44
64025390.29	56613.55966	Logan Well Users Aug Plan - 6402539		6402539Re10	44
64025390.30	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au2	37
64025390.31	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au4	37
64025390.32	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au5	37
64025390.33	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au6	37
64025390.34	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au8	37
64025390.35	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au9	37
64025390.36	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au11	37
64025390.37	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au12	37
64025390.38	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au30	37
64025390.39	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au16	37
64025390.40	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au18	37
64025390.41	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au20	37
64025390.42	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au22	37
64025390.43	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au25	37
64025390.44	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au27	37

64025390.45	99996.00000	Logan Well Users Aug Plan - 6402539		6402539Au29	37

5.10.10.18 Low Line Ditch Company Augmentation Plan (6402540)

The Low Line Ditch Company Augmentation Plan is generally operated based on junior water rights that fill numerous recharge areas located off of Low Line Ditch. Based on information from 03CW094, the model includes operations to divert a 40 cfs junior Low Line Ditch water right to an aggregated recharge area, tracking the in-ditch and recharge area seepage as an augmentation supply. A plan limitation was used to limit diversions to recharge to historical diversions. Note that the decree also allows excess recharge credits to be exchanged back up to Low Line Ditch, however these operations are not currently supported by StateMod and therefore excluded. Historical diversion records support the use of an augmentation well to provide supplemental supplies; a single augmentation well was included in the operations. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64025400.01	55940.00001	Low Line Ditch Aug Plan - 6402540			43
64025400.02	1.00000			Low Line Ditch Aug Plan Release Limit - 6402540_RL	47
64025400.03	55882.55786	Low Line Ditch Aug Plan Recharge Area - 6402540_R	Lowline Ditch - 6400524	6400524.02	45
64025400.04	55940.00002	Low Line Ditch Aug Plan - 6402540		Low Line Ditch Aug Plan Canal Seepage -6402540_PlC	48
64025400.05	55940.00003	Low Line Ditch Aug Plan – 6402540		Lowe Line Ditch Aug Plan Reservoir Seepage - 6402540_PlR	48
64025400.06	99996.00000	Low Line Ditch Aug Plan – 6402540		6402540Au1	37

5.10.10.19 Lower South Platte Water Conservancy District (LSPWCD) Augmentation Plan (6402542)

The LSPWCD Augmentation plan is generally operated based on junior water rights that fill numerous recharge areas located off of Liddle Ditch, Peterson Ditch, and the Heyborne Lift Station. Case Nos. 03CW0209 and 08CW024 were primarily used to support the representation of the following operations:

- *Liddle Ditch*. The junior 7 cfs water right on Liddle Ditch (6400502) is carried to the on-ditch aggregated recharge area (6402542_RL). In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions.

- *Peterson Ditch*. The junior 35 cfs water right on Peterson Ditch (6400504) is carried to the on-ditch aggregated recharge area (6402542_RP). In-ditch and recharge area seepage are tracked and applied to meet the augmentation plan demand. A plan limitation was used to limit diversions to recharge to historical diversions.

- *Heyborne Lift Station*. The newly constructed Heyborne Lift Station (6400643) pumps water from the river to the Heyborne Recharge Areas (6402542_RH). Recharge area seepage is tracked and applied to meet the augmentation plan demand.

Several recharge wells are also included as a supply to the augmentation plan; recharge wells do not pump out of priority in StateMod, so operating rules were set to the well right priority for each well. Note that the decree also indicates that the effluent and lawn irrigation return flows from the Towns of Ovid and Julesburg can be used as an augmentation supply, however these towns are not modeled explicitly and the operations are not included. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64025420.01	57708.46551	LSPWCD Aug Plan - 6402542			43
64025420.02	1.00000			LSPWCD Aug Plan Release Limit 1 - 6402542_R1	47
64025420.03	53726.00000	LSPWCD Aug Plan Liddle Recharge Area - 6402542_RL	Liddle Ditch - 6400502	6400502.02	45
64025420.04	1.00000			LSPWCD Aug Plan Release Limit 2 -6402542_R2	47
64025420.05	51134.50891	LSPWCD Aug Plan Peterson Recharge Area - 6402542_RP	Peterson Ditch - 6400504	6400504.03	45
64025420.06	1.00000			LSPWCD Aug Plan Release Limit 3 - 6402542_R3	47
64025420.07	57716.00000	LSPWCD Aug Plan Heyborne Recharge Area - 6402542_RH	Heyborne Lift Station - 6400643	6400643.01	45
64025420.08	57716.00002	LSPWCD Aug Plan – 6402542		LSPWCD Aug Plan Liddle Canal Seepage - 6402542_PCL	48
64025420.09	57716.00002	LSPWCD Aug Plan – 6402542		LSPWCD Aug Plan Peterson Canal Seepage - 6402542_PCP	48
64025420.10	57716.00003	LSPWCD Aug Plan – 6402542		LSPWCD Aug Plan Reservoir Seepage - 6402542_PlR	48
64025420.11	56605.00000	LSPWCD Aug Plan Recharge Area - 6402542_R		6402542Re1	44
64025420.12	56605.00000	LSPWCD Aug Plan		6402542Re2	44

		Recharge Area - 6402542_R			
64025420.13	56605.00000	LSPWCD Aug Plan Recharge Area - 6402542_R		6402542Re3	44

5.10.10.20 North Sterling Augmentation Plan (6403392)

The North Sterling Augmentation plan is generally operated based on junior water rights that fill numerous recharge areas located off of North Sterling Canal. Based on information from 96CW1034, the model includes operations to divert junior North Sterling Canal water rights to an aggregated recharge area, tracking the in-ditch and recharge area seepage as an augmentation supply. A plan limitation was used to limit diversions to recharge to historical diversions. This supply is supplemented with releases from the augmentation/recharge account in North Sterling Reservoir. The decree allows reservoir releases to be stored in recharge areas; however a simplified approach was taken in the model in order to limit the releases from the reservoir to only meet remaining augmentation demand. Note that the decree also allows excess recharge credits to be exchanged back up to North Sterling Canal, however these operations are not currently supported by StateMod and therefore excluded. Per decree, wintertime depletions from PSCo Pawnee Well Field (0100711) are covered by North Sterling Augmentation Plan. There are no well rights associated with the well field in HydroBase; therefore the wells were modeled with a senior well right. As such, the depletions will be considered “in-priority” by the model and not accounted for under this plan. Future modeling efforts should investigate the appropriate well right and augmentation plan agreement for these depletions. As presented in the table below, the following operating rules were used to simulate this augmentation plan.

Right ID	Admin #	Destination	Account, Carrier, Return Location (R), or % Split	Source	Right Type
64025420.01	54237.00001	North Sterling Aug Plan - 6403392			43
64033920.02	1.00000			North Sterling Aug Plan Release Limit -6403392_RL	47
64033920.03	53454.00000	North Sterling Augmentation Plan Recharge Area - 6403392_R	North Sterling Div Sys – 0100687	0100687.04	45
64033920.04	53454.00000	North Sterling Augmentation Plan Recharge Area - 6403392_R	North Sterling Div Sys – 0100687	0100687.05	45
64033920.05	54237.00002	North Sterling Aug Plan – 6403392		North Sterling Aug Plan Canal Seepage -6403392_PlC	48
64033920.06	54237.00003	North Sterling Aug Plan –6403392		North Sterling Aug Plan Reservoir Seepage - 6403392_PlR	48
64033920.07	54237.00004	North Sterling Aug Plan – 6403392	Account Number 2	North Sterling Reservoir - 6403551	48

5.10.11South Platte Compact

The South Platte Compact requires that Colorado deliver 120 cfs to the Stateline from April 1 to October 15 at an administration date of June 14, 1897, without calling out any diversions located upstream of the Washington County line (i.e. upstream of Water District 64). As StateMod operates water rights from senior to junior over the entire river system, the Washington County limitation was implemented by developing two operating rules specific to the Compact. A Type 50 operating rule is used to temporarily store water available to the South Platte Compact in a plan when in priority and a Type 40 operating rule is used to release water from the plan first to any structure that is water short and outside/upstream of Water District 64 and then to the Compact demand. The Type 40 operating rule is used to determine if exchange potential exist which will allow a junior water right to exchange water from the Compact plan to meet their unmet demand. This check occurs immediately following the priority of a water right that is short.

- If exchange potential exists, water will be exchanged to the diversion limited by the structure's demand, water right and capacity. In addition return flows will be calculated, a re-operation will occur and potentially allow water rights throughout the system to divert more water to meet their demands.
- If exchange potential does not exist, the water stays in the Compact plan.

The Type 40 operating rule determines if the structure is outside/upstream of Water District 64 based on the first two digits of the model ID and does *not* exchange to any diversion structure with a 64* model ID. Additionally, the Type 40 operating rule only exchanges to diversion structures located on-channel; exchanges to any off-channel demands (i.e. off-channel irrigation demands) in upstream reaches of the river will require a separate operating rule (Type 28).

Right ID	**Admin #**	**Destination**	**Account, Carrier, Return Location (R), or % Split**	**Source**	**Right Type**
Compact In	17332.00000	Compact_Pln		6499999.01	50
Compact_64x	17332.00000	64x		Compact_Pln	40
Compact_Isf	99999.99999	Compact (6499999)		Compact_Pln	40
CompactEx.1	18353.10000	Bijou Irrigation (0100507_I)	Empire Ditch (0100501)	Compact_Pln	28
CompactEx.2	20969.10000	Riverside Irrigation System (0100503_I)	Riverside Irrigation System (0100503_D)	Compact_Pln	28
CompactEx.3	26302.23523	N Sterling Irrig (0100687_I)	North Sterling Div Sys (0100687)	Compact_Pln	28

6. Calibration

6.1 Calibration Results Summary

Calibration is the process of simulating the river basin under historical conditions, and adjusting parameters to achieve agreement between observed and simulated values of streamflow gages, reservoir levels, and diversions. In general, the overall calibration of the South Platte River basin model is considered to be good, particularly considering the complexity of the model due to imported transmountain supplies, ground water depletions, complex and flexible municipal operations, and numerous changed water rights.

- *Streamflow Calibration.* Correlation between observed and simulated streamflow gages is considered to be good to excellent on many of the modeled rivers and tributaries, with R^2 values greater than 0.90 over the 1993 to 2012 period. Lower correlations on specific streams, specifically Big Dry Creek, Big Thompson River, and the headwaters of the South Platte River, can be attributed to missing data or transmountain or municipal operations. Despite a lower correlation, the simulated streamflow generally follows the trends of observed flow across wet and dry year types.

- *Reservoir Calibration.* Reservoir calibration is also considered to be good, particularly for the large off-channel irrigation reservoirs in the lower South Platte River basin. Many of the reservoirs are generally staying fuller than historical conditions reflect; however follow the general seasonal patterns. Reservoir calibration is particularly difficult in this model due to the multiple water supplies available to meet each demand, such as direct diversions, supplemental ground water, and transbasin supply. It is necessary to develop a set order of operations in the model in which supplies can be used to meet each demand; this order of operations varies historically resulting in poorer calibration of the reservoirs.

- *Diversions and Demand Calibration.* Diversion calibration for structures with single municipal or irrigation demand is considered excellent. Diversion calibration for structures that carry to multiple demands (e.g. ditches that carry water for irrigation and storage in reservoirs and recharge pits) is considered moderately good. This is again due to the fact that the model reflects a set order of operations for the entire period, and these operations varied historically based on year type and water availability. In order to assess the level of calibration of diversion structures, calibration was viewed from the perspective of the amount of irrigation and municipal demand that is met in each basin. This accounts for operational decisions associated with demands that can be met by more than one source of water. In a perfectly calibrated model, the simulated amount of demand met would be 100 percent; the following summarizes the level of demand calibration in each basin.

Basin	SW Demand (af)	GW Demand (af)	Total Demand (af)	% Demand Met
Upper Basin	807,000	143,000	950,000	99%
Big Thompson	227,000	2,000	229,000	95%
St. Vrain	152,000	470	153,000	98%
Boulder	154,000	260	154,000	97%
Clear Creek	97,000	3,000	100,000	93%
Lower South Platte	636,000	410,000	1,046,000	100%
Total	**2,073,000**	**558,730**	**2,632,000**	**98%**

Future model enhancements are discussed in detail in Section 6.3, however the following enhancements would specifically improve the overall calibration of the model.

- *Recharge operation refinement*. Refinement of both recharge diversions and accretions could improve the streamflow calibration of the Lower South Platte.

- *Lower St. Vrain Creek and Big Dry Creek baseflow gains and losses.* Additional calibration efforts are recommended to mitigate remaining baseflow issues on these tributaries.

The following sections and Section 7.6 provide information on how the South Platte Model was developed and calibrated first at the sub-basin level, and then integrated into an overall model, as well as information on the specific calibration efforts in each sub-basin.

6.1.1 Sub-basin Calibration

The objective of the sub-basin calibration was to refine baseflow hydrology and operations isolated to the sub-basin level before introducing complexities and interactions associated with the overall model. In this initial calibration scenario, the dataset reflects historical diversions, reservoir contents, and operations, and any diversions or return flows that leave the sub-basin model were treated as an "export". In addition, calibration gages were added to major off-channel reservoir systems to determine if any baseflow was created due to data inconsistencies. In general, off-channel reservoir systems, represented on "mock" tributaries, should not have any baseflow. Data inconsistencies between headgate diversions and reservoir contents can result in baseflow generation. This model scenario was then simulated and the results were reviewed to assess where calibration efforts were needed.

Much of the sub-basin calibration effort was focused on baseflows, particularly to perform the following:

- Remove imports from baseflow estimates

- Check that baseflow was gaining as it moved downstream

- Address excessive amounts of baseflow generated from off-channel systems

- Determine correct amount of baseflow distributed to ungaged locations

Baseflow issues associated with import plans were generally addressed by adjusting diversions and import plan representation. Baseflow issues associated with losing reaches were generally addressed by adjusting return flow locations and, in some cases, adjustment of structure locations in the network. Baseflow issues associated with off-channel reservoir systems were generally addressed by reviewing and setting the reservoir content data or the release demands to better reflect the diversions to storage data, thus reducing the data inconsistency issue. Note that this was a significant effort in some basins, particularly in the Lower South Platte where data inconsistencies can result in the generation of baseflow in the thousands of acre-feet. This was also a significant issue for the Carter Lake system, where data inconsistencies would cause baseflow issues greater than the native flow in the Big Thompson River. Baseflow issues associated with ungaged locations were addressed by adjusting area/precipitation parameters that resulted in more appropriate distributions.

Once the baseflows were better calibrated, the off-channel reservoir system calibration gages were removed and the model was re-simulated. The simulated streamflow, diversions, and reservoir contents from this scenario were compared to historical values to provide an initial level of calibration. Many of the calibration issues that were identified from these results were caused by operational issues, particularly the order of supplies in which demands were met. This largely focused on municipal water users who generally have a diverse water rights portfolio and can use these supplies in different orders to meet their demands. This also occurred for irrigation demands that could be served by several different supplies, including direct rights, C-BT supplies, and reservoir storage. Order of operation issues were generally identified because of poor reservoir calibration, poor diversion calibration, or the under-simulation of transmountain supplies. These issues were generally addressed by adjusting priorities of operating rules over several model runs to narrow in on more representative operations. Other techniques used to address these issues were to limit the operations to specific years and/or seasons, revise capacities to reflect recent and sustained values, or add monthly or annual volumetric limitations.

As discussed in more detail below, StateMod operates based on a set order of operations and will not be able to completely match the dynamic operational decisions made by water users. The goal of calibrating the order of operations was to capture the recent operations that users most often abide by. Additional constraints could be added to the operating rules to better calibrate operations, however it would reduce the flexibility of these rules during future scenarios.

Note that sub-basin models were developed independently and although consistency was stressed throughout the project, there are inconsistencies in how operations were set up, which operations were modeled explicitly, and the level of calibration achieved. In general, these model inconsistencies do not impact the calibration of the overall model; however it should be considered when users review operations across different basins.

6.1.2 Full Model Calibration Approach

Once the sub-basin models were completed, they were integrated to develop the overall South Platte Model. During integration, it was necessary to address the interactions that occur between the sub-basins. Interactions were generally in the form of routing return flows across sub-basin boundaries, releasing from a reservoir to a demand in a downstream sub-basin, and transmountain pipelines. The first two interactions were addressed by revising return flow locations and patterns, and creating dynamic reservoir operations. These interactions are particularly prevalent in the Big Thompson River, St. Vrain Creek, and Boulder Creek sub-basins. Transmountain pipelines proved to be more complicated and are discussed in Section 6.1.2.1 below.

The overall model calibration was completed using a similar process to make sure that the integration effort did not result in additional calibration issues. Baseflows were recreated and reviewed; simulated diversions and reservoir contents were compared to historical values; and use of transmountain supplies were reviewed. As discussed above, operating rules were generally revised to reflect better calibration. In addition, augmentation plan supplies vs. demands were reviewed to determine if sufficient supplies were represented in the model. If not, augmentation plan operations were reviewed and additional supplies were modeled as necessary.

Once baseflows, diversions, and reservoirs were addressed, the calibration effort focused on refinement of simulated streamflow. Under-simulation of streamflow results in shortages and dry-up points in the river, over-simulation of streamflow allows more junior uses to be in-priority. In general, the simulated streamflow in the South Platte Model is greater than historical gaged records. This results in reduced augmentation plan demands (i.e. well depletions are simulated as in-priority), reservoirs filling quicker and staying fuller than historically, and over-diversion of junior rights model-wide. Refinement efforts for this issue included adjusting efficiencies for municipal indoor uses, adjusting of well depletion locations, and revising plan release locations.

Basin-specific calibration issues and results are discussed in the sections below.

6.1.2.1 Sub-basin Model Integration

The South Platte Model was developed by combining five separate sub-basin models into a single integrated basin-wide model. This basin-wide model includes tributary inflow to the South Platte, with the exception of Cache la Poudre River. During the original sub-basin modeling effort, modelers used historical measured or estimated data to represent water that was moved from one sub-basin to another. These sub-basin interactions include routing return flows across sub-basin boundaries, releasing from a reservoir to a demand in a downstream sub-basin, and pipelines that move transmountain water from one sub-basin to the next. The first two interactions were easily addressed during model integration and are completely demand driven.

The initial goal during model integration was to distribute transmountain water (for example C-BT supplies) between sub-basins based on end-user demands and not historical measured sub-basin supplies. This section discusses these sub-basin interactions, efforts to make the interactions more dynamic, and resulting calibration issues.

As shown in Table 6-1 below, there are two primary transmountain systems that meet demands in more than one sub-basin.

Table 6-1: Sub-basin Import/Export Interactions

Transmountain Import	Import Sub-basin	Sub-basin Demand Structure Name	Sub-basin Demand Structure ID
Adams Tunnel	St. Vrain Creek	Inflow to Boulder Reservoir	05_BRCBT
	St. Vrain Creek	St. Vrain Supply Canal Import (WD 5 Users)	05_SVCBT
	St. Vrain Creek	Longmont C-BT Deliveries	05_LongCBT
	St. Vrain Creek	Left Hand Ditch C-BT Deliveries	05_LHCBT
	Boulder Creek	Southern Water Supply Pipeline Deliveries (excluding Longmont)	06_SWSP_IMP
Adams Tunnel	Boulder Creek	Boulder Municipal Import	060800_IMP
Adams Tunnel	Boulder Creek	Boulder Creek Supply Canal Export	06_CBT_IMP
Moffat Tunnel	Clear Creek	South Boulder Diversion Conduit Import	SBDC_Pln/ 0600590

Colorado Big-Thompson Project (C-BT) transmountain diversions are imported to the Big Thompson River via Adams Tunnel and then distributed to storage and demands on the Poudre River, Big Thompson River, St. Vrain Creek, Boulder Creek, and users on the South Platte. Moffat Tunnel transmountain diversion is delivered to South Boulder Creek for storage in Gross Reservoir and distributed to municipal uses in the Denver Metropolitan area. To provide a perspective of these transmountain diversions, the St. Vrain Supply Canal and South Boulder Conduit systems combined carry approximately 120,000 af of water annually, which is greater than the St. Vrain Creek natural flow.

As the model was integrated, an approach was initially developed to replace the historically measured sub-basin imports and exports with operations that allowed for dynamic diversion of the transmountain supplies to meet end-user demands. In other words, allow the Denver Water or C-BT transmountain supplies be fully end-user demand-driven instead of sending the historical amount to each sub-basin. This approach involved including operating rules for the users to meet demands directly from the original transmountain supplies, carried via the St. Vrain Supply Canal, South Boulder Diversion Conduit, or Boulder Creek Supply Canal, instead of the operating rules pointing to the sub-basin import demand structure as the source of water.

The South Boulder Diversion Conduit was selected as the first sub-basin interaction to be replaced with end-user demand-driven operating rules. Moffat Tunnel imports transmountain diversions into South Boulder Creek where they are stored in Gross Reservoir and/or carried directly to Ralston Reservoir and downstream demands via the South Boulder Diversion Conduit. The transmountain diversions are ultimately used at Denver Water's Moffat Water Treatment Plant and delivered to other municipal contracts, including Arvada and Consolidated Mutual.

The following general steps were taken to implement this revision:

1. *Convert the South Boulder Diversion Conduit from an export to a carrier*. Set the diversion demand to zero and revise the conduit to be a non-consumptive diversion carrier.
2. *Remove the South Boulder Diversion Conduit import structure.* Remove the import plan structure from the network, diversion, and plan files.
3. *Revise operating rules for the system*. Revise the source for system operating rules from the import plan structure (SBDC_Pln) to the Moffat Tunnel import plan with the South Boulder Diversion Conduit as a carrier. For example, revise the operating rule to allow Moffat Tunnel to release to Ralston Reservoir via the South Boulder Diversion Conduit based on the reservoir demand.
4. *Release remaining supplies to the Clear Creek Basin*. Any remaining imported water in the Moffat Tunnel plan was released to a small tributary in the Clear Creek Basin, as this water did not historically flow down South Boulder Creek.

The model was simulated using the new demand-driven operations and the integrated model results were compared to the sub-basin model results to determine if the implementation was successful. Figure 6-1 through Figure 6-4 reflect the following four comparisons:

1. Amount of Moffat Tunnel water released to meet demands
2. Amount of water carried by the South Boulder Diversion Conduit
3. Reservoir contents in Gross Reservoir
4. Streamflow at South Boulder Creek Near Eldorado Springs (06729500) – downstream of the South Boulder Diversion Conduit

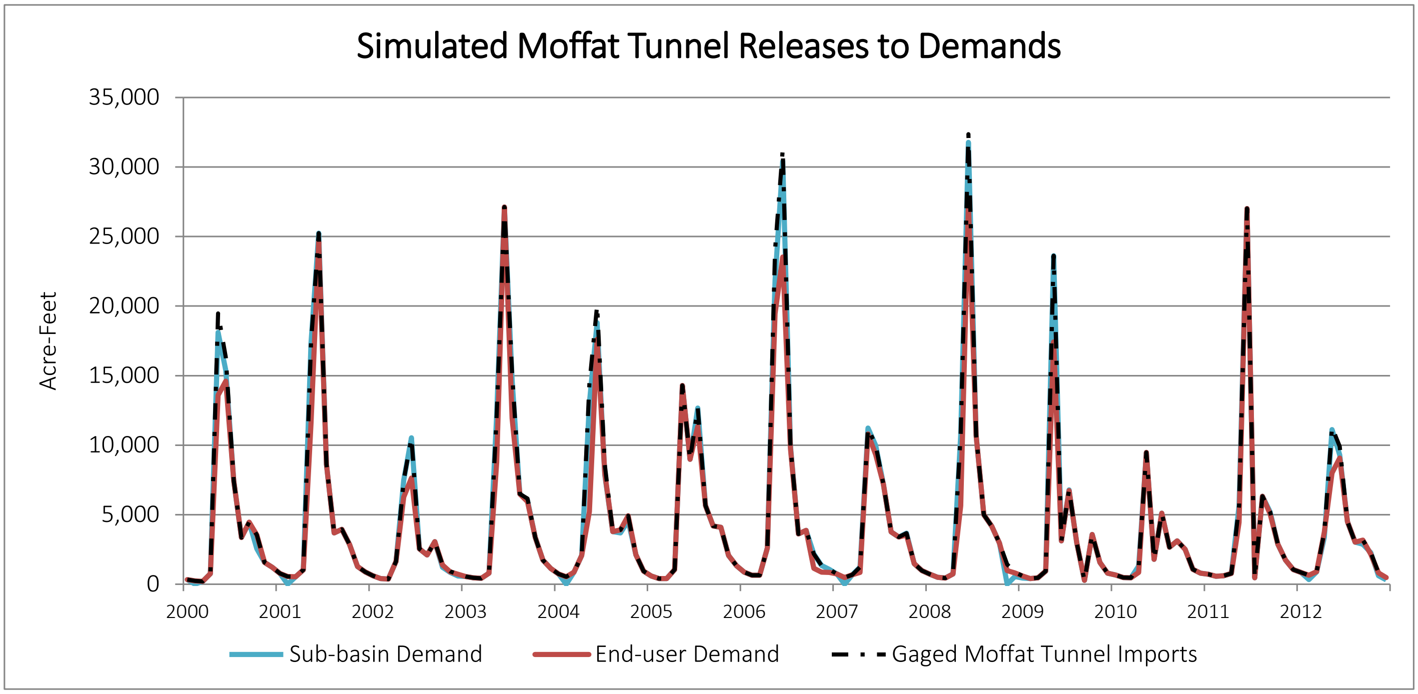


Figure 6-1: Simulated Moffat Tunnel Releases to Demand

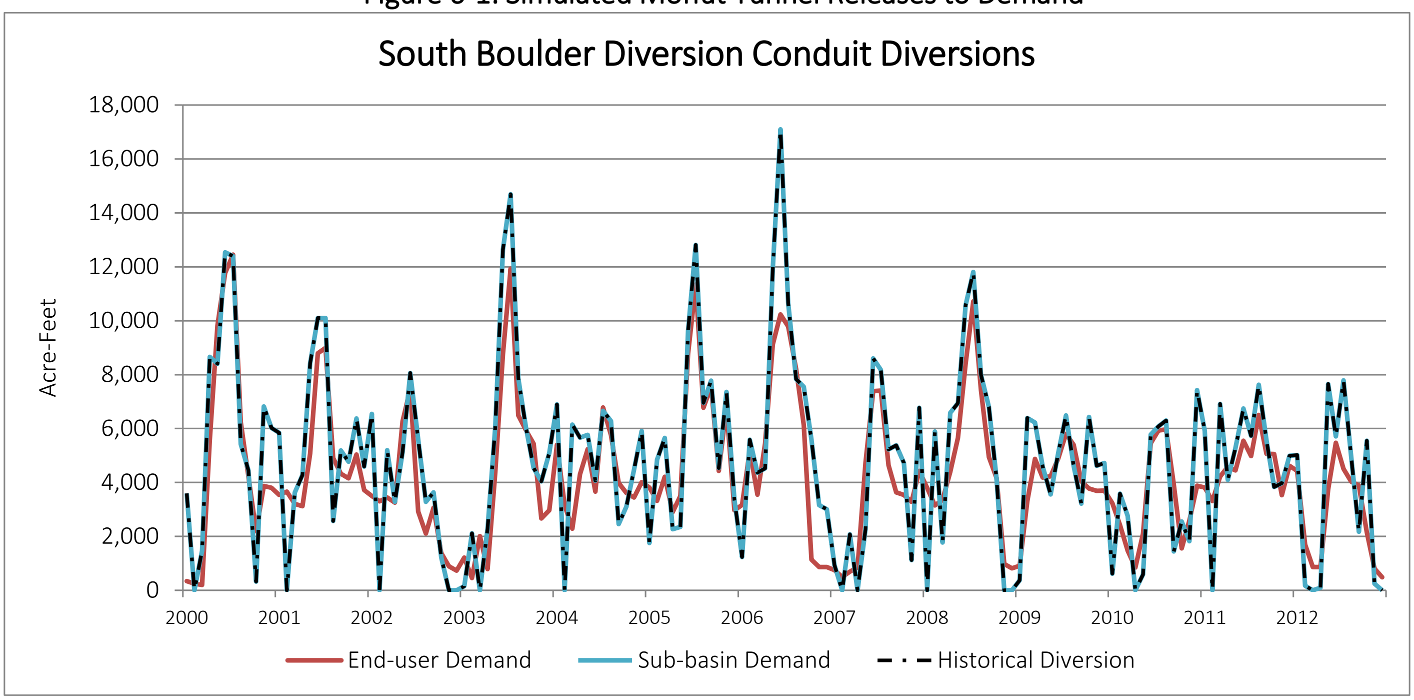


Figure 6-2: South Boulder Diversion Conduit Diversion

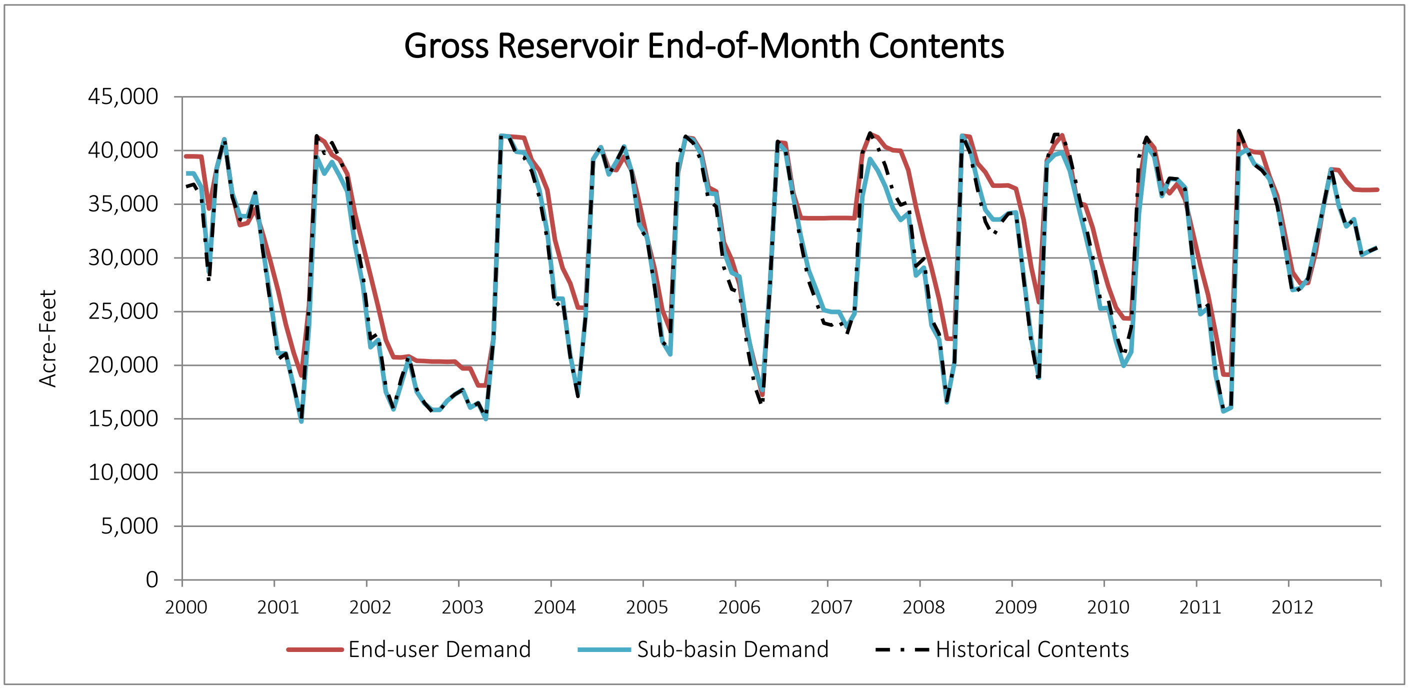


Figure 6-3: Gross Reservoir End-of-Month Contents

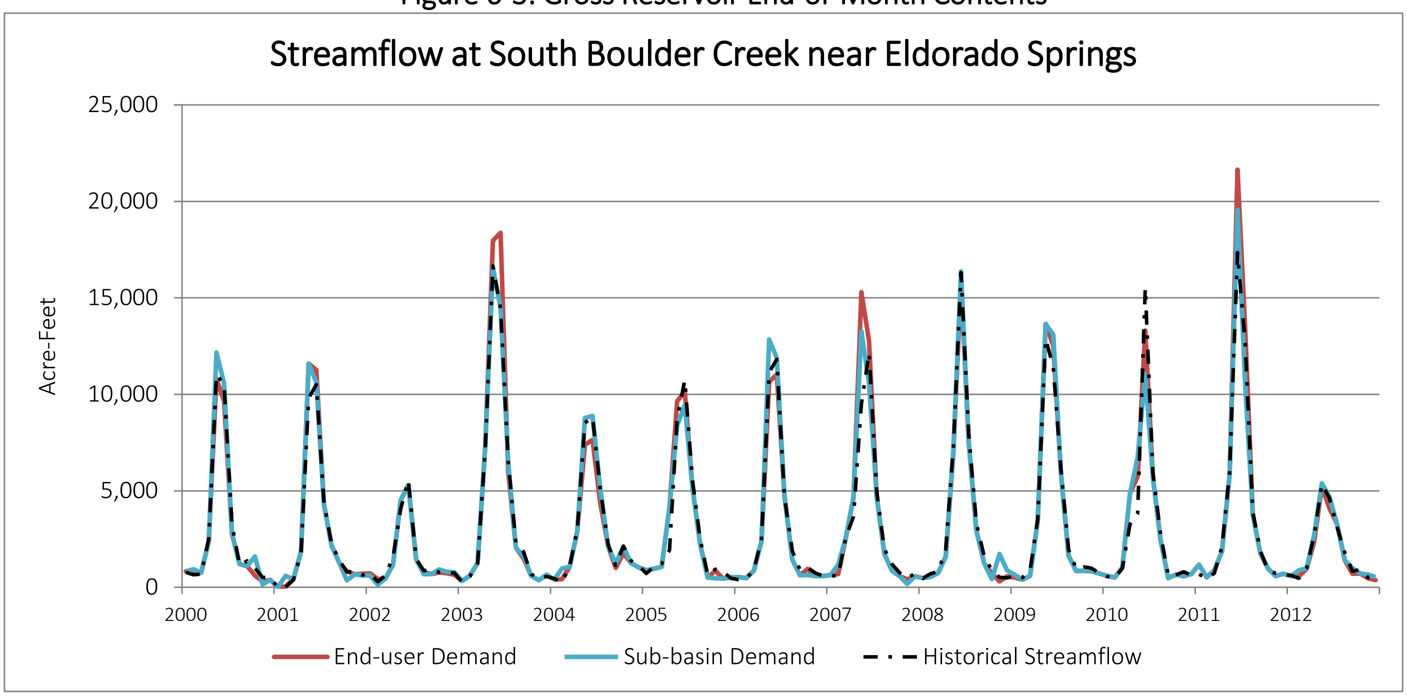


Figure 6-4: Streamflow at South Boulder Creek near Eldorado Springs

As shown in the figures above, the sub-basin demand driven results very closely mimic the historically gaged records at Moffat Tunnel, Gross Reservoir, and South Boulder Diversion Conduit. This is due to the fact that the model exports the full South Boulder Diversion Conduit amount to the Clear Creek Basin regardless of end-user demands, essentially forcing the system to operate the same way it has historically and resulting in excellent calibration results at the South Boulder Creek gage.

If the model was perfectly calibrated, the imported water would be re-diverted at the Moffat Water Treatment Plant, Ralston Reservoir, or by other municipal contractors in the same timing and magnitude as they have historically. Under less than perfect calibration scenarios, the imported water is not re-diverted by these structures/entities and the remaining water (i.e. plan release) flows down a small Clear Creek tributary and ends up in the South Platte River. When end-user demands drive use of Moffat Tunnel transmountain diversions, the Moffat Tunnel import plan is releasing less water to meet demands; South Boulder Diversion Conduit is carrying less water than it has historically; and Gross Reservoir contents are higher than they have been historically. This is likely due to the fact that the Moffat Tunnel demands (Moffat Water Treatment Plant, Ralston Reservoir, and other municipal contractors) are not completely calibrated, per-capita use or outdoor uses may be potentially underestimated, and/or there are additional contract deliveries that are not modeled explicitly. There are several years when the calibration is very good, and years when operations still need to be refined. Based on these calibration results, the Moffat Tunnel operations are included in the model with dynamic user demand-driven.

The C-BT transmountain sub-basin interactions discussed in Table 6-1 were represented in the South Platte Model by first delivering to the historical sub-basin demand, then allowing that "set" supply to meet end-user demands. This was recommended based on the following:

- *Water delivery based on operational decisions*. StateMod allocates water based on priority. As such, it is necessary to develop a standard "order of operations" for each water user that has multiple supplies. This is sometimes in contrast to how the water user may actually use their supplies. Although the users provided a general order of operations, there are many operational decisions that cause divergence from the general order. Transmountain diversions in particular do not fit into the normal order of operations because once they are imported to the system; they can be delivered to users without the constraints of the priority system. A general order of operations was identified that included the use of these transmountain supplies; however, even a moderate divergence in the order of operations for a major water user can result in calibration issues. Therefore, additional calibration of major water users' operations will be required when the sub-basin interactions are revised to be end-user demand-driven.
- *Lack of information regarding historical uses.* Diversion coding in the South Platte Basin does not consistently differentiate transmountain supplies from diversions taken under direct rights. Likewise, the type and resolution of data made available by Northern (i.e. recent shareholder ownership) provided information into the sub-basin delivery of C-BT water but did not provide sufficient information to understand how much C-BT water was delivered to the end-users over a long period.
- *Annual variation in historical uses.* C-BT shares owned by users vary year-to-year and the project provides a mechanism to easily lease shares between users. Therefore, even when DWR's revised Diversion Records Standards provide better information about C-BT

deliveries on a ditch or municipal level, if the use and/or lease is not consistent over time, it cannot be accurately modeled using set operating rules.

6.2 Calibration Results

This section describes specific areas of the model that required significant calibration efforts, and it presents graphs and summaries comparing modeled results for 1993 through 2012 with historical values for the period grouped by sub-basin. Table 7.6 provides a summary of the average annual (1993 – 2012) surface and ground water demand, the percent of demand met during simulation, and the total irrigation and M&I consumptive use for each structure in the model. With perfect calibration, 100 percent of the demand is met during model simulation. Carrier structures are excluded from the table because they do not have set demands, rather they carry water to meet other structures' demands. A summary of these results is presented at the top of each sub-basin's calibration section below.

6.2.1 Water Balance

Table 6-2 summarizes the average monthly water balance for the South Platte Model for the calibration period (1993 - 2013). Following are observations based on the summary table:

- Plan operations account for the large portion of the water simulated in the model each year, over 882,000 af on average, primarily due to imported diversions.
- Annual diversions amount to approximately 3.3 million af on average.
- Approximately 390,000 af of streamflow per year leaves the state.
- Total Inflow and Total Outflow reflect the net result of inflow components (inflow, return flows, and negative change in reservoir and soil moisture contents) less outflow components (diversions, outflow, evaporation, and positive changes in storage) and indicates that the model correctly conserves mass.

Refer to the StateMod documentation for information on how the water balance components are deteremined (*.xwb). Note that the current StateMod version has an identified reporting error associated with the water balance summary regarding plan structures. This error was accounted for and corrected in the table below.

Table 6-2: Model Water Balance

Inflow Components (AF)						
Mo.	Stream Inflow	Returns	From/To GW Storage	From Soil Moisture	From Plan Structures	Total Inflow
Jan	42,256	123,466	1,128	1	62,860	193,390
Feb	38,808	113,843	1,154	0	54,442	176,317
Mar	60,270	116,898	926	645	55,972	200,618
Apr	102,541	151,042	1,319	3,412	52,713	275,438
May	233,009	209,853	2,815	10,217	86,439	478,996
Jun	333,859	258,839	3,231	26,125	95,911	642,713
Jul	195,872	282,126	6,120	16,951	124,069	531,046
Aug	121,366	262,111	1,996	10,425	114,773	424,555
Sep	77,058	225,593	481	6,232	85,669	334,092
Oct	73,680	179,345	-440	2,827	54,999	270,266
Nov	51,049	143,448	1,060	251	38,104	209,377
Dec	36,801	132,357	1,408	6	56,381	194,178
Total	**1,366,569**	**2,198,921**	**21,198**	**77,092**	**882,332**	**4,546,112**

Outflow Components (AF)									
Mo.	Diversions	Well Depletions	Res. Evap.	Res. Seepage	Stream Outflow	Reservoir Change	To Soil Moisture	Soil Moisture Change	Total Outflow
Jan	114,526	30,379	4,962	7,445	31,617	40,780	4,476	-4,475	229,711
Feb	103,682	27,472	6,891	10,864	26,082	33,257	4,168	-4,168	208,248
Mar	119,672	25,423	8,678	19,593	18,411	42,290	5,710	-5,064	234,711
Apr	209,163	24,839	15,393	19,289	23,452	15,479	14,878	-11,466	311,026
May	405,396	27,720	18,552	18,832	42,260	19,356	10,990	-773	542,334
Jun	496,420	35,278	28,674	17,253	111,654	2,561	2,725	23,400	717,966
Jul	616,416	44,183	28,573	9,184	31,362	-121,530	4,850	12,101	625,138
Aug	524,712	50,245	23,158	4,927	18,503	-121,301	4,127	6,299	510,670
Sep	349,159	49,830	17,296	6,458	14,549	-48,490	5,323	910	395,035
Oct	189,641	44,190	11,953	13,978	38,729	9,095	9,171	-6,344	310,411
Nov	99,810	36,584	6,097	4,885	12,527	73,758	4,510	-4,260	233,911
Dec	114,512	33,618	4,718	4,986	19,900	49,212	5,108	-5,102	226,953
Total	**3,343,109**	**429,761**	**174,945**	**137,694**	**389,046**	**-5,533**	**76,036**	**1,058**	**4,546,114**

6.2.2 Water Districts 80, 23, 9, 8, and 2 (Upper South Platte River) Calibration

The Upper South Platte River Basin operations are dominated by municipal uses with their on-channel reservoirs and transmountain imports, and irrigation uses with their off-channel reservoirs. Considering the complexity of the operations in the Upper South Platte River basin, the reservoirs and diversions calibrate very well, and the municipal demands have minimal to no shortages. The streamflow, however, is generally over-simulating compared to historical gage data and, as shown in the graphs below, these excess flows are carried all the way downstream. Specific calibration issues and recommendations are discussed in more detail below; it is recommended model users also refer to the operating rule section for more information on the municipal operations discussed below.

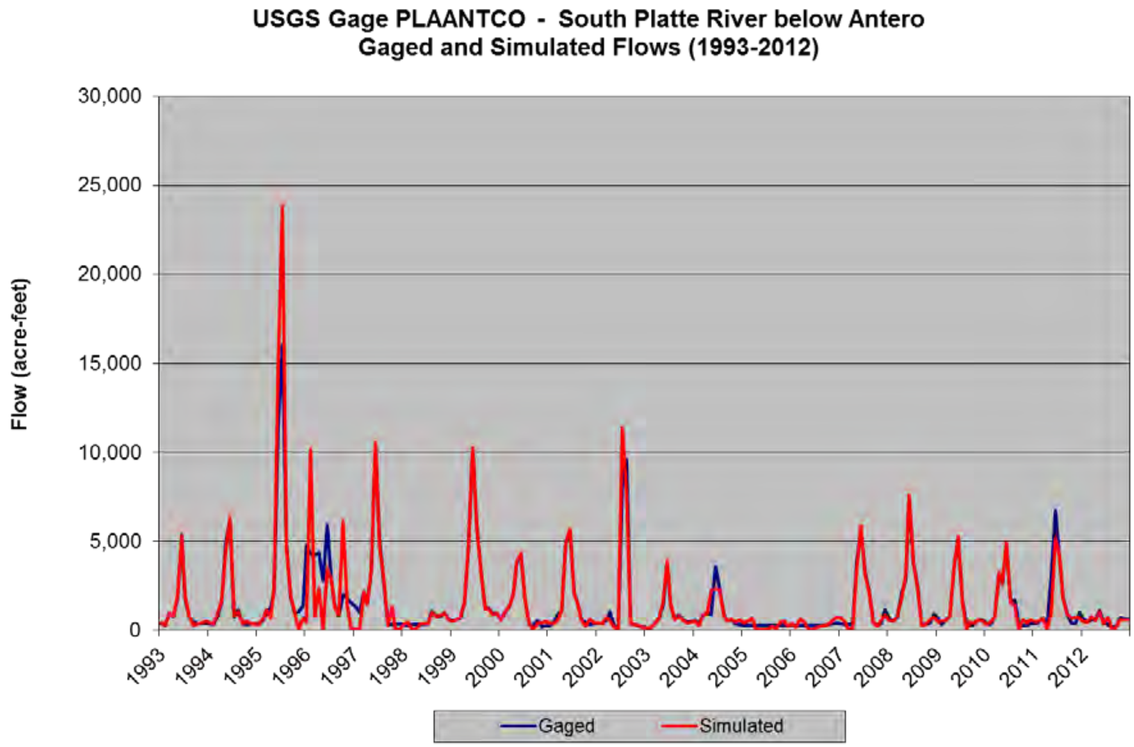
The following table presents the number of each structure type in the sub-basin:

	Diversions	Reservoirs	Well Only	Plans
Upper Basin	228	46	25	233

The following tables present the average annual surface and ground water demand (af), the percent of demand that was met, and the associated M&I and irrigation consumptive use over the 1993 to 2012 period. Note that the SW Demand can be met by native flow, reservoir releases, and transmountain supplies. See Table 7-6 for more information on the demand and consumptive use for specific structures. The Upper South Platte sub-basin receives approximately 150,000 af of imported supplies on average annually through Moffat Tunnel, Roberts Tunnel, and the Homestake Project.

	SW Demand (AF)	GW Demand (AF)	Total Demand (AF)	Percent Demand Met
Upper Basin	807,000	143,000	950,000	99%

	Irrigation Consumptive Use (AF)	M&I Consumptive Use (AF)	Total Consumptive Use (AF)
Upper Basin	258,000	185,000	443,000



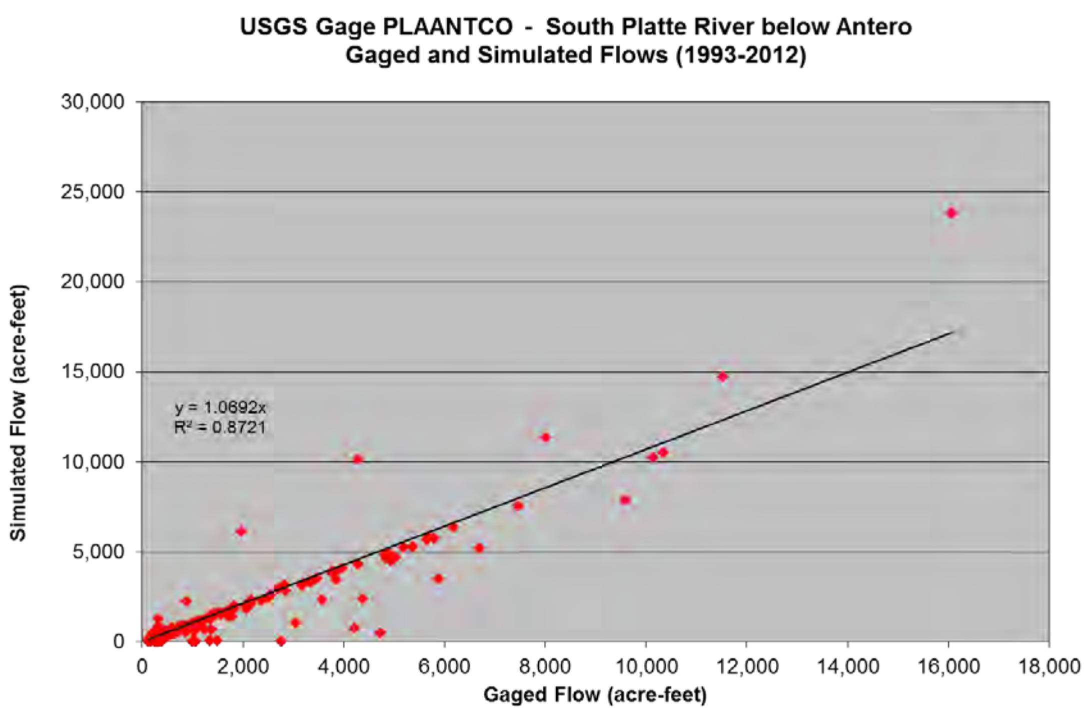
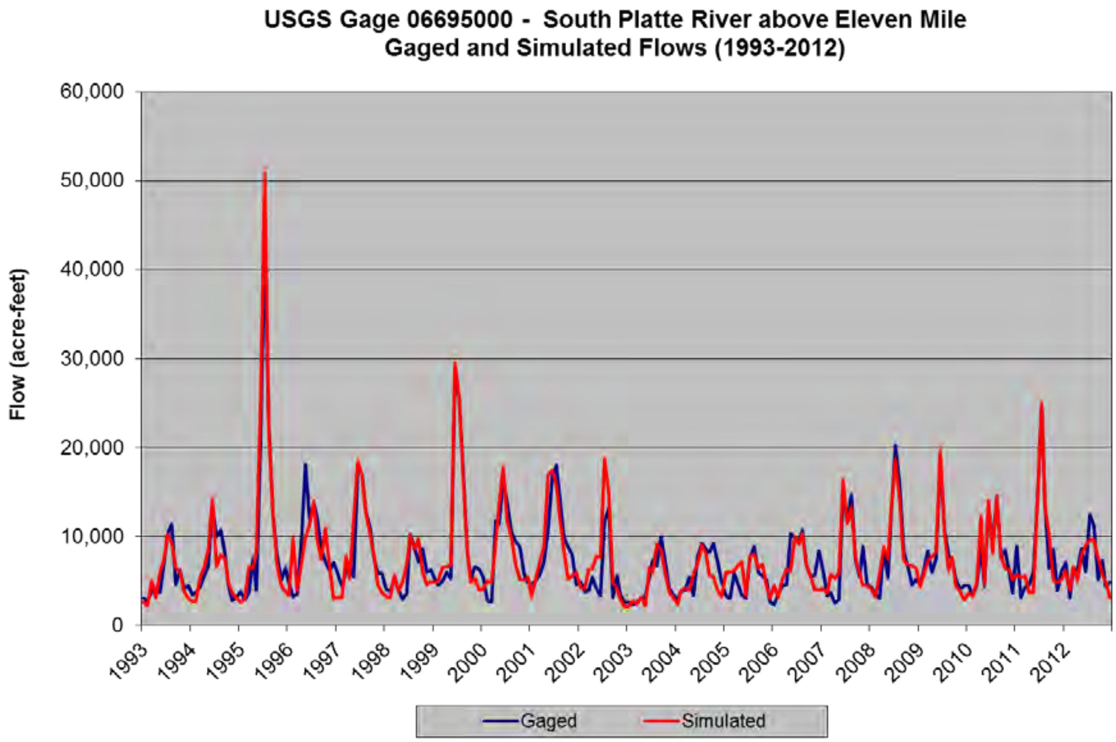


Figure 6-5: South Platte River below Antero Reservoir (District 23)



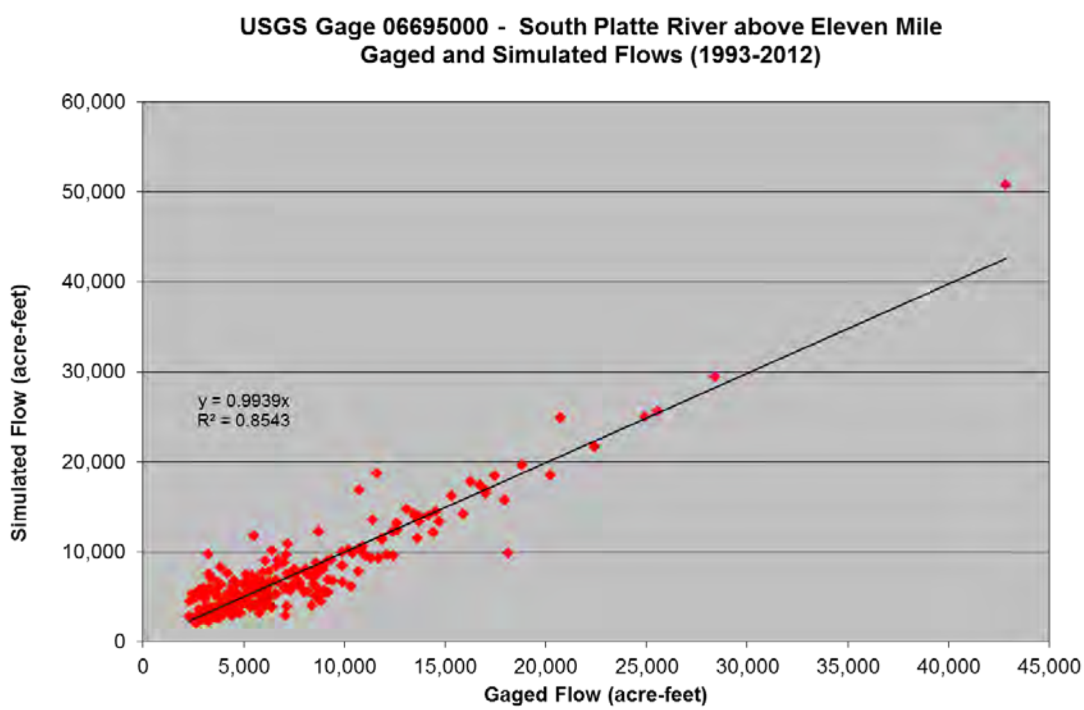
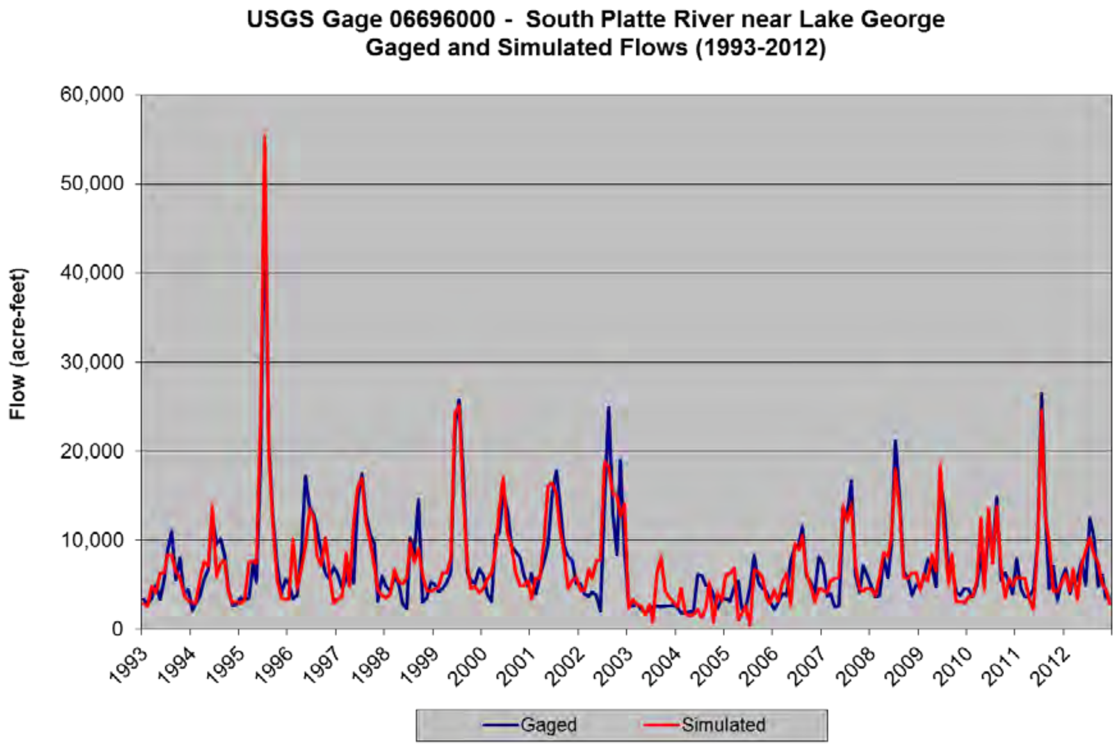


Figure 6-6: South Platte River above Eleven Mile Reservoir (District 23)



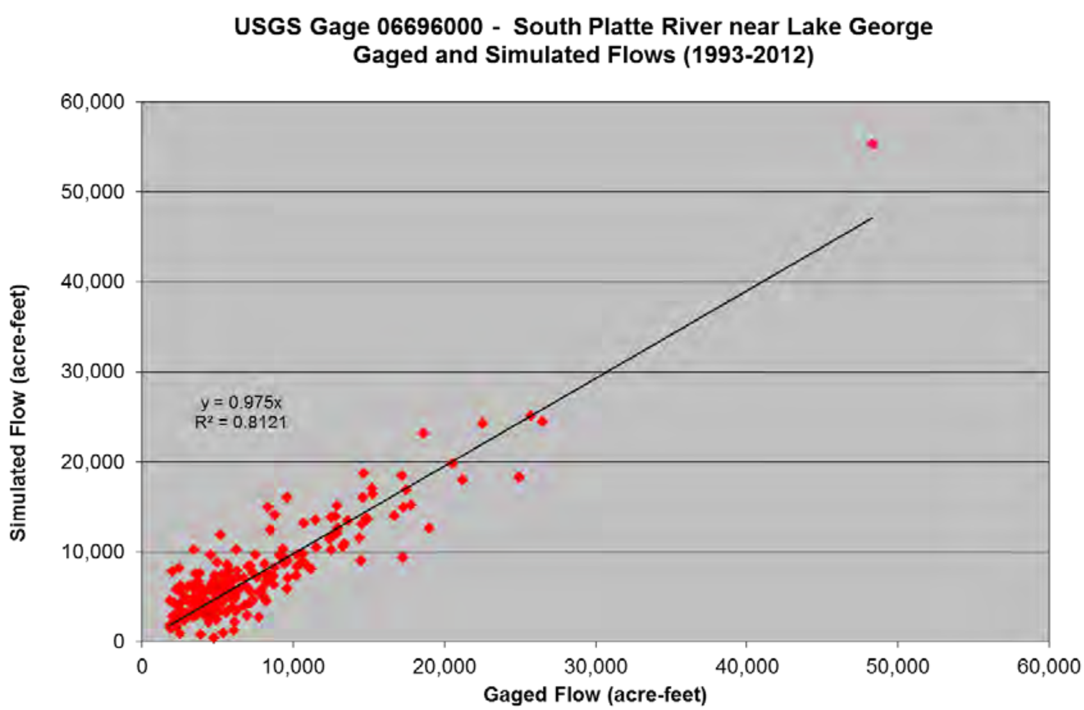
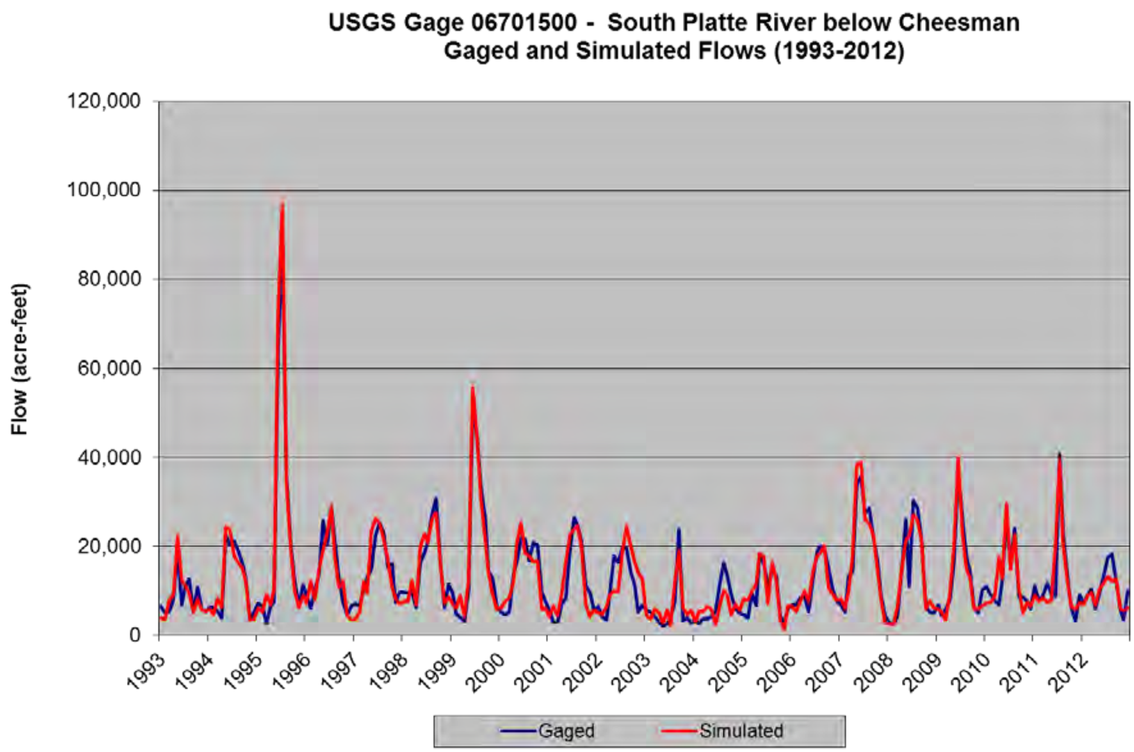


Figure 6-7: South Platte River near Lake George (District 23)



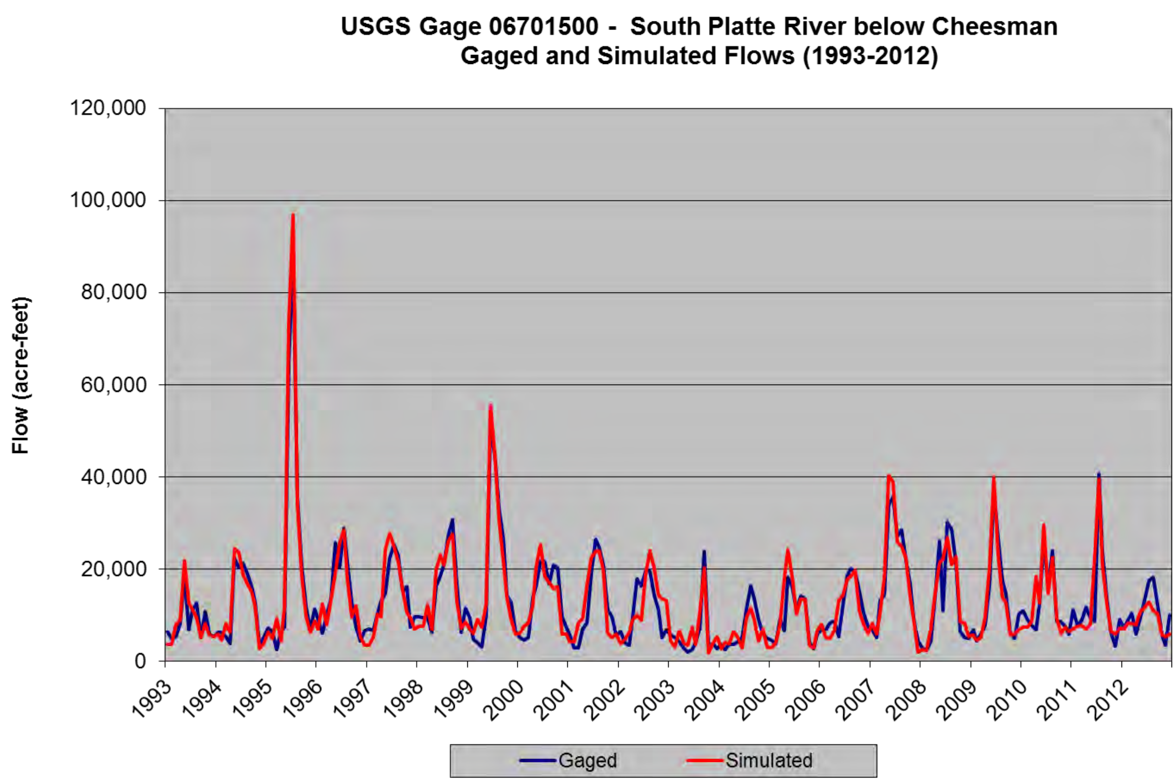
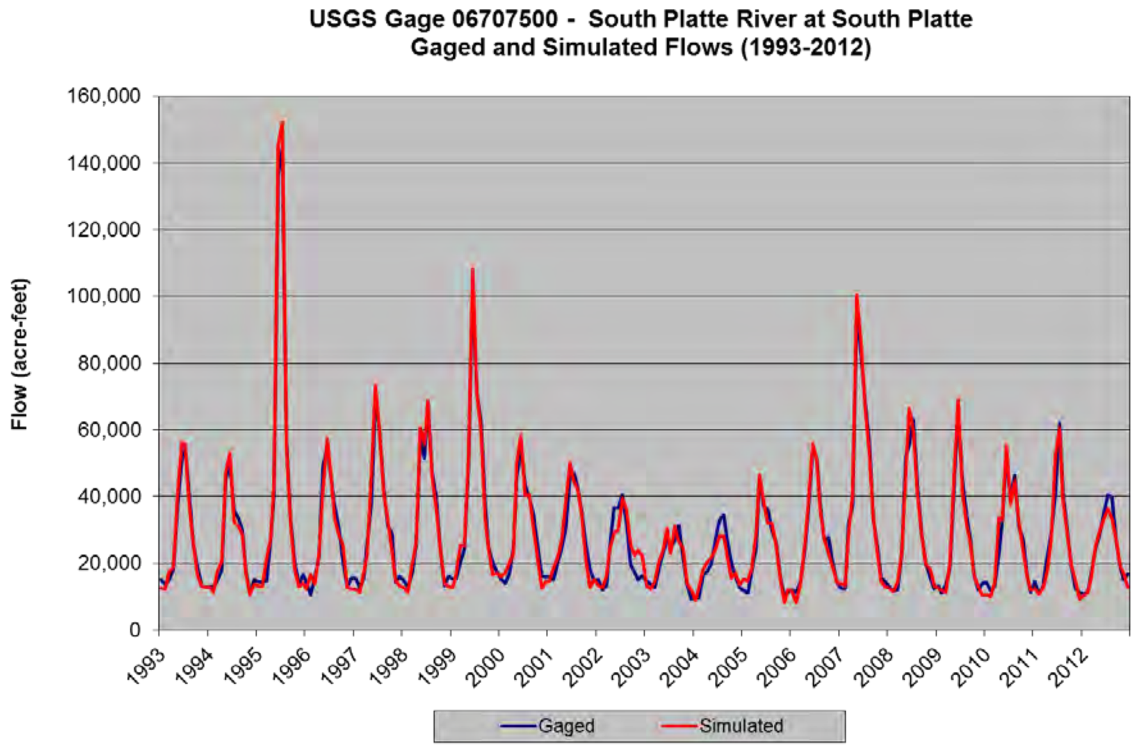


Figure 6-8: South Platte River below Cheesman Reservoir (District 8/80)



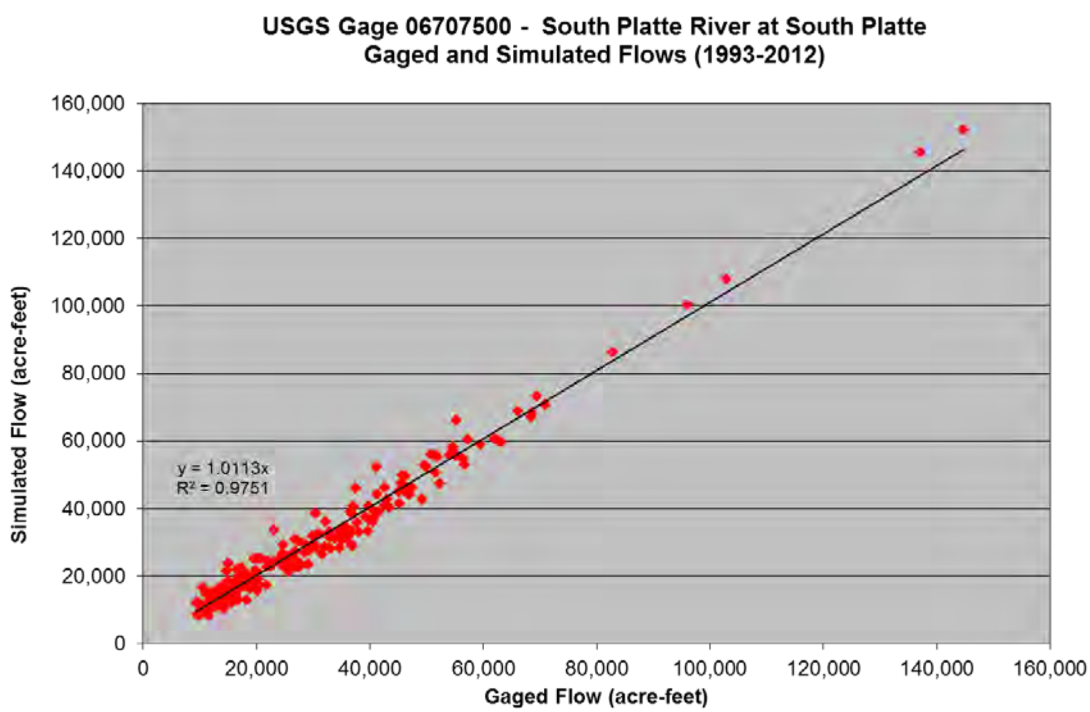
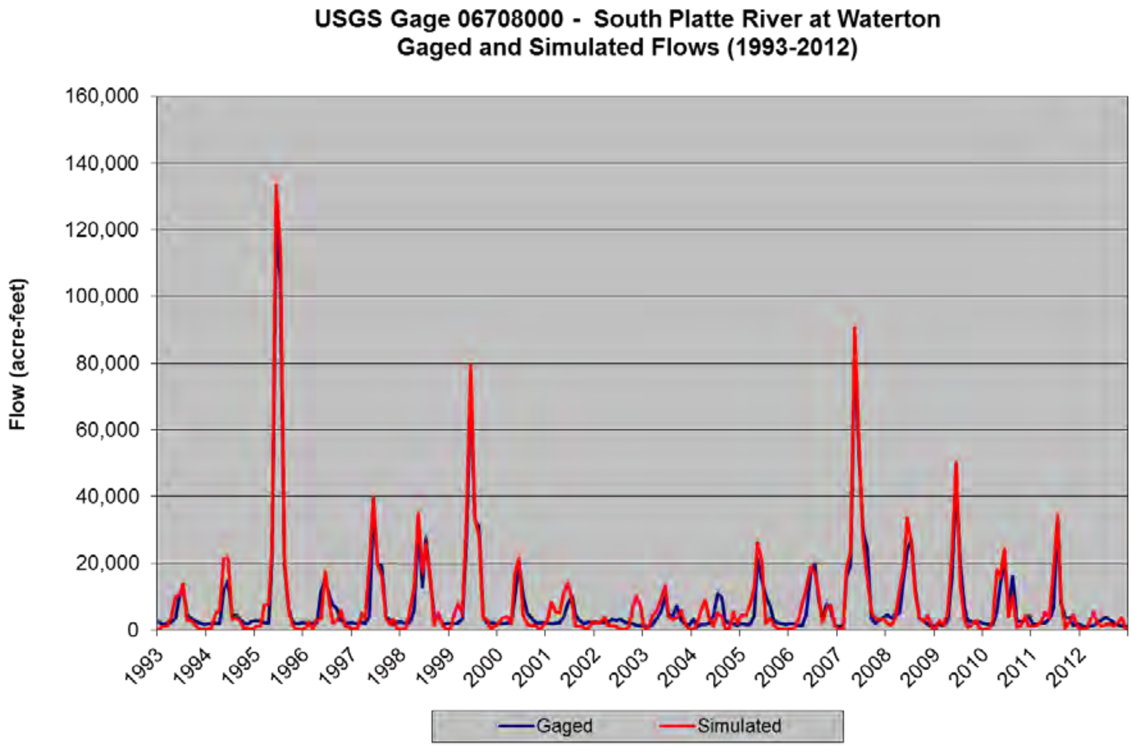


Figure 6-9: South Platte River at South Platte (District 8/80)



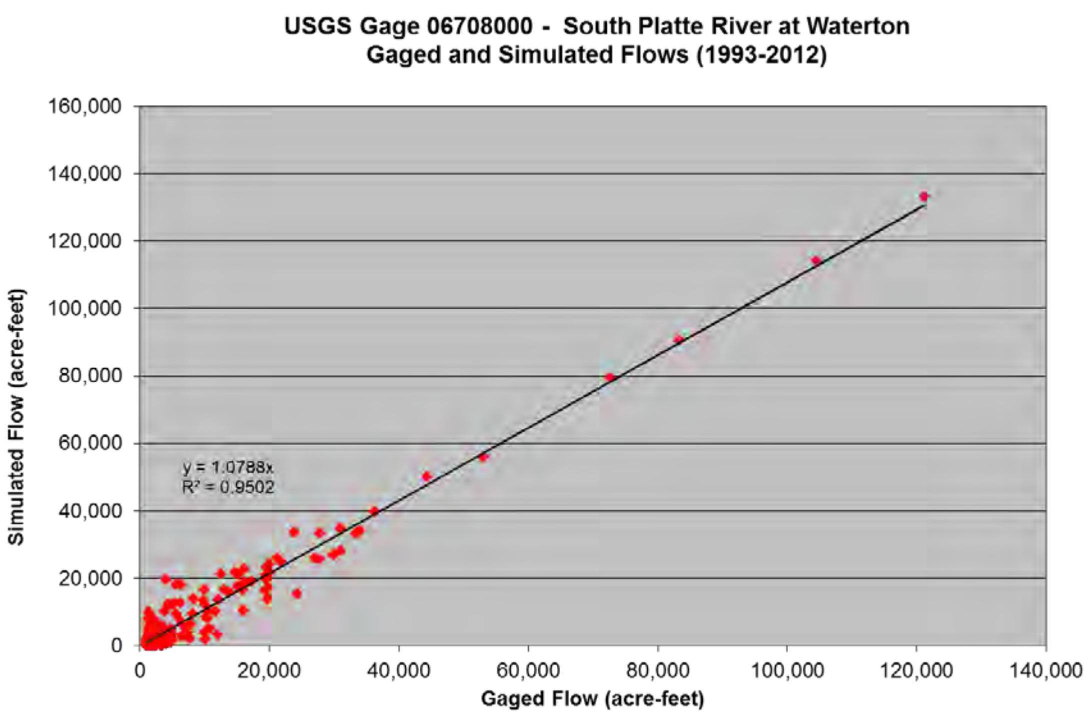
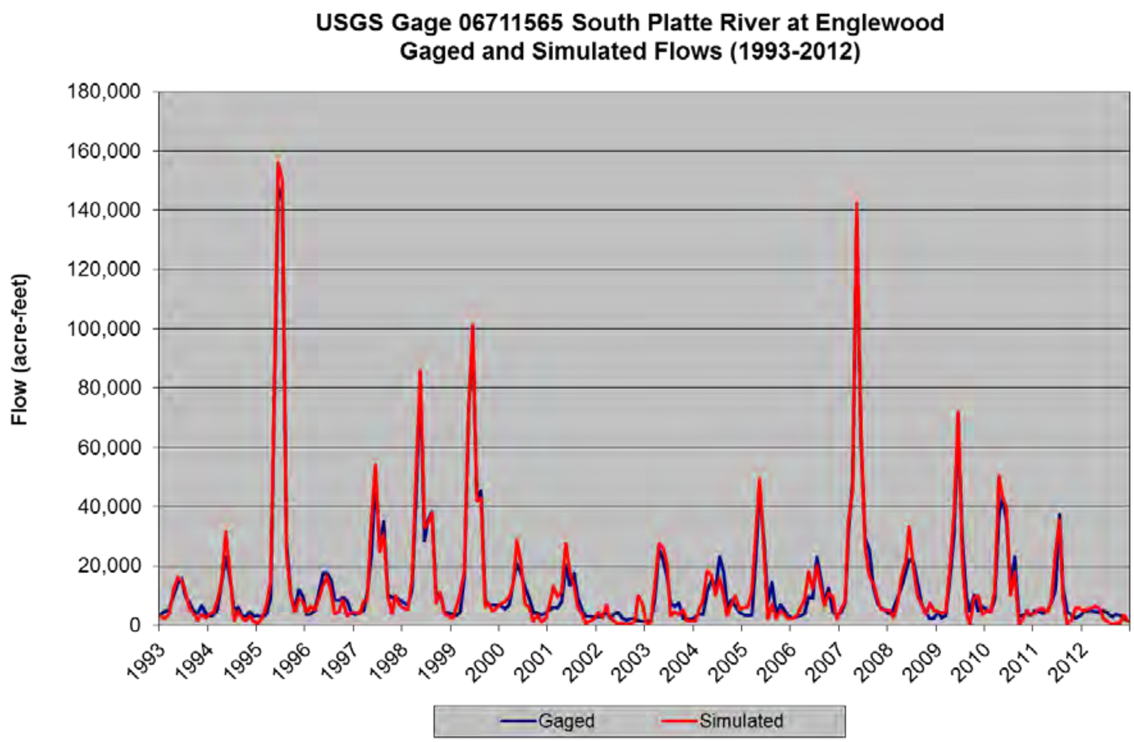


Figure 6-10: South Platte River at Waterton



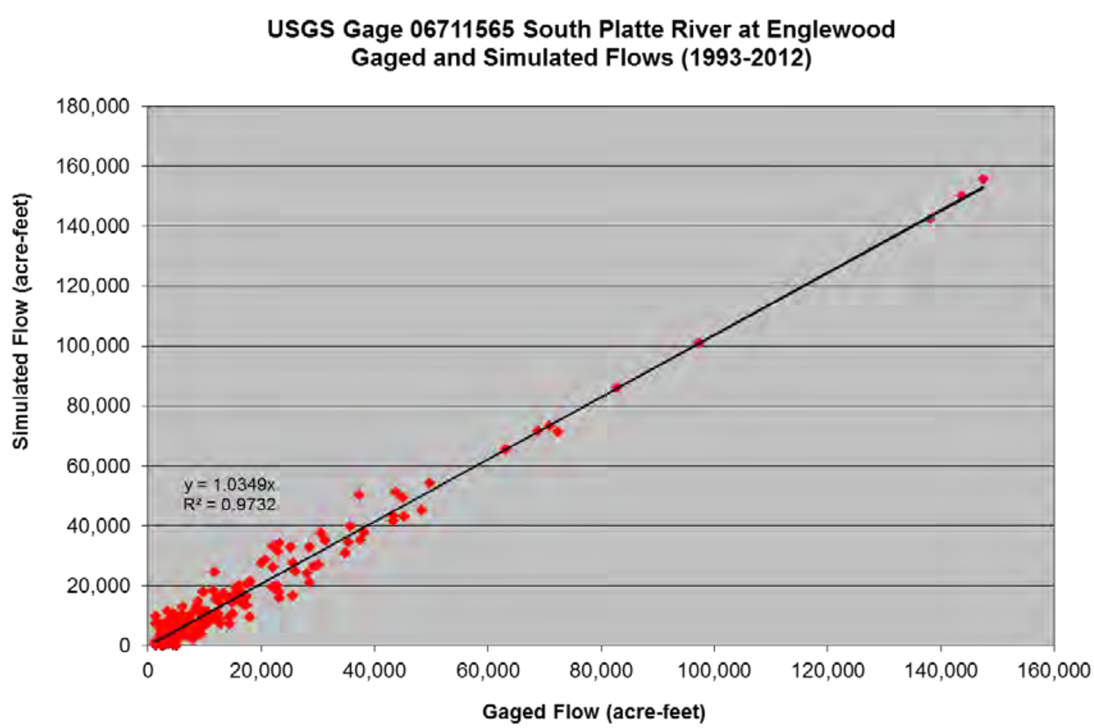
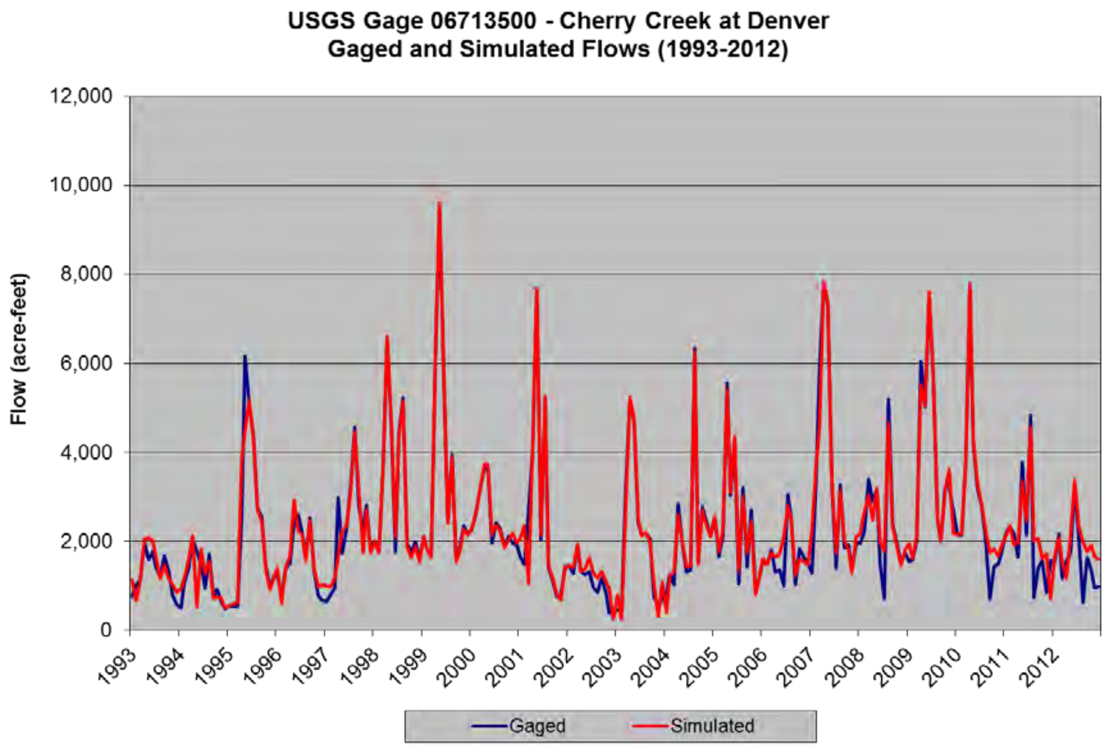


Figure 6-11: South Platte River at Englewood



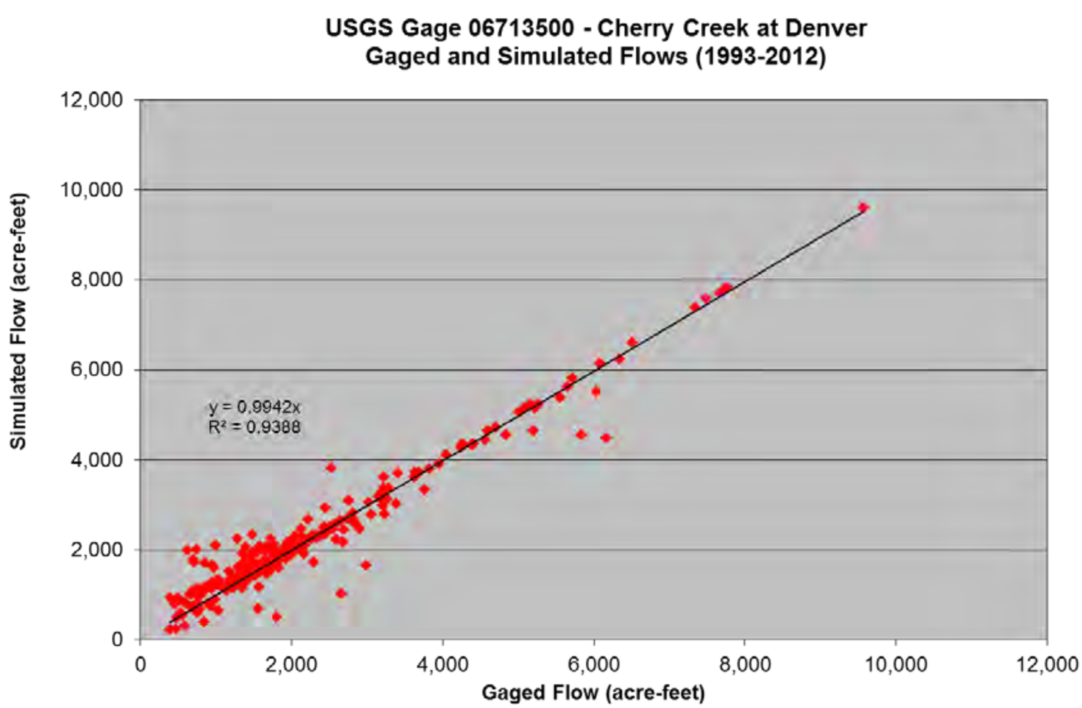
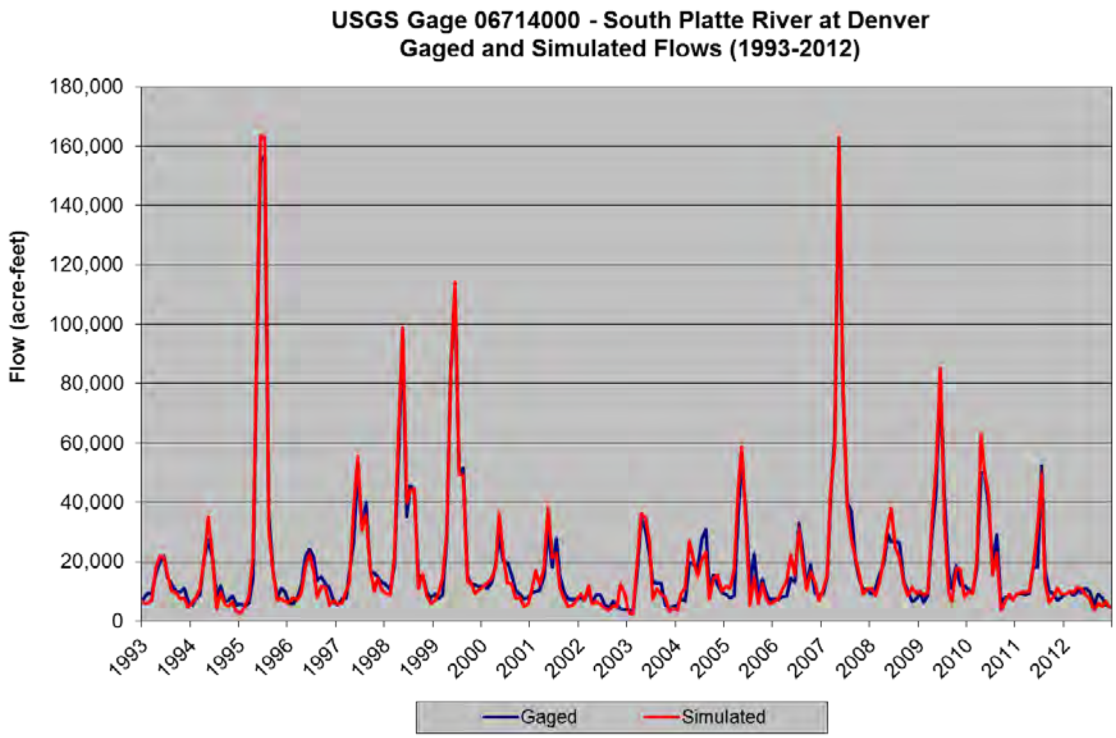


Figure 6-12: Cherry Creek at Denver



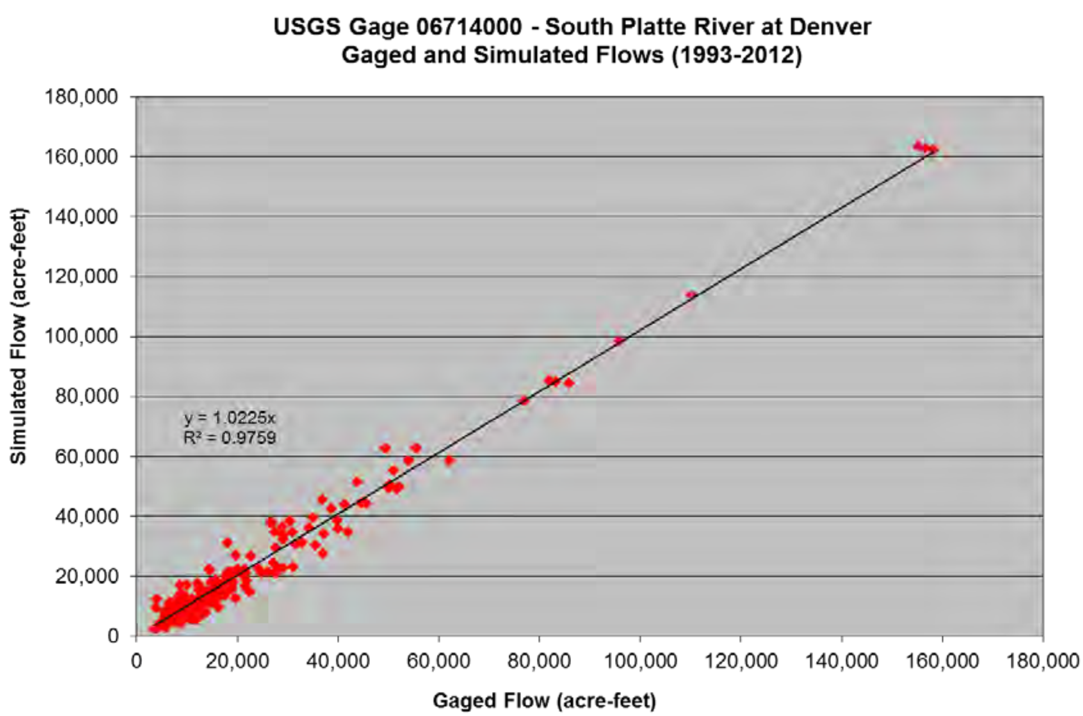
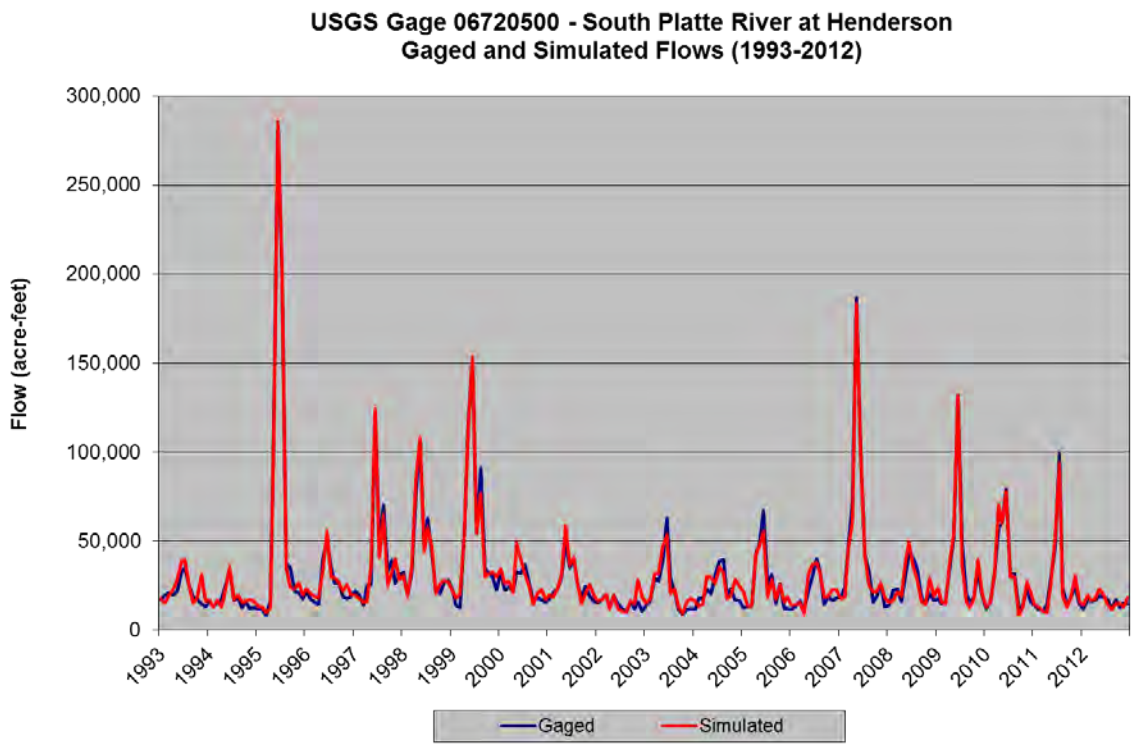


Figure 6-13: South Platte River at Denver



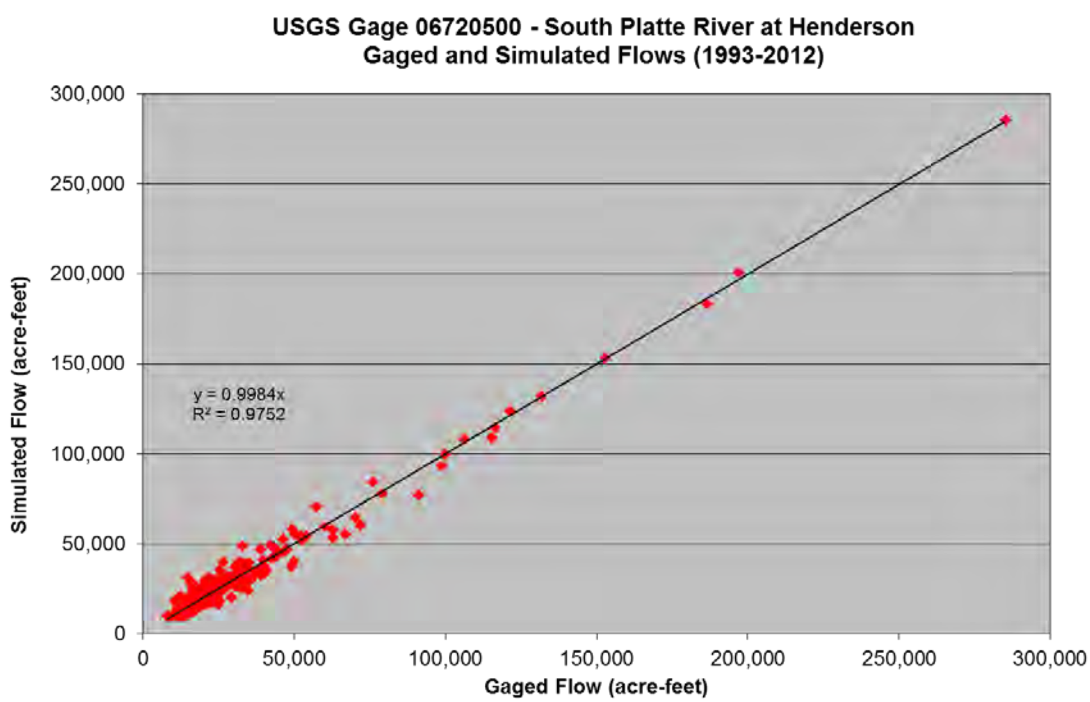
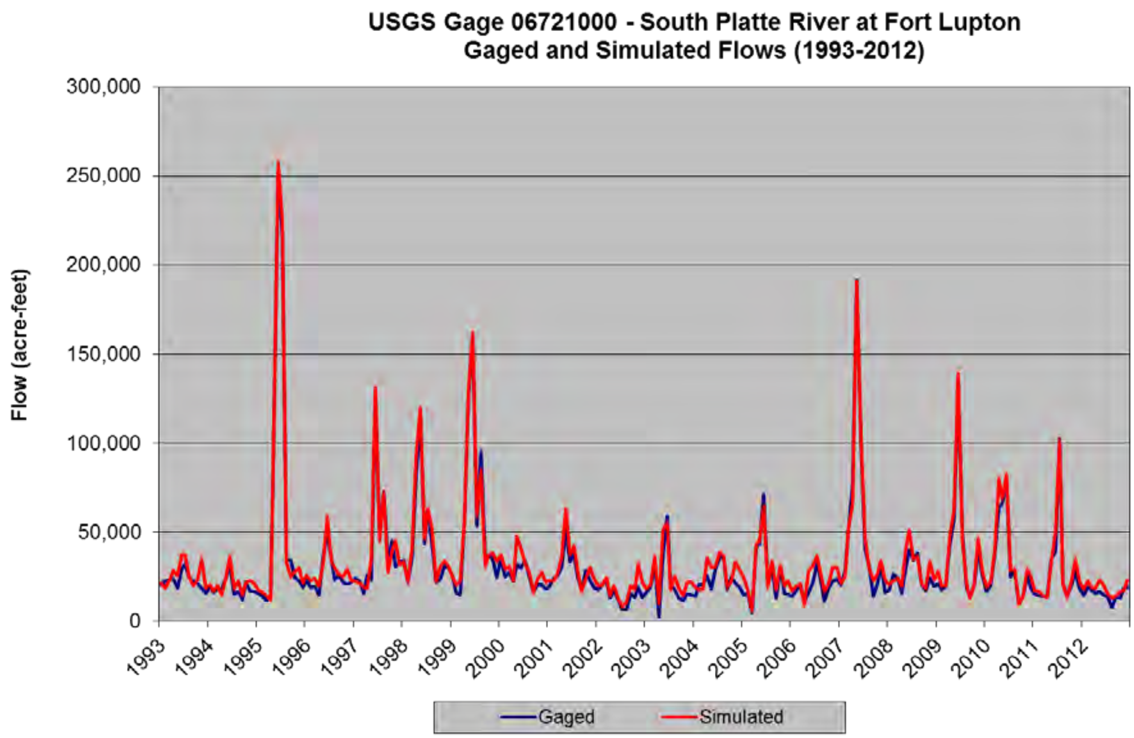


Figure 6-14: South Platte River at Henderson



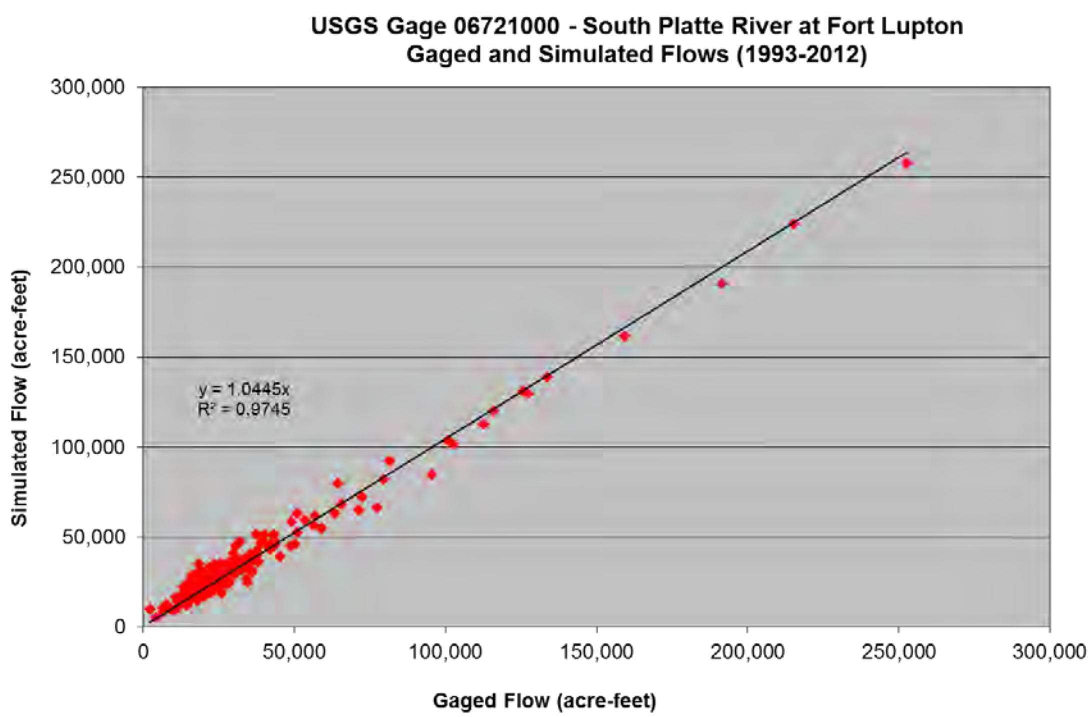


Figure 6-15: South Platte River at Fort Lupton

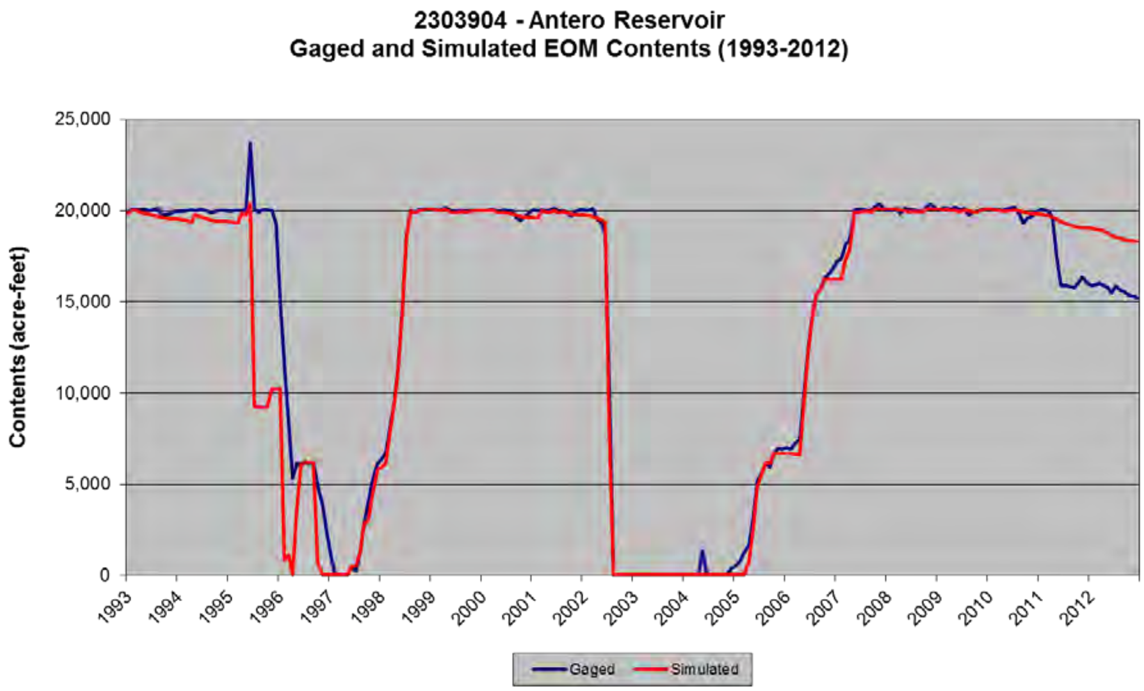


Figure 6-16: Antero Reservoir

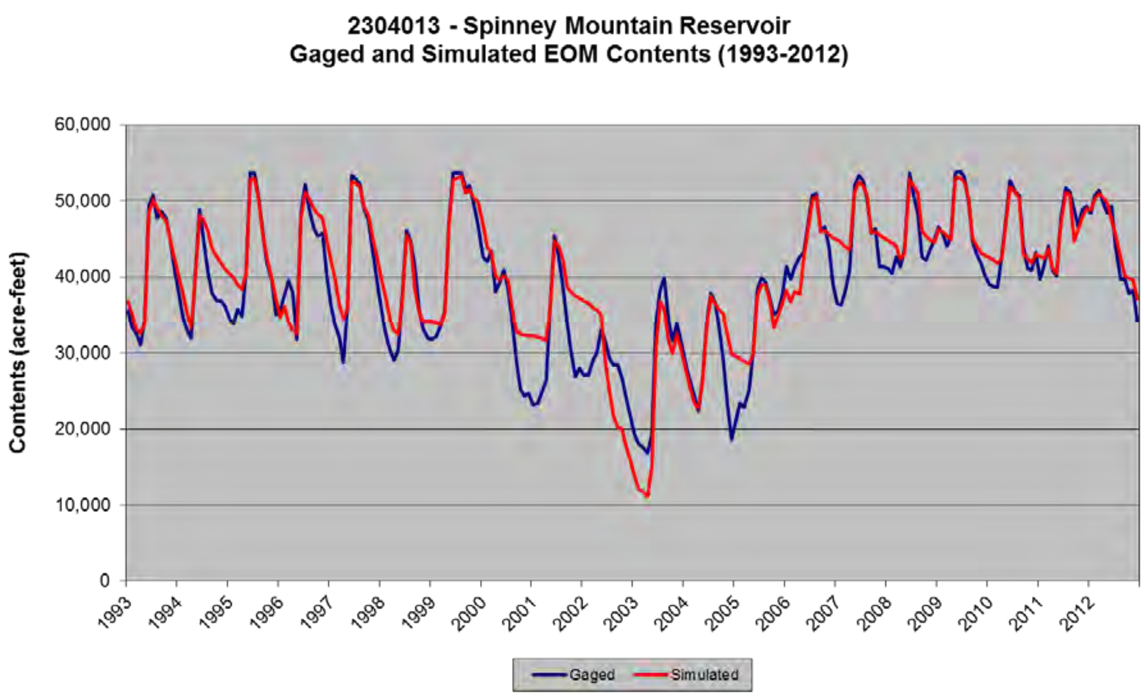


Figure 6-17: Spinney Mountain Reservoir

Figure 6-18: Eleven Mile Reservoir

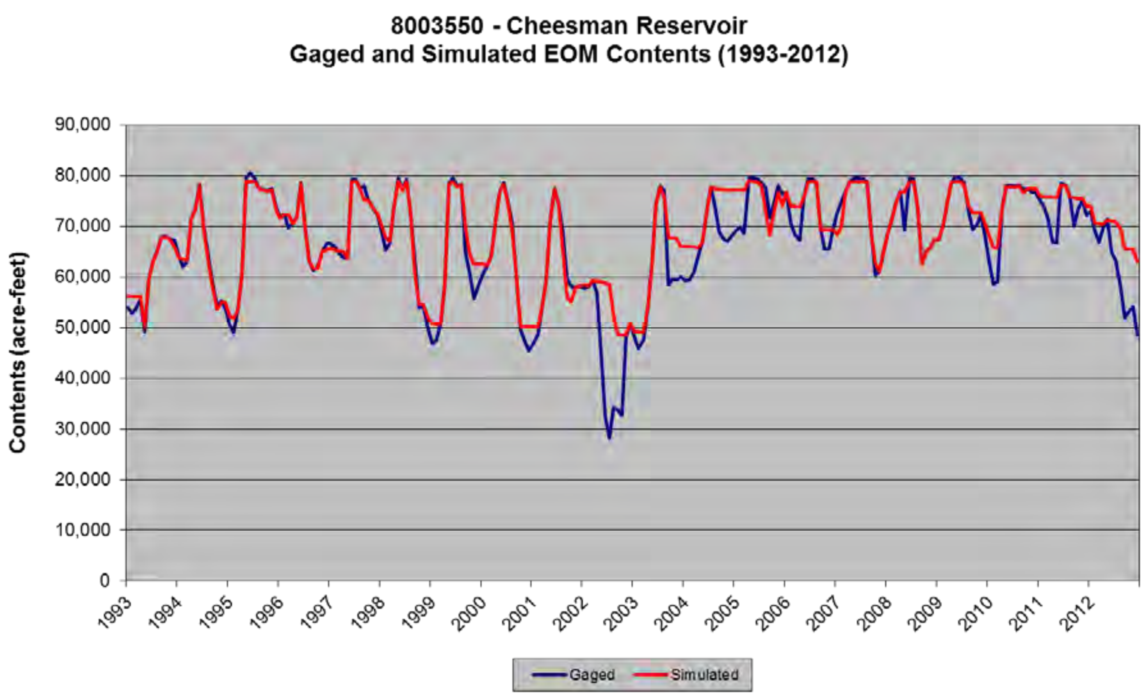


Figure 6-19: Cheesman Reservoir

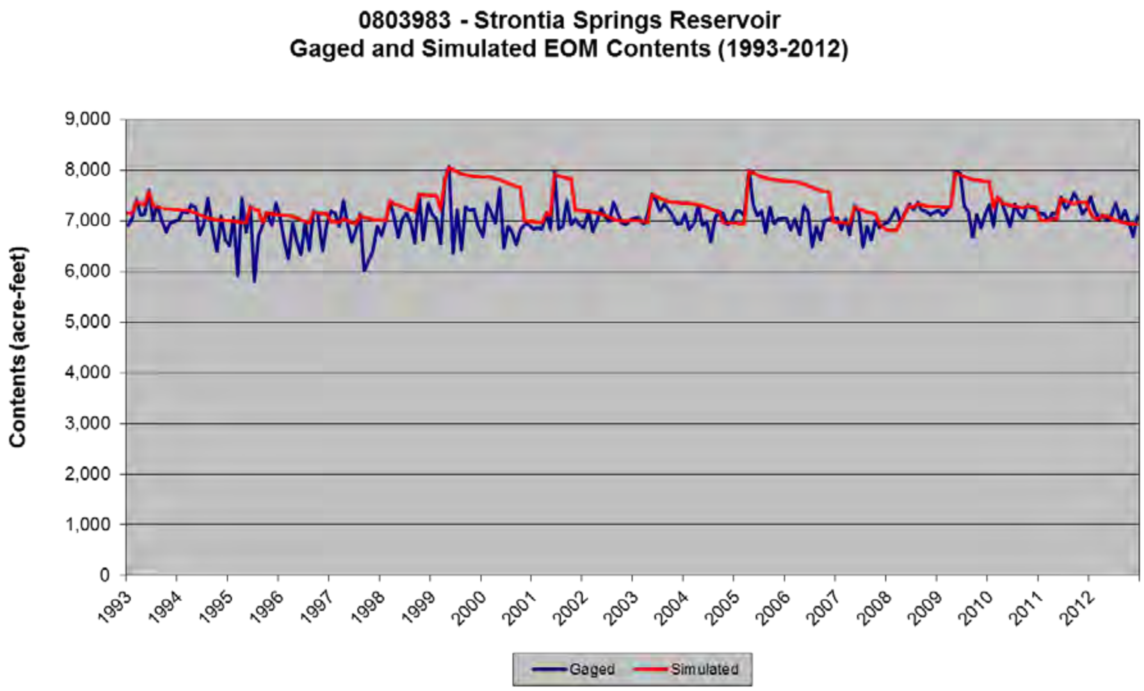


Figure 6-20: Strontia Springs Reservoir

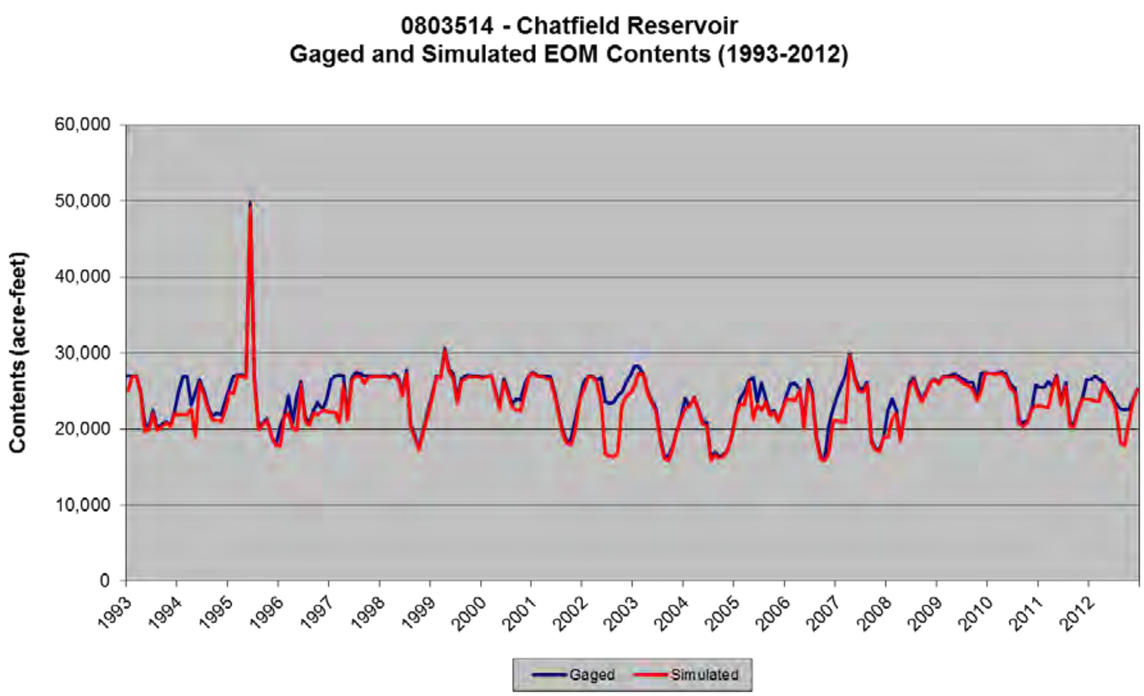


Figure 6-21: Chatfield Reservoir

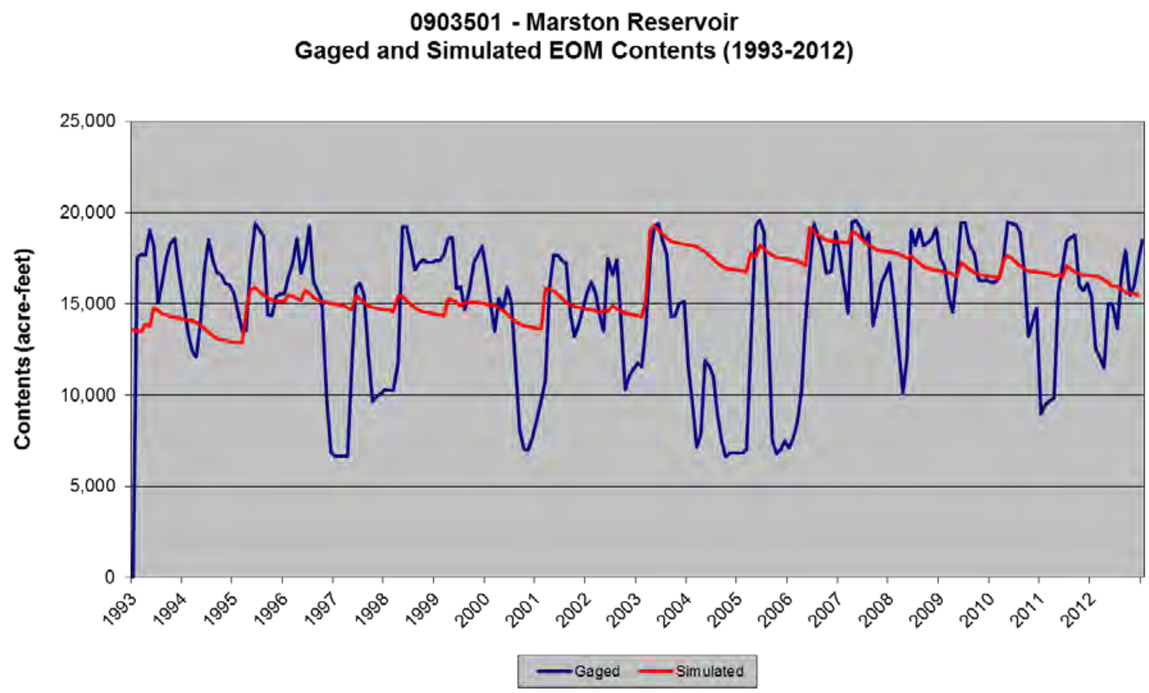


Figure 6-22: Marston Reservoir

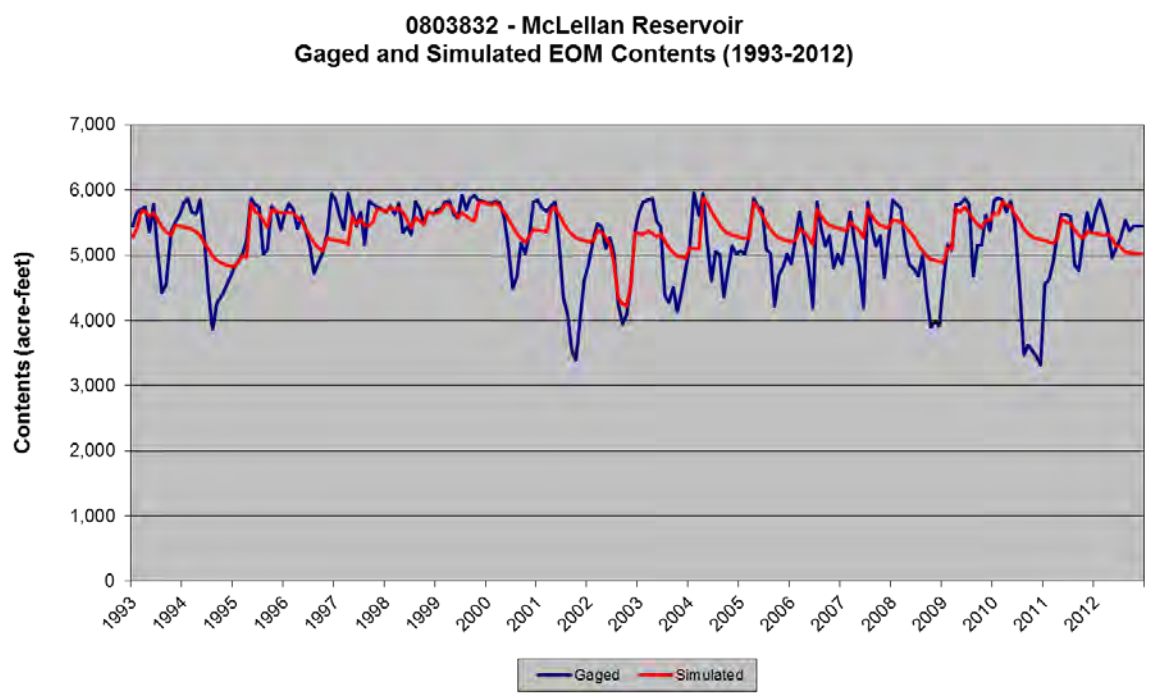


Figure 6-23: McLellan Reservoir

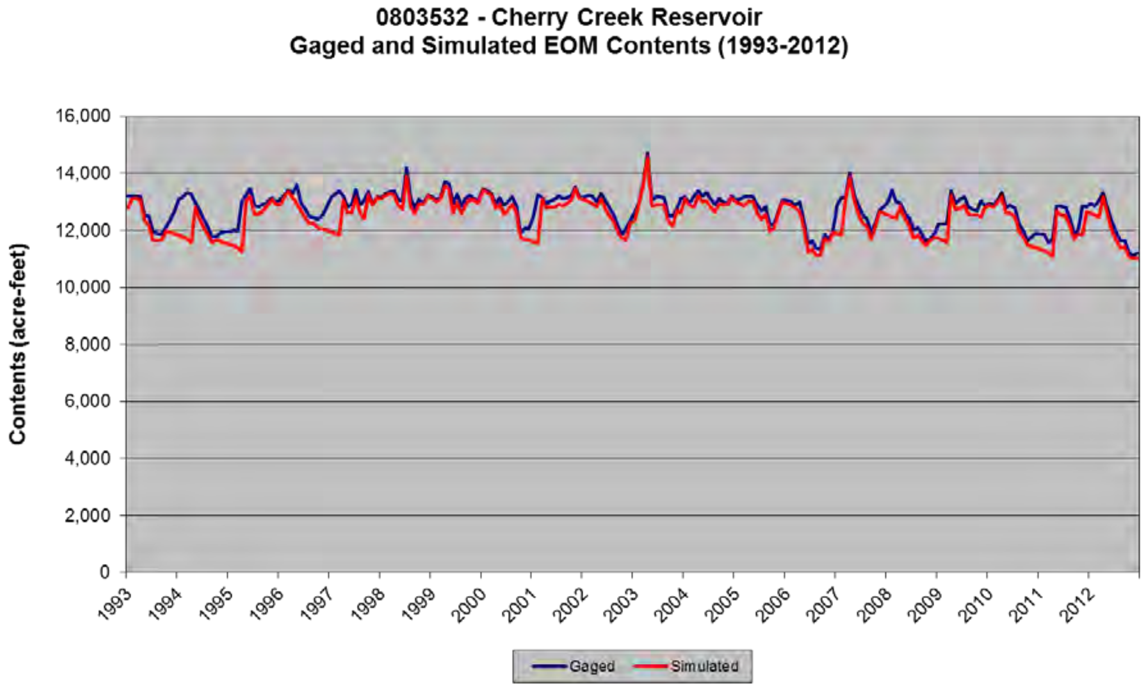


Figure 6-24: Cherry Creek Reservoir

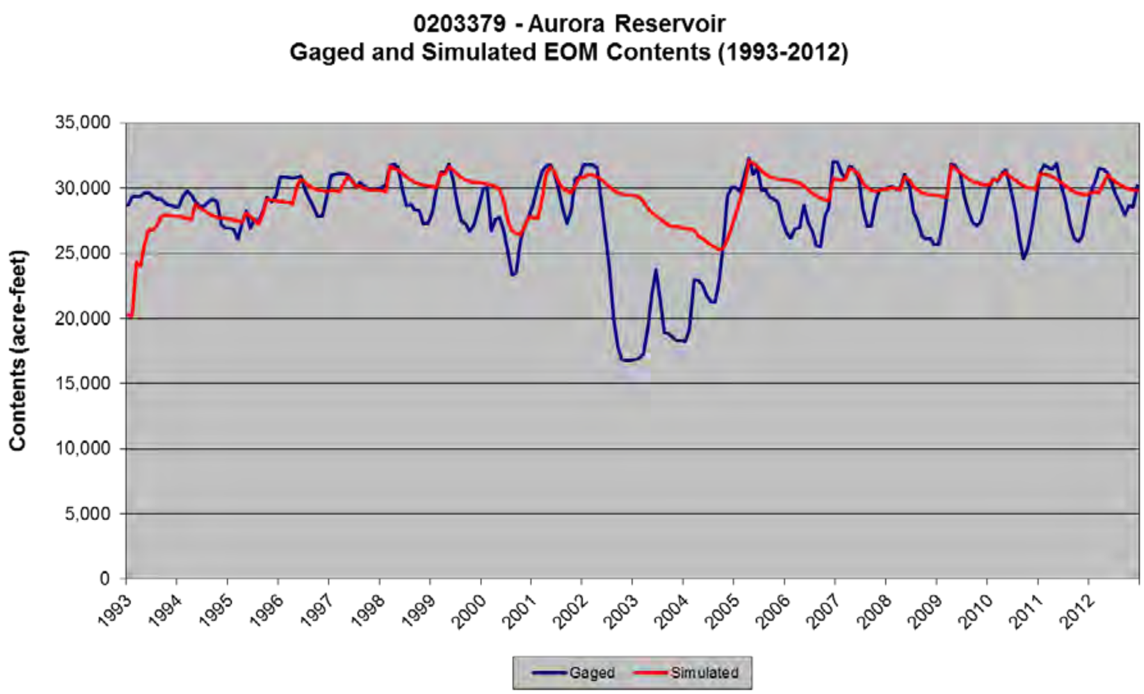


Figure 6-25: Aurora Reservoir

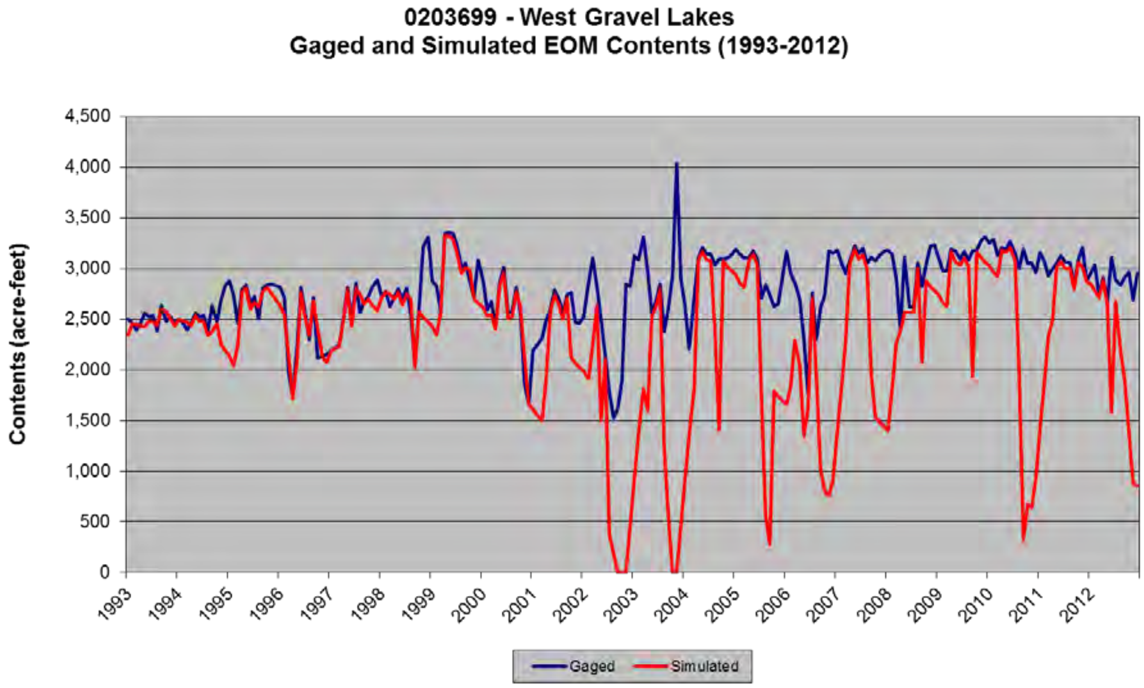


Figure 6-26: West Gravel Lakes

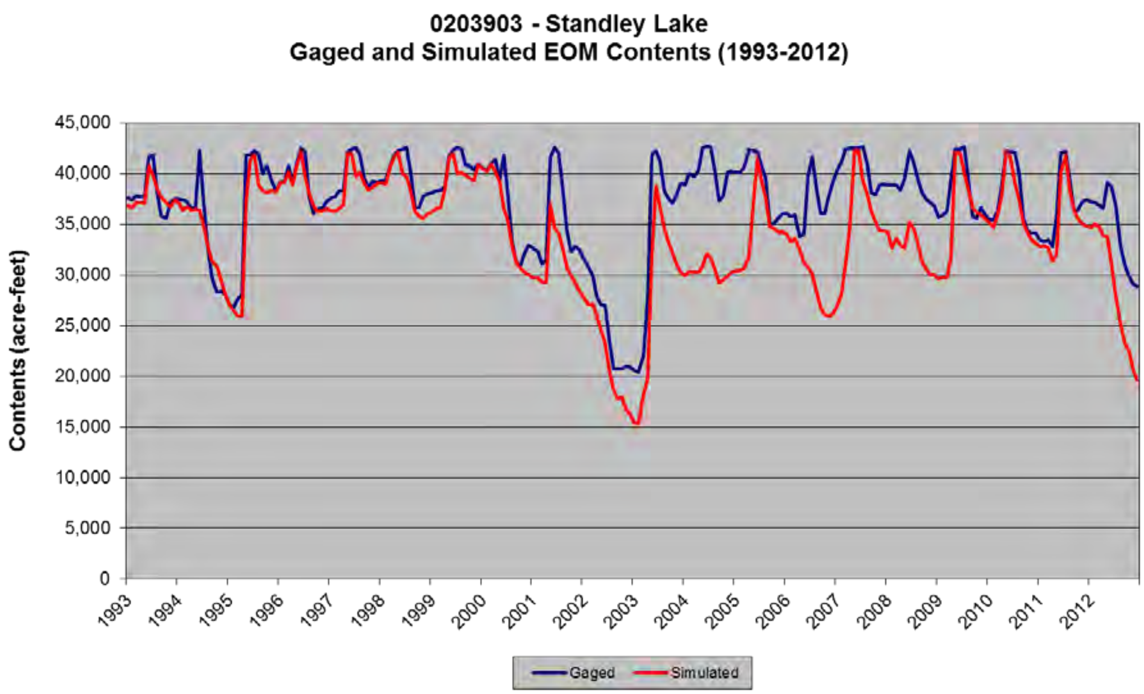


Figure 6-27: Standley Lake

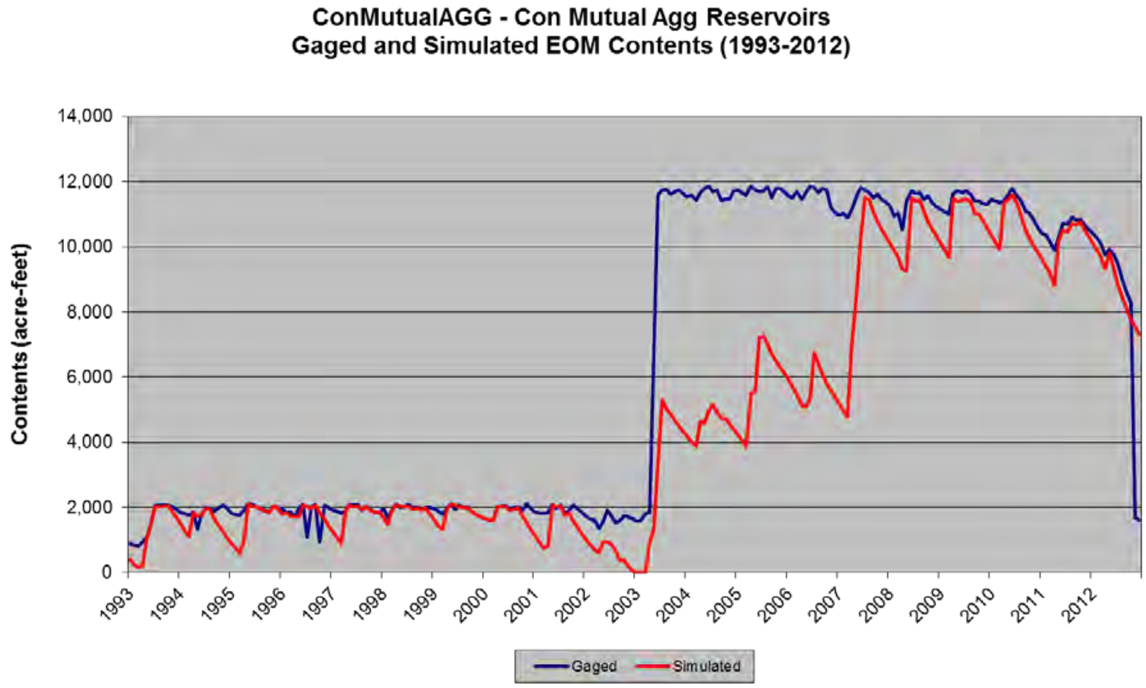


Figure 6-28: Con Mutual Agg Reservoirs

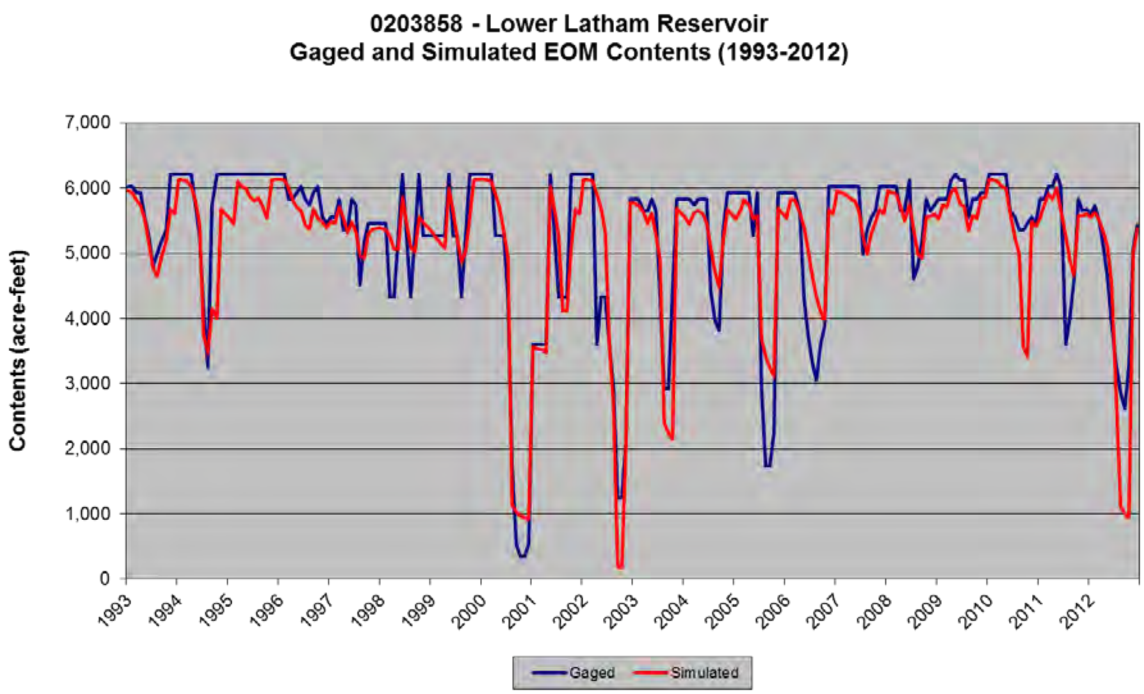


Figure 6-29: Lower Latham Reservoir

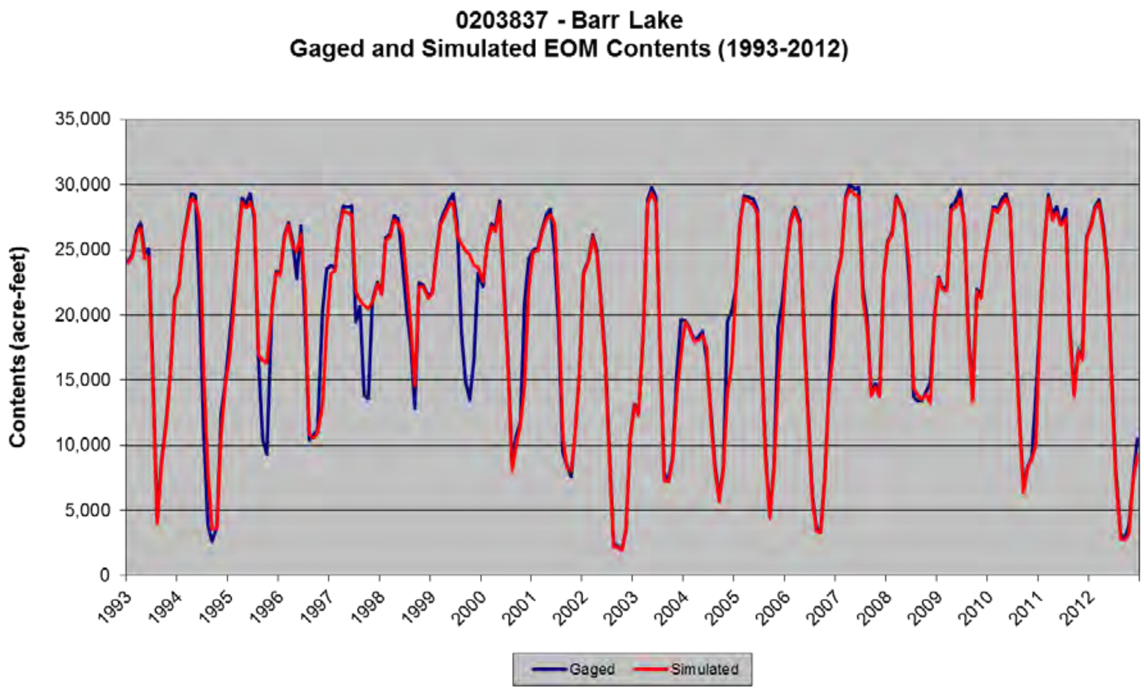


Figure 6-30: Barr Lake

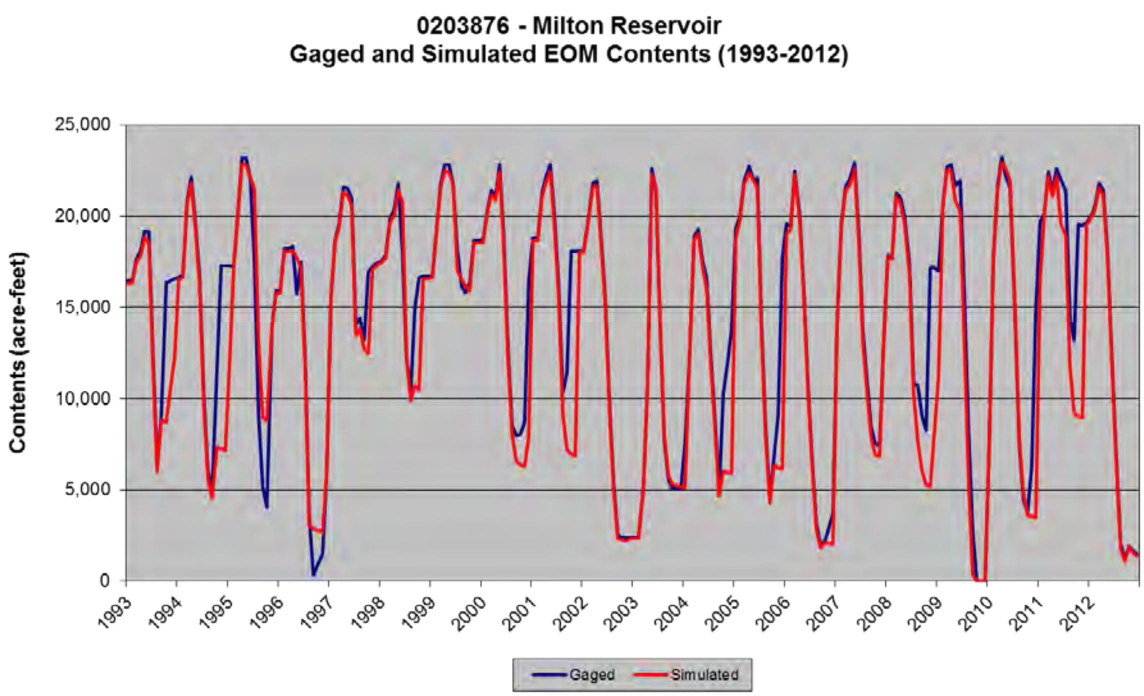


Figure 6-31: Milton Reservoir

6.2.2.1 Big Dry Creek Baseflows and Simulated Streamflows

The native flow to Big Dry Creek is comprised mostly of Standley Lake releases to FRICO irrigators (e.g., Bull Canal system) and irrigation return flows and ditch losses from diversions from Clear Creek through the Church Ditch, Farmers' Highline Canal, and Croke Canal. Baseflow and calibration issues occurred because of the magnitude of the Standley Lake and Clear Creek diversion operations compared to the native flow of Big Dry Creek.

Baseflow calculations on Big Dry Creek are complicated primarily due to missing streamflow gage data, inconsistencies between Standley Lake storage contents, colors of water and locations of diversions records for the above three ditches, and the standard approach of using a fixed ditch loss value year-round for each structure. Nonetheless, the number of months with calculated negative baseflows is not significant during the periods since the early-1990s, when both the Big Dry Creek at Mouth and Big Dry Creek at Westminster gages have been active.

The primary calibration effort used to improve development of baseflows and simulation of streamflows was a detailed review of and disaggregation of water diversion class data and comparing storage diversions to Standley Lake historical storage contents subject to different ditch loss values. Additionally, several filling techniques were investigated to improve the filled streamflow gage data. Input data were revised, as necessary, using improved data and information provided by both FRICO and the City of Westminster.

6.2.2.2 Denver Water Board

Denver Water's approach to meeting its demands incorporates complex decision processes based on current and projected supplies from multiple river basins. It is further complicated by a large interconnected infrastructure capable of moving water throughout its Northern system and Southern system demands and facilities (see Task 5 Denver Water Memorandum for further information). In addition, after its direct demands are satisfied, Denver Water conveys water between different storage units for upcoming needs.

Representation of the Denver Water system was simplified in the demand-based StateMod modeling environment. In addition, StateMod has limitations regarding "coloring" effluent as reusable when a demand is input with multiple return flow locations. Therefore, a decision was made to assign single WWTP locations for each of the users (Denver and Aurora at Metro WWTP; Westminster at its Big Dry Creek WWTP). The same approach was used for calculating baseflows so the net impact of this decision on simulation was minimized.

The general approach to meeting Denver Water's demands in the SPDSS model consists of using transbasin supplies first followed by changed water rights, reusable effluent, and storage releases. Transbasin supplies from the western slope are fixed inputs and the modeled order of water supplies to meet demands is consistent every year, regardless of the type of hydrologic conditions (i.e., wet, dry, or average). Operationally, Denver Water uses different reservoirs depending on certain conditions; for example, the South Park reservoirs (Eleven Mile and Antero) are primarily used during drought conditions.

Denver Water's total demand of approximately 220,000 acre-feet per year is satisfied with the supplies delivered through the Moffat system (Moffat Tunnel, Gross Reservoir, and Ralston Reservoir) then the Foothills system (Conduit 26) and then the Marston system (Conduit 20, Conduit 15, and Marston Reservoir). Sufficient supplies are typically available during simulation to meet Denver Water's demands.

Antero Reservoir and Eleven Mile Reservoir were not being drawn down during model simulation during drought years. This was due, in part, to the high baseflows at the Englewood gage allowing direct flow rights to be in priority more than occurred historically. Keeping the reservoir full resulted in oversimulation of streamflows at the top of system and undersimulation of streamflows during historical fills. The effects on streamflow at the top of the basin were carried to below the Denver metropolitan area. Operating rules for reservoir release to target to meet historical contents were added to improve simulation of upper basin reservoirs and streamflows during drought periods.

The historical demands at the Moffat treatment plant are satisfied during model simulation but the specific supplies used to meet the demand do not match the historical operations. A further discussion on the calibration efforts on Moffat Tunnel, Gross Reservoir, and South Boulder Diversion Conduit is discussed in Section 6.1.2.1.

Based on Denver Water operations, the Marston Reservoir system was input as the third supply, after Moffat and Foothills, to meet Denver Water demands. This resulted in poor calibration of Marston Reservoir.

Modelers met with Denver Water to present initial calibration results and obtain additional data. Information from this meeting was incorporated into the model, and natural flows and calibration were greatly improved. Additional refinement of operations would improve the calibration of the system, as well as the inclusion of additional contract deliveries. Further research into the StateMod algorithm and possible solutions to addressing simulation of WWTP returns to multiple locations may also be appropriate.

6.2.2.3 City of Aurora

As discussed in Section 5.10.8.2, the City of Aurora diverts its surface water diversions through the Aurora Intake, located at Strontia Springs Reservoir. Aurora demands are supplemented by well pumping from Cherry Creek at locations near Cherry Creek Reservoir. Sufficient surface water supplies are typically available during simulation to meet Aurora's demands. Therefore, use of the ground water supplies from these wells was under-simulated.

Transbasin supplies are simulated with the most senior priority to meet municipal demands in order to represent full use of water that was brought over from other basins. Until the South Platte, Arkansas, and Colorado DSS models are integrated, the transbasin imports from the

Arkansas River Basin and Colorado River Basin are fixed based on historical deliveries. The general approach to Aurora's operations was to use changed water rights in relative order of priority of the original water rights. This initially led to a model representation that would under-simulate storage releases, because they are typically set as the most junior priorities. Additional calibration was performed to adjust some of these priorities which resulted in better calibration at Spinney Mountain Reservoir and Aurora Reservoir. It is recommended that during future modeling efforts, additional review of model input and output be discussed with Aurora to fine tune the operations used to meet its demands.

6.2.2.4 FRICO-Barr-Henrylyn System

The original approach to representing the Burlington Ditch / O'Brian Canal system relied on diversion data and storage data in HydroBase, supplemented with information compiled as part of the engineering reports developed to support the Burlington Ditch change Case No. 87CW107. Ditch loss values through the various ditches within the FRICO-Barr-Henrylyn system included in the reports were also used.

Simulation of the entire system is considered very good. The primary effort in calibrating the system operations involved reviewing and revising much of the historical diversion data and ditch loss values. The major source of those changes was the data used in Case No. 02CW403 and analysis by FRICO's water resources engineer, Ecological Resource Consultants.

6.2.2.5 Lower Latham System

The Union Ditch delivers water to irrigation and to Lower Latham Reservoir. In addition, the Union Irrigators are supplied by the Union Feeder Ditch and Lower Latham Reservoir is fed by the Morrison Seep. The Union Feeder Ditch and Morrison Seep structures are not explicitly represented in the Upper South Platte Model network but their inflows to the Lower Latham system are represented via return flows from the Barr and Milton systems.

Specific calibration issues were related to data inconsistencies between diversions to storage and change in storage. These issues were mitigated by changing input data to minimize the data inconsistencies for structures on the off-channel Latham tributary. Diversion class records for the Union Feeder Ditch were subtracted from the Union Ditch headgate diversions. The Union Ditch diversions to irrigation and storage and storage diversion data at Lower Latham Reservoir are not consistent. Since diversions to storage in HydroBase were often estimated, calculated diversions to storage based on EOM contents and evaporation were used to assume mass balance on the system.

6.2.3 Water District 4 (Big Thompson River) Calibration

The C-BT transmountain imports and operations, the City of Loveland's municipal operations, and irrigation uses are the primary operations in the Big Thompson Basin. In general, the irrigation operations reflect good calibration with very few shortages. Reservoirs used for irrigation are generally well calibrated. Similarly, the Loveland municipal operations are fairly well calibrated; however Green Ridge Glade Reservoir is staying fuller than historically. The streamflow calibration of the Big Thompson River is considered poor. The Little Thompson River does not have a good quality streamgage against which to evaluate the calibration. Remaining baseflow and calibration issues are due to the magnitude of the C-BT operations compared to the native flow of the Big Thompson and Little Thompson rivers. Specific calibration issues and recommendations are discussed in more detail below for many of the basin operations.

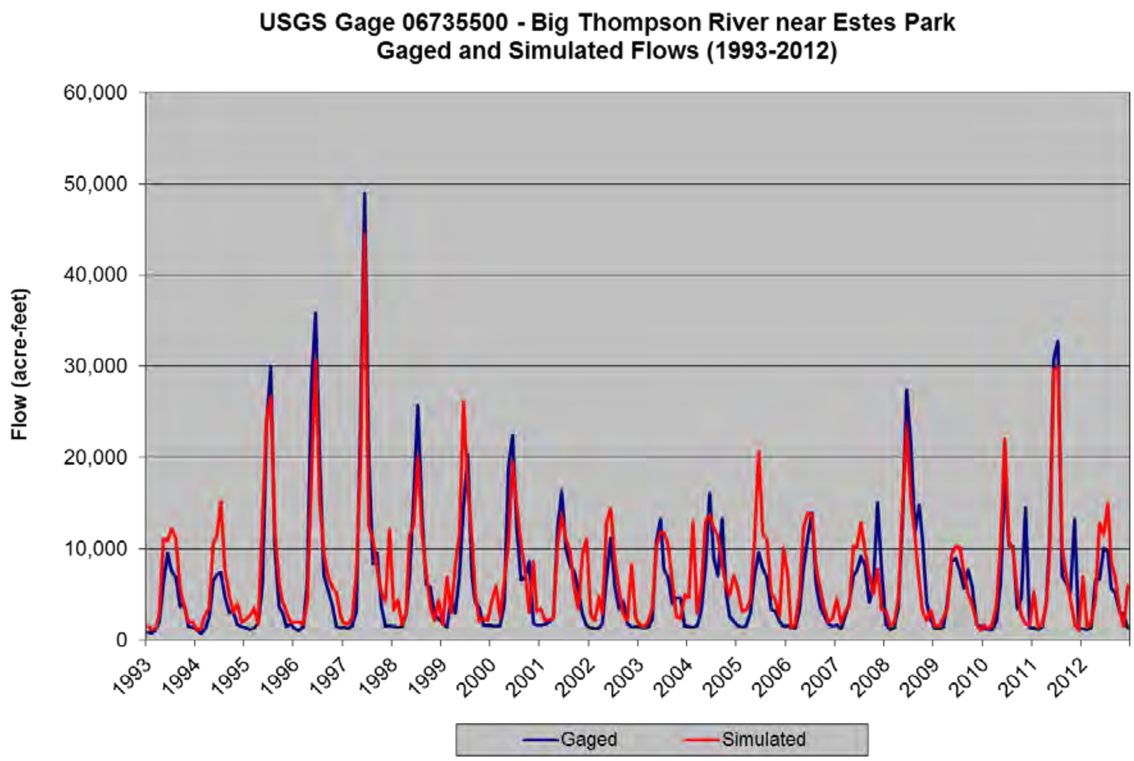
The following table presents the number of each structure type in the sub-basin:

	Diversions	Reservoirs	Well Only	Plans
Big Thompson	60	12	4	23

The following tables present the average annual surface and ground water demand (af), the percent of demand that was met, and the associated M&I and irrigation consumptive use over the 1993 to 2012 period. See Table 7-6 for more information on the demand and consumptive use for specific structures.

	SW Demand (AF)	GW Demand (AF)	Total Demand (AF)	Percent Demand Met
Big Thompson	227,000	2,000	229,000	95%

	Irrigation Consumptive Use (AF)	M&I Consumptive Use (AF)	Total Consumptive Use (AF)
Big Thompson	70,000	8,000	78,000



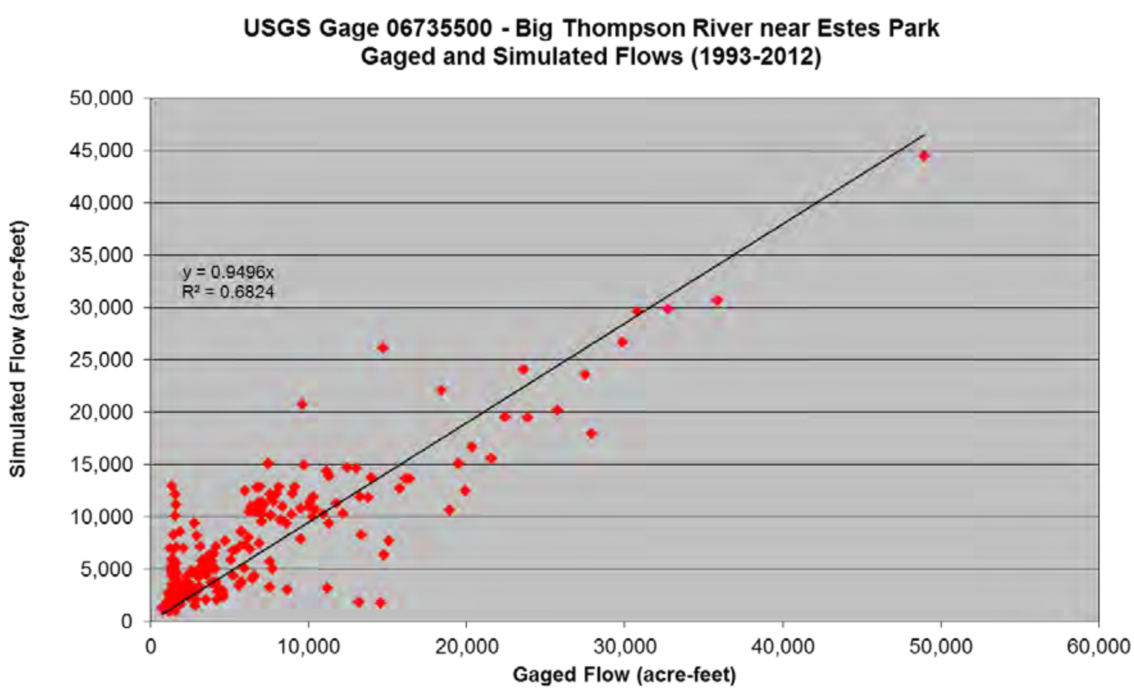
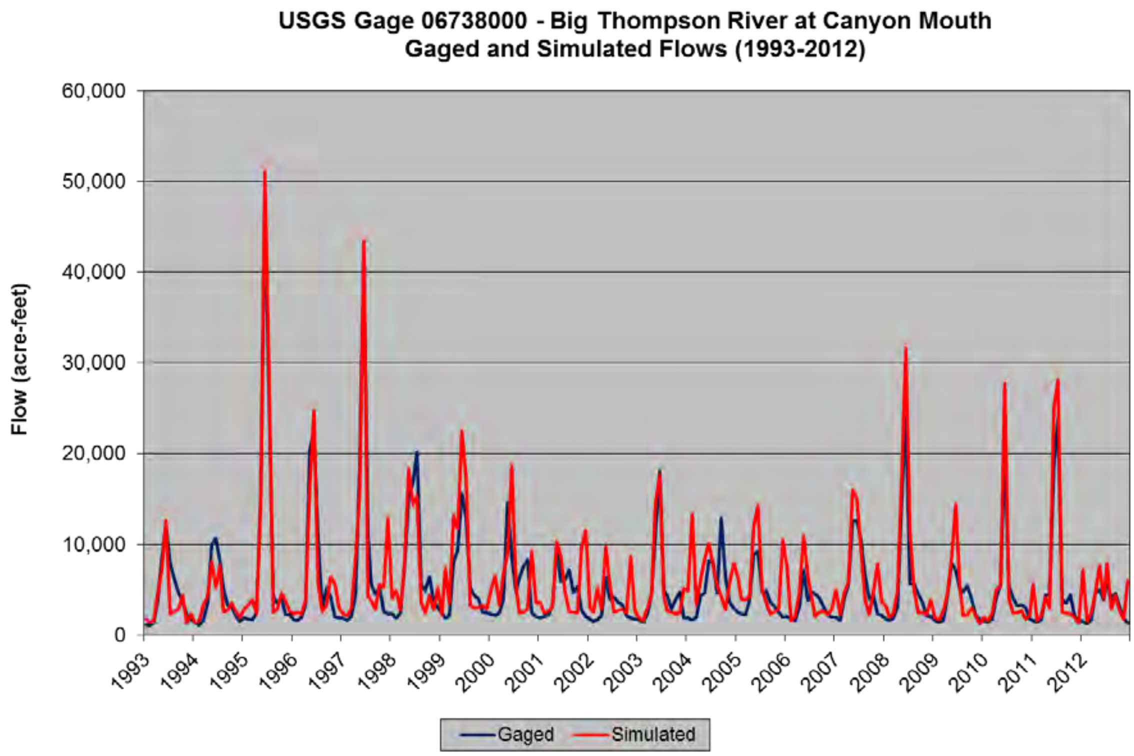


Figure 6-32: Big Thompson River near Estes Park Streamflow



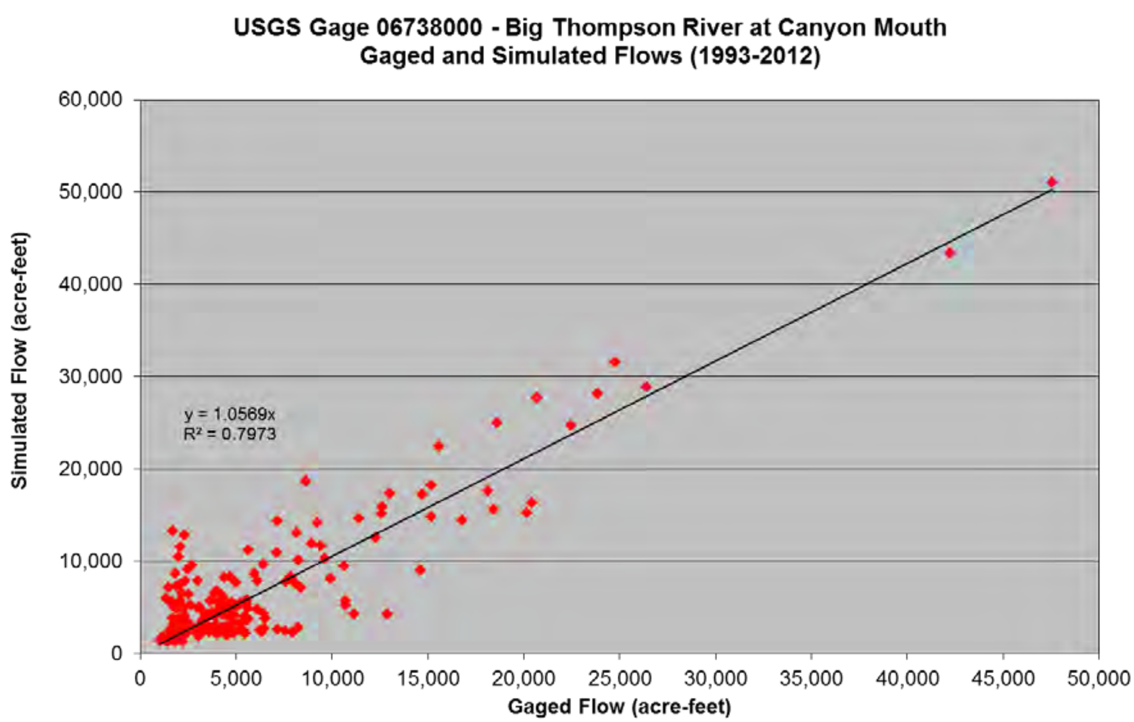
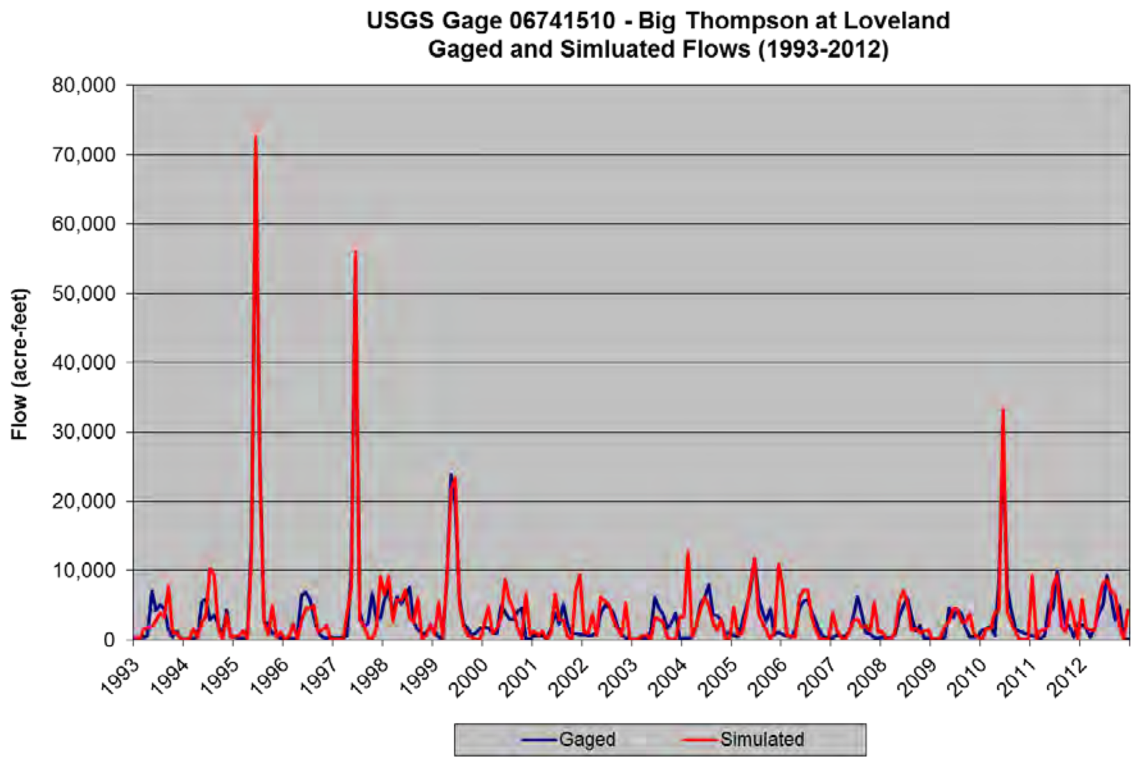


Figure 6-33: Big Thompson River at Canyon Mouth Streamflow



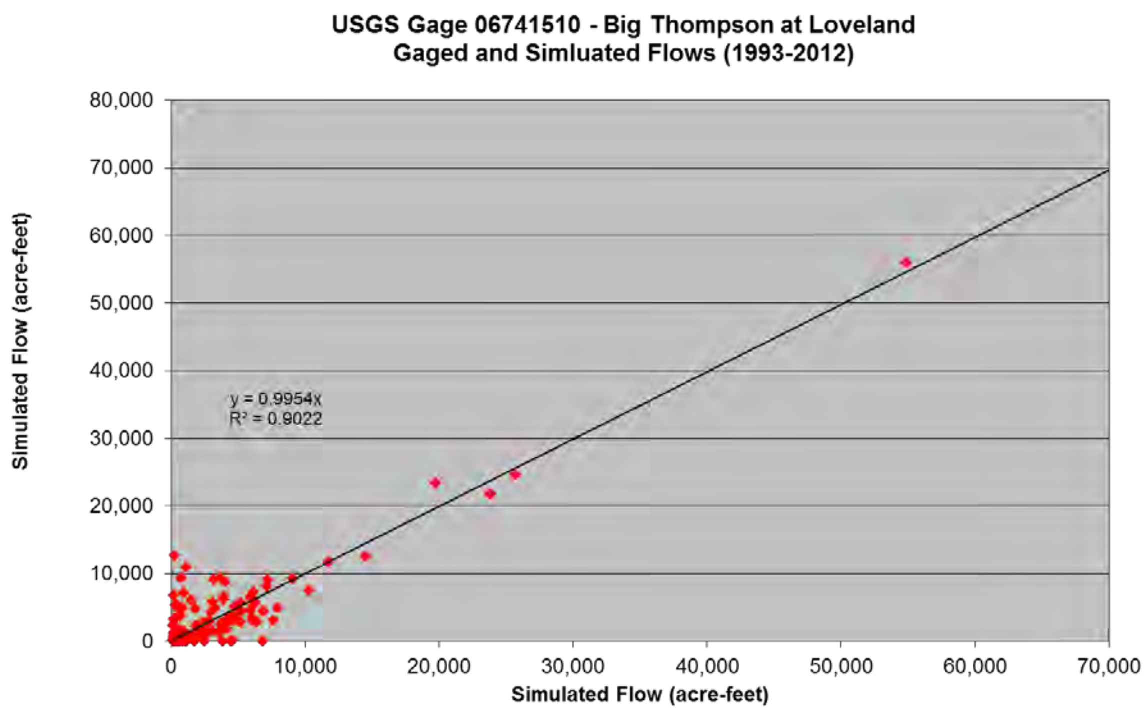
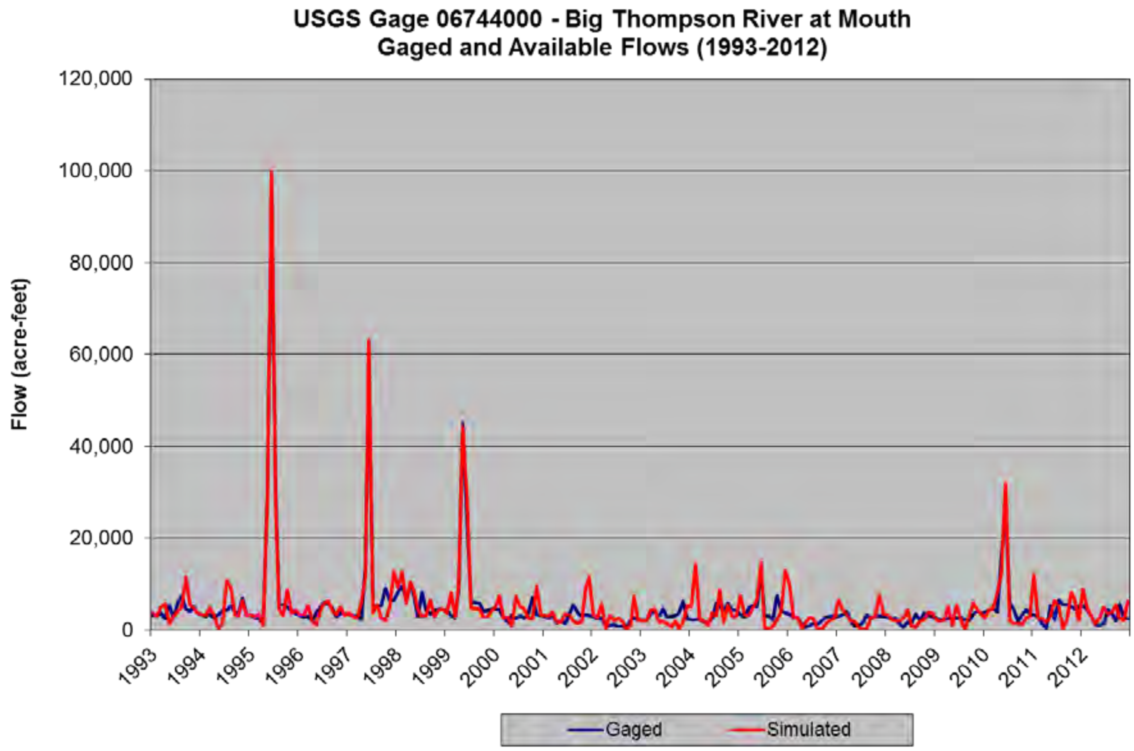


Figure 6-34: Big Thompson River at Loveland



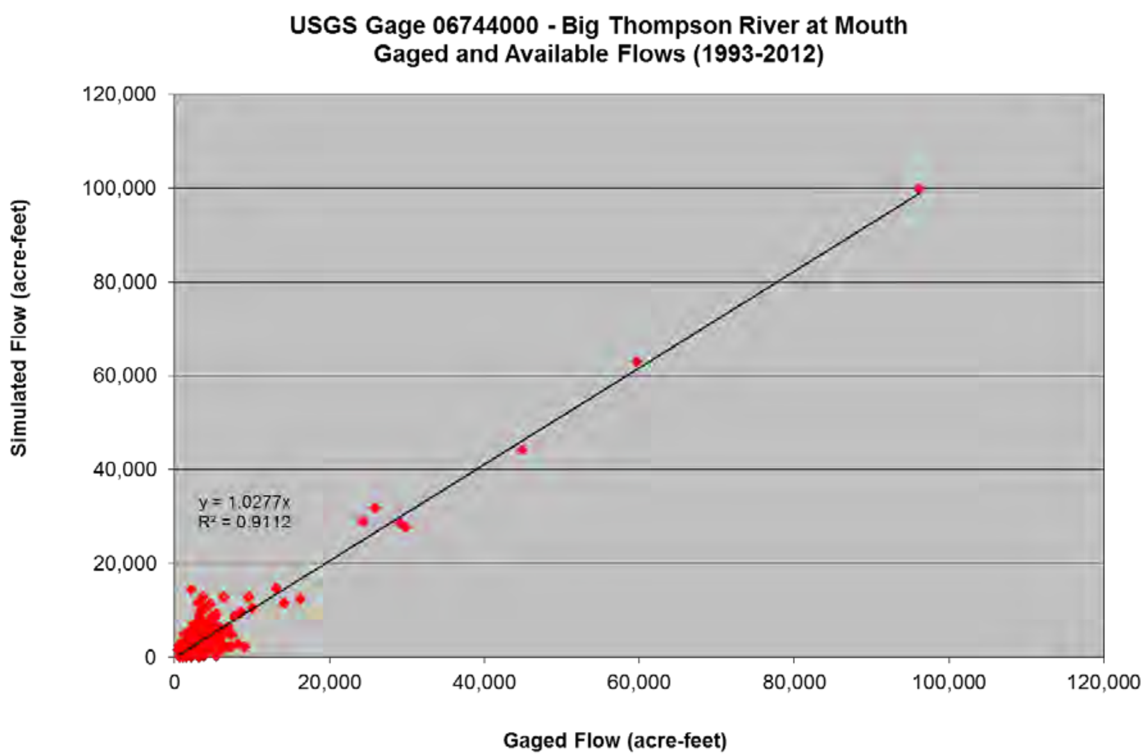


Figure 6-35: Big Thompson River at Mouth

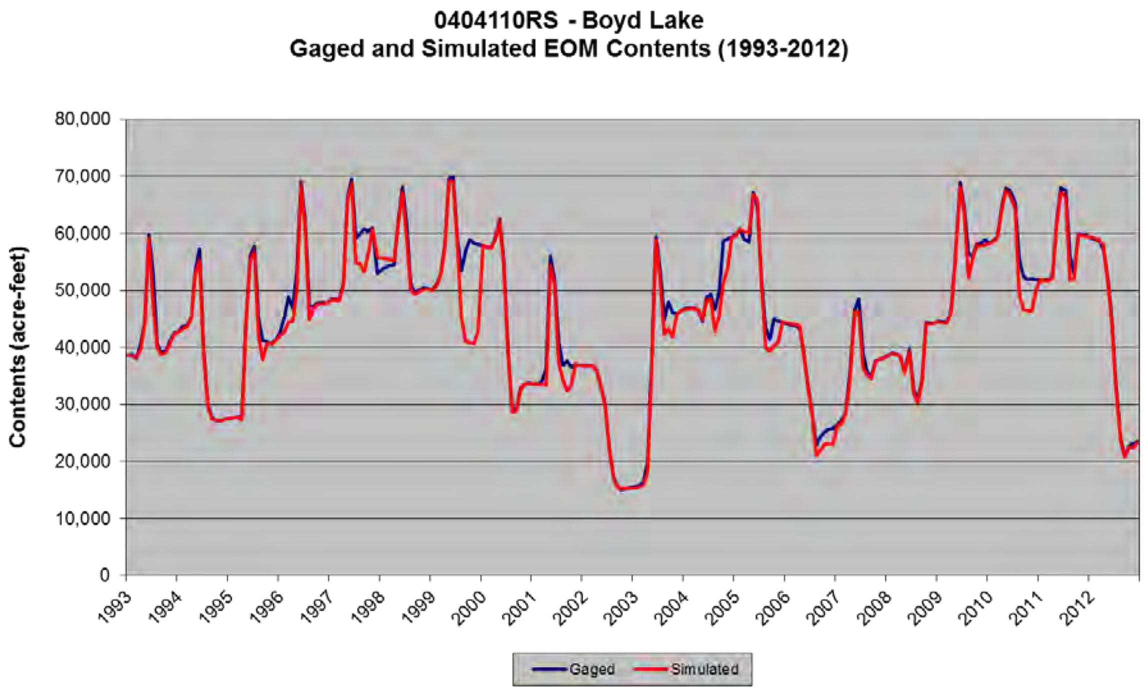


Figure 6-36: Boyd Lake

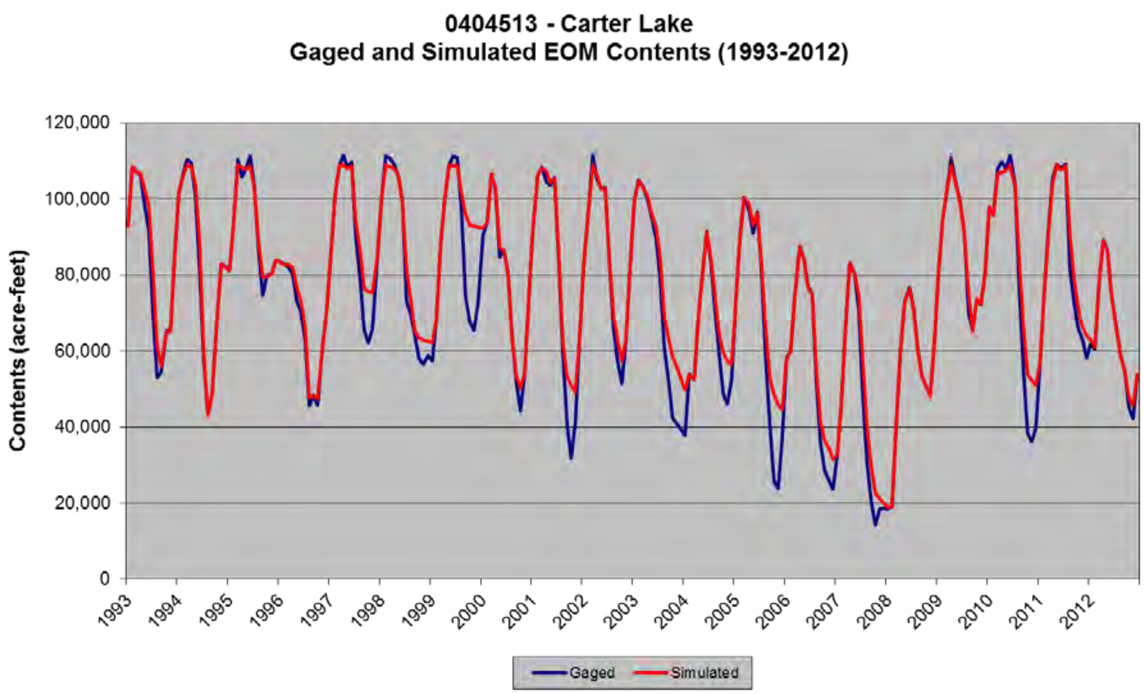


Figure 6-37: Carter Lake

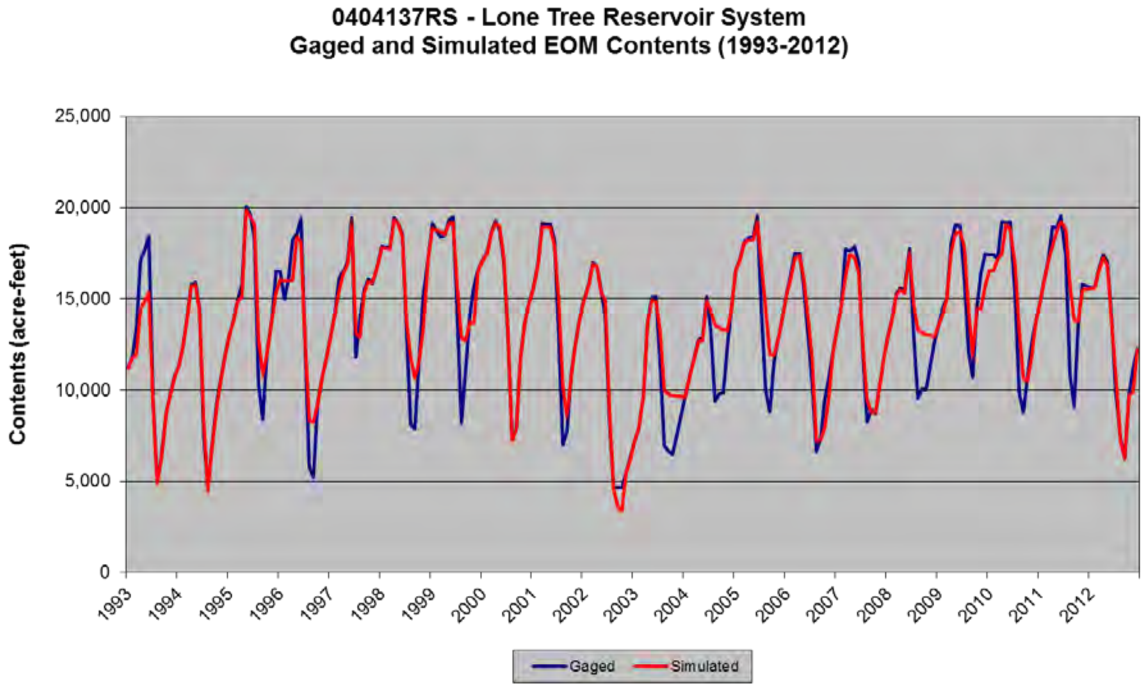


Figure 6-38: Lone Tree Reservoir System

6.2.3.1 Big Thompson River from Adams Tunnel to Big Thompson Canyon Mouth

For Water District 4, C-BT allottees are allowed to dynamically request water from the Adams Tunnel import. Historical exports to Water District 3 via the Hansen Feeder Canal and exports to Water District 4 via the St. Vrain Supply Canal are based on historical distributions, as provided by Northern Water. Additionally, the historical flow through the Big Thompson Power Plant (which returns to the Big Thompson River) and the water returned to the Big Thompson River via the Hansen Feeder Waste Way are also modeled. Transmountain and native (skim) water is carried through Olympus Tunnel. Olympus Tunnel serves as a carrier only. It does not have its own demand. The simulated volume of water passing through Olympus Tunnel compared to historical records shows a very good calibration, as shown in Figure 6-40 below. However, when the model does not perfectly replicate Olympus Tunnel historical diversions, there is a large impact on the calibration of the stream flow gage Big Thompson near Estes Park (06735500), which measures streamflow entering the Big Thompson canyon, downstream of the Olympus Tunnel diversion point (Figure 6-33). The magnitude of the streamflow in the canyon compared to the volume of C-BT water is about equal.

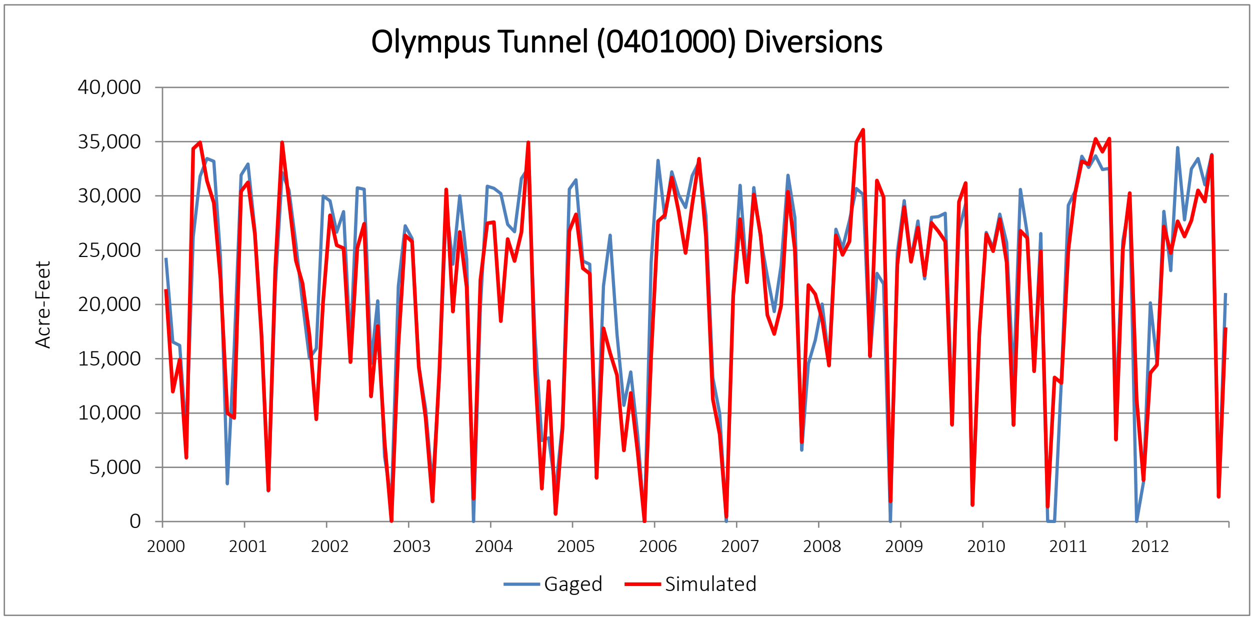


Figure 6-39: Olympus Tunnel Calibration

The next downstream gage (Big Thompson at Canyon Mouth - 06738000) shows a much poorer calibration. This is caused by problems with the Olympus Tunnel simulation and compounded by any problems with the simulation of Dille Tunnel. While the Dille Tunnel calibration itself is considered fair for a carrier, the magnitude of the diversions is again about equal with the streamflow itself, so small differences in simulation have a large impact on streamflow calibration.

Dille Tunnel is part of the C-BT operations and diverts water in the Big Thompson Canyon and deliveries the water either to the Big Thompson Power Plant, the Hansen Feeder Canal, or the Hansen Feeder Canal Waste Way. The calibration is also complicated by the model representation. In the model, diversion demands in Water District 4 call for C-BT water from the Adams Tunnel Plan and it is carried through Olympus Tunnel, but is not used to satisfy the Big Thompson Power Plant or the Hansen Feeder Waste Way demands. This is a modeling simplification and results in the Big Thompson Power Plant and Hansen Feeder Waste Way being shorted. The model meets the Big Thompson Power Plant and the Hansen Feeder Waste Way demands with native Big Thompson water through either Olympus Tunnel or Dille Tunnel and then C-BT water from the Adams Tunnel. Because of this simplification, Adams Tunnel water is frequently allocated when the Power Plant or Waste Way request that water. Therefore, the total amount of imported C-BT water is correctly allocated to end-users, but the path it takes to arrive at its destination does not match the historical operational decisions. The combination of this model representation with the varying operational decisions to produce hydropower in the C-BT system, it is very difficult for the model to correctly match historical operations.

Note that modelers met with Northern staff to present initial calibration results and obtain additional data. Information from this meeting was incorporated into the model, and natural flows and calibration were greatly improved.

6.2.3.2 City of Loveland Municipal Operations

The City of Loveland has a very good calibration. The city is almost never shorted and the Green Ridge Glade Reservoir shows a slight over-simulation in recent years. One simplification to the Loveland system is important to note. No effort was made to distinguish between diversions historically taken at the Loveland Pipeline (0400511) or through the turn-out from the Hansen Feeder Canal in simulation. This simplification was possible because the diversion capacity of the Loveland Pipeline is large enough to accommodate the combined historical diversions at both locations. This may result in an over-simulation of the physical streamflow at the Handy Ditch headgate (0400521).

6.2.3.3 Irrigation and Off-Channel Reservoir Operations

The irrigation diversion structures have a very good calibration in the Big Thompson Basin. There are almost no shortages to irrigation demand and the off-channel reservoirs generally have good calibrations. The off-channel system with the poorest calibration is the Ryan Gulch/Southside Reservoir system (0404171RS). This reservoir system generally releases water by exchange with upstream diversion structures, but this behavior is not captured in the model. The exchanges are sporadic and not well coded in HydroBase. The system may also benefit from good neighbor practices common in the basin that are not captured by StateMod.

6.2.4 Water District 5 (St. Vrain Creek) Calibration

The City of Longmont's municipal operations, transmountain imports, and irrigation uses, particularly the operation of the Left Hand Ditch system, are the primary operations in the St. Vrain Creek Basin. In general, the irrigation operations reflect good calibration with very few shortages, although in some cases, reservoirs used for irrigation are staying fuller than their historical contents reflect. Shortages are experienced on Left Hand Ditch structures, however as discussed below, the historical diversion data for this system was limited and extensive calibration efforts were undertaken to reduce shortages. Similarly, the municipal operations are fairly well calibrated; however their associated reservoirs are also staying fuller than historically. The streamflow calibration of the mainstem St. Vrain Creek Basin is considered very good; baseflow and calibration issues occurred once Boulder Creek was integrated into the system. Specific calibration issues and recommendations are discussed in more detail below for many of the basin operations.

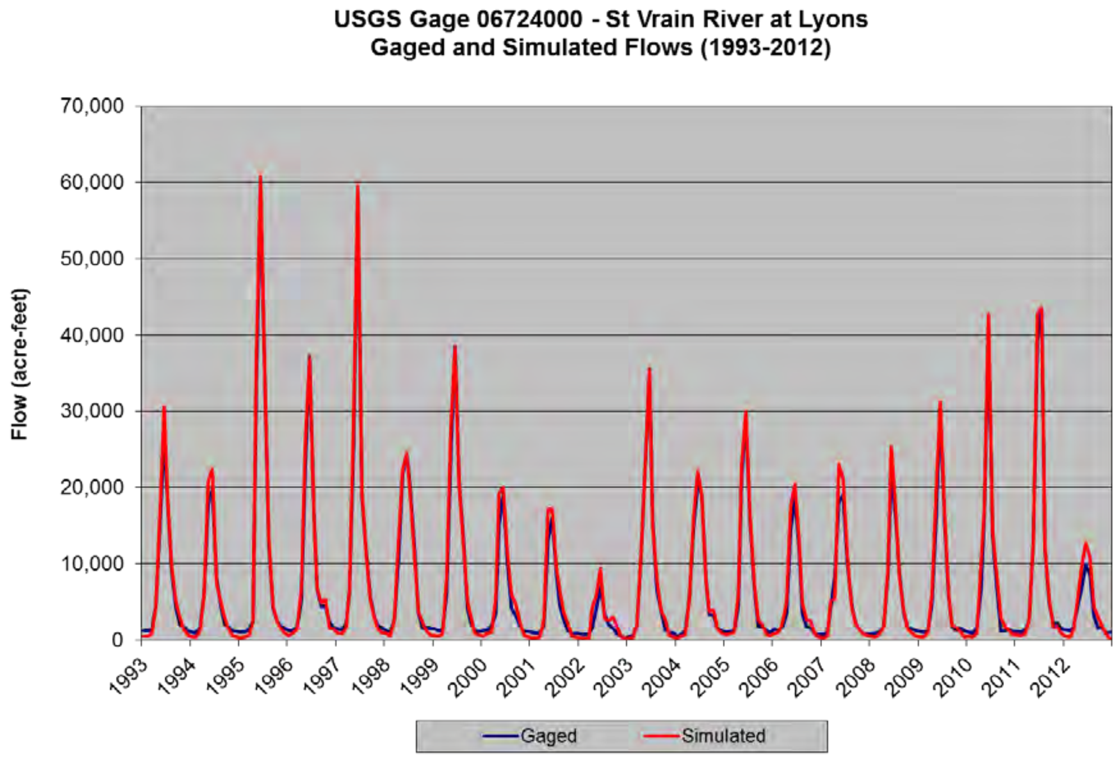
The following table presents the number of each structure type in the sub-basin:

	Diversions	Reservoirs	Well Only	Plans
St. Vrain	70	15	2	46

The following tables present the average annual surface and ground water demand (af), the percent of demand that was met, and the associated M&I and irrigation consumptive use over the 1993 to 2012 period. See Table 7-6 for more information on the demand and consumptive use for specific structures.

	SW Demand (AF)	GW Demand (AF)	Total Demand (AF)	Percent Demand Met
St. Vrain	152,000	470	153,000	98%

	Irrigation Consumptive Use (AF)	M&I Consumptive Use (AF)	Total Consumptive Use (AF)
St. Vrain	51,000	9,000	60,000



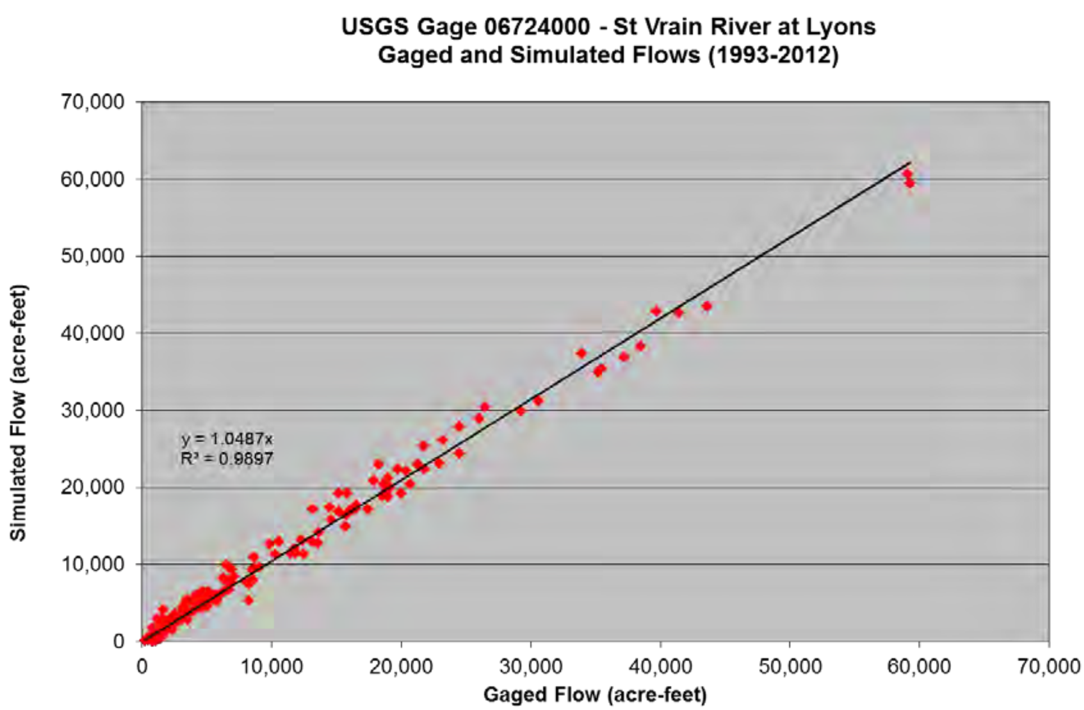
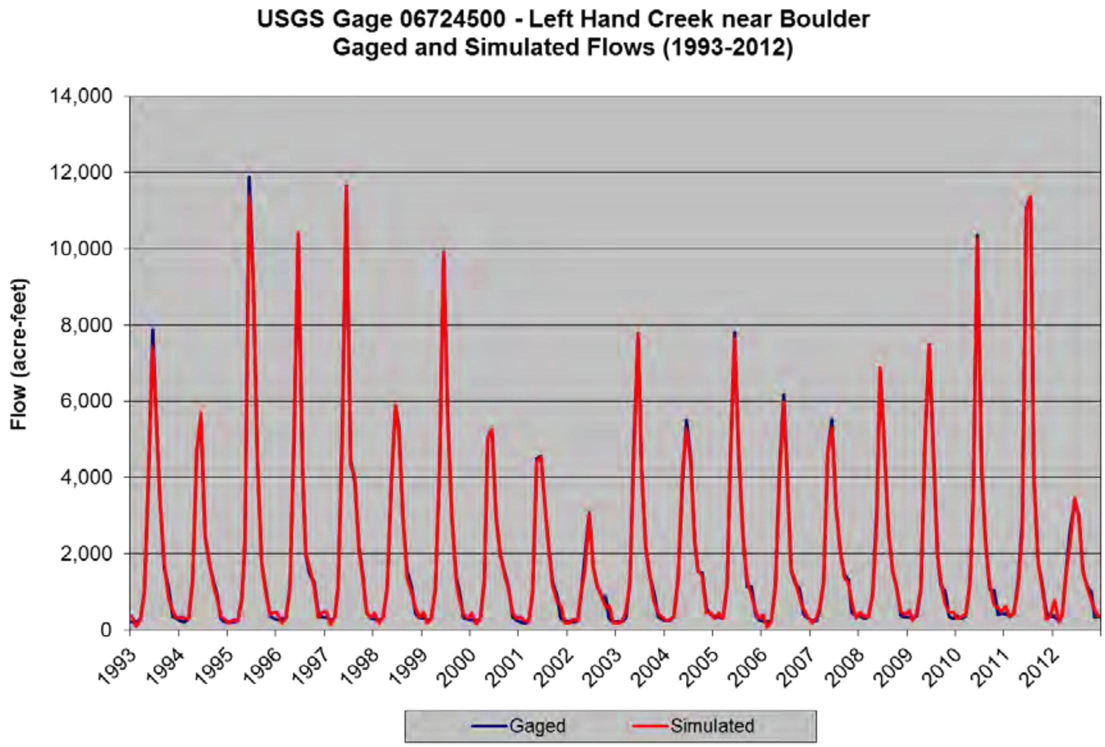


Figure 6-40: St Vrain at Lyons



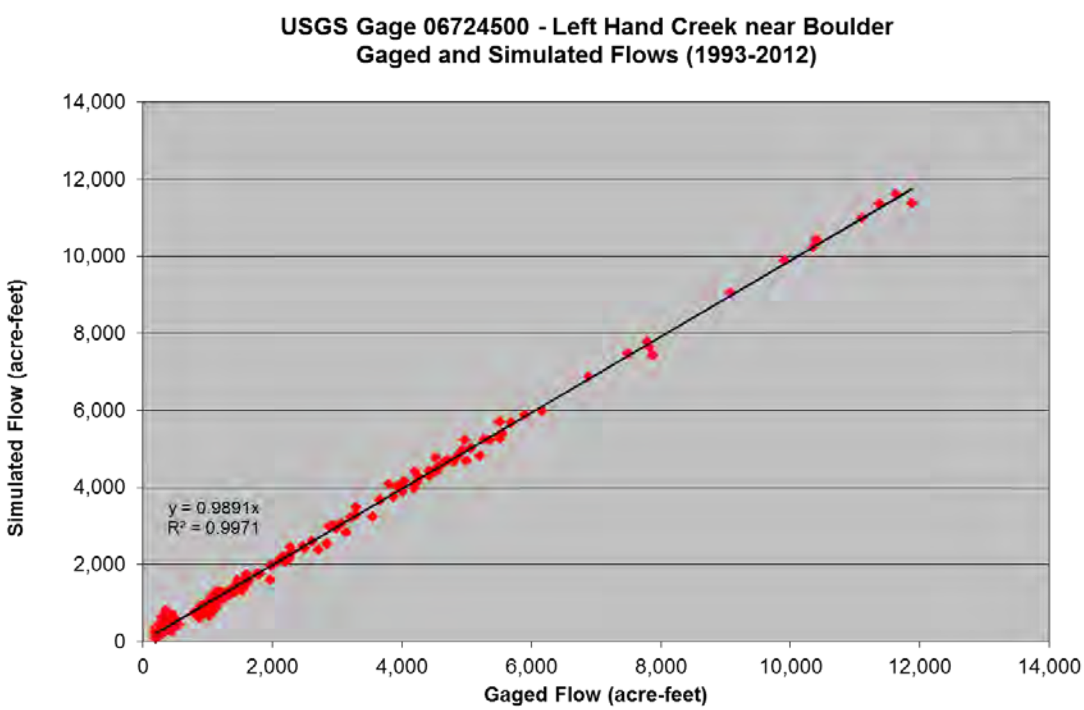
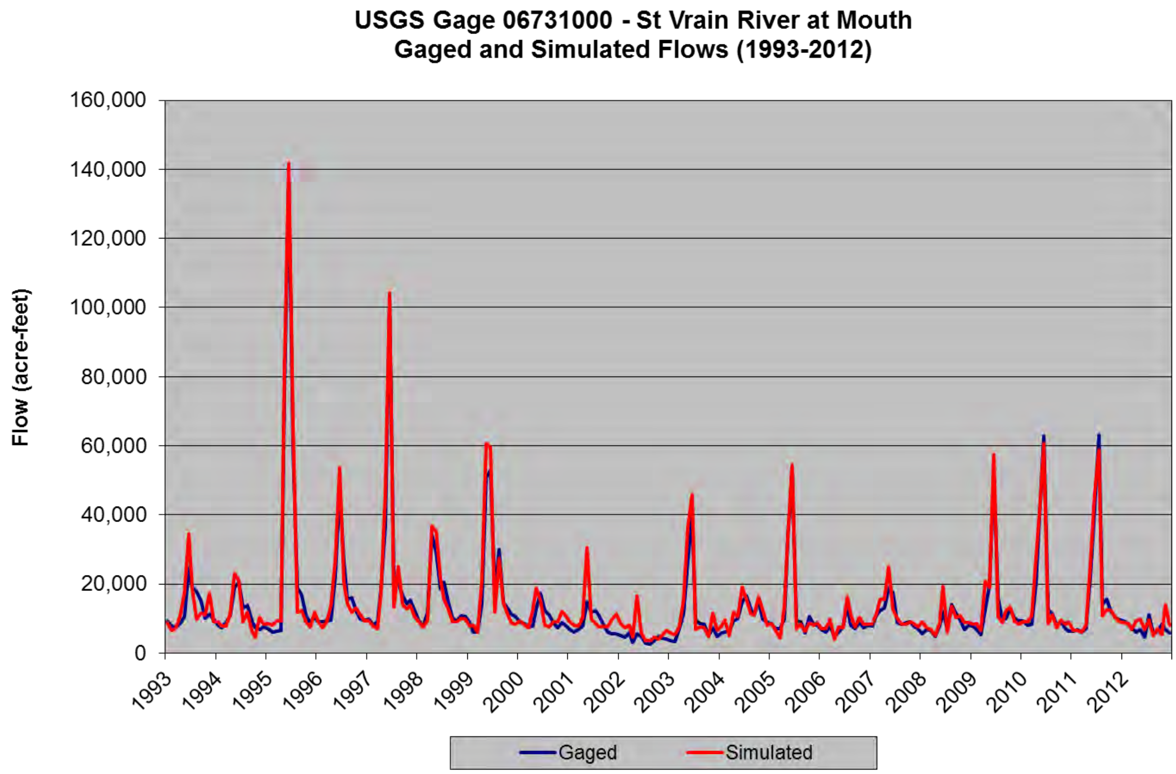


Figure 6-41: Lefthand Creek near Boulder



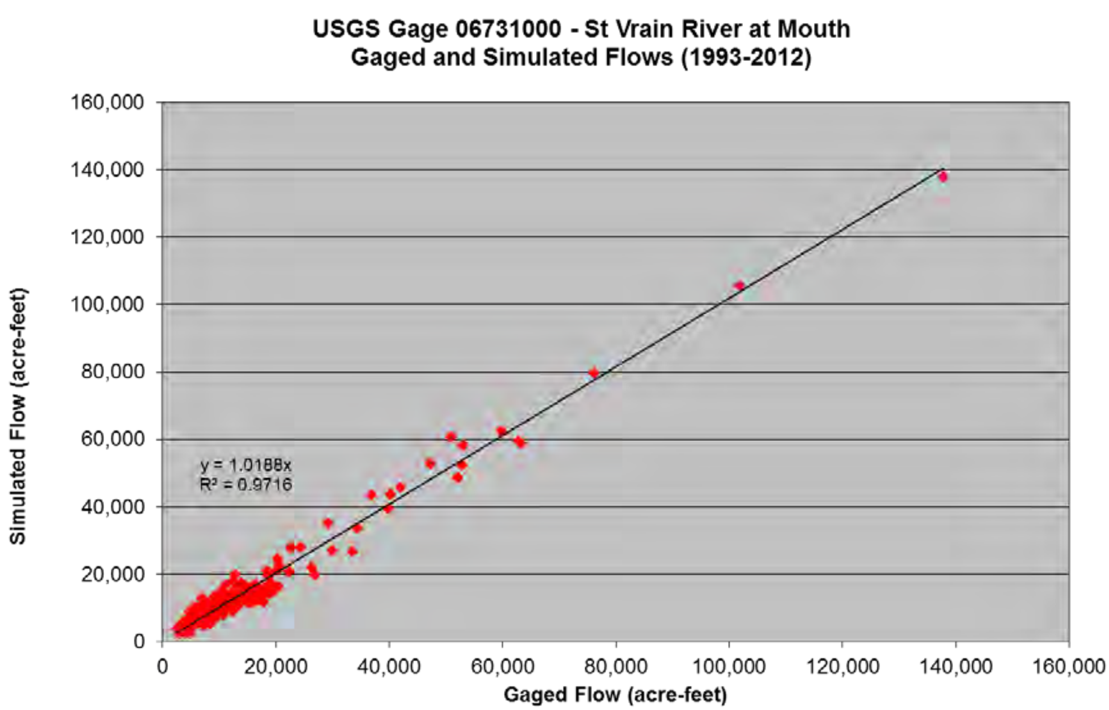


Figure 6-42: St Vrain River at Mouth

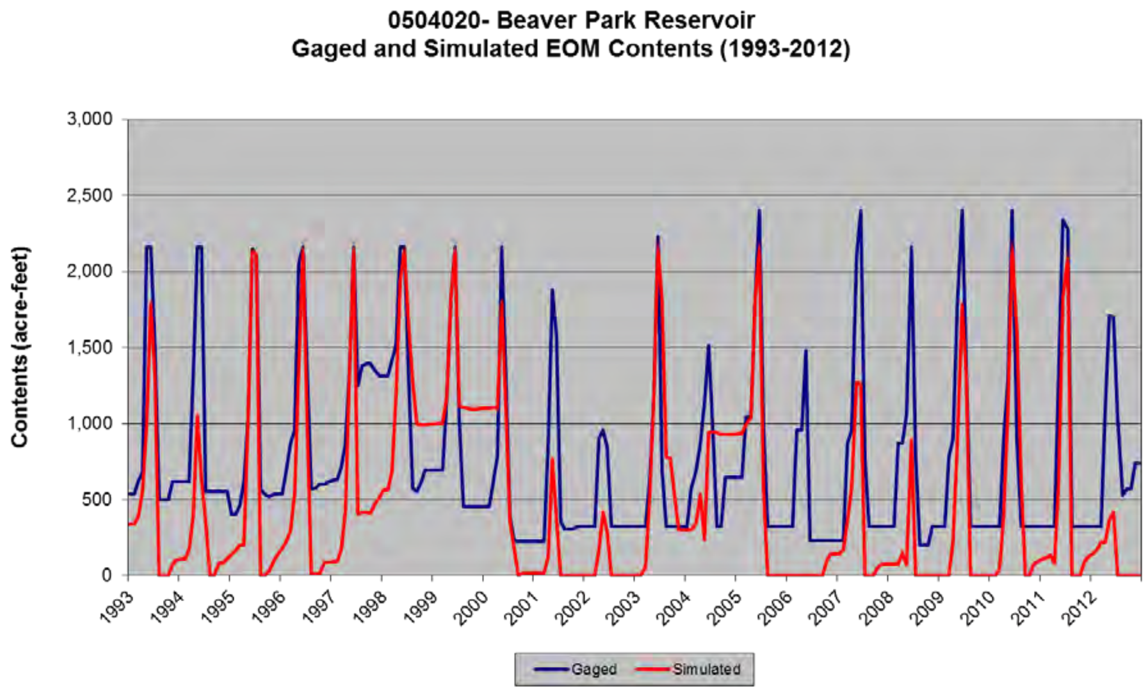


Figure 6-43: Beaver Park Reservoir

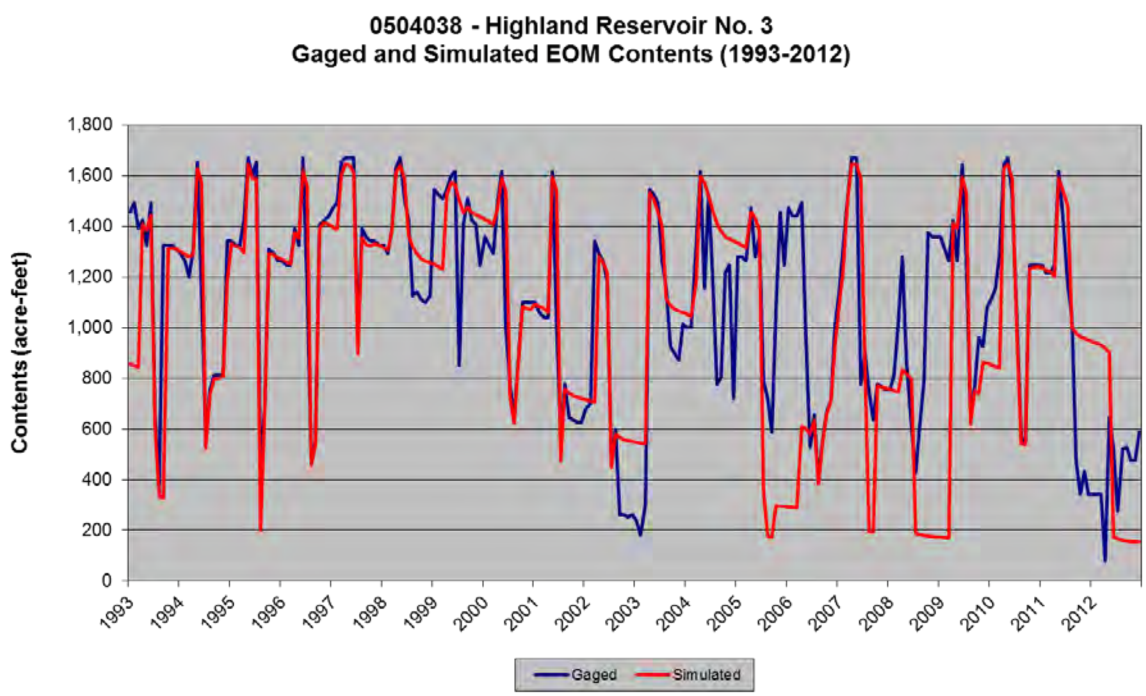


Figure 6-44: Highland Reservoir No. 3

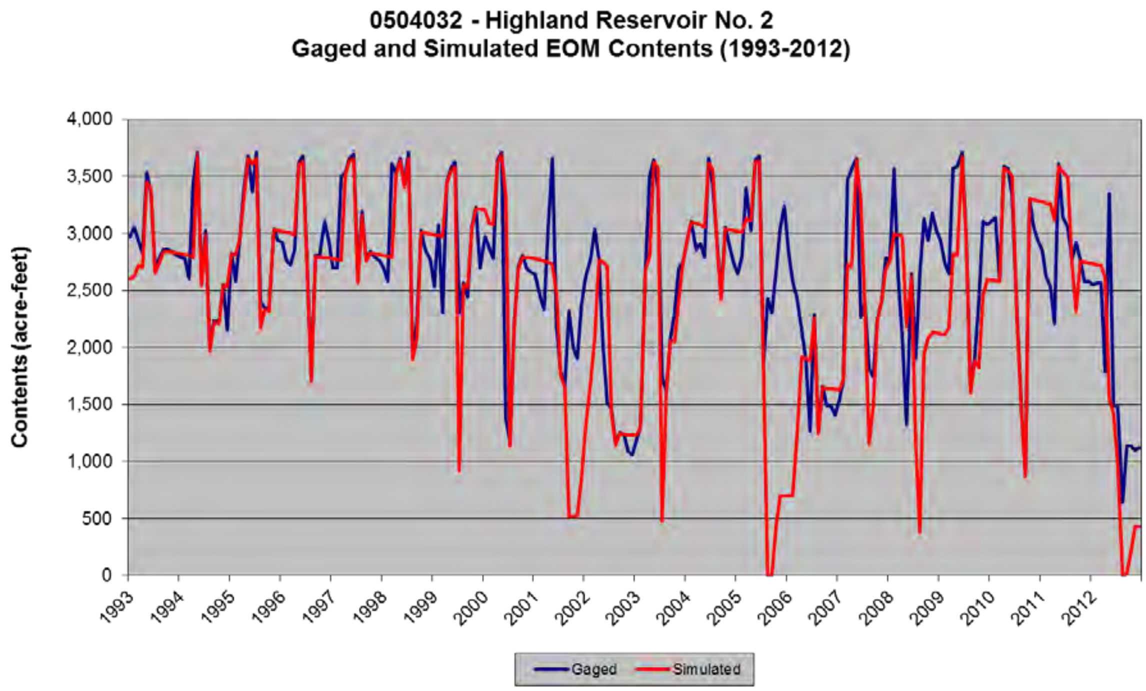


Figure 6-45: Highland Reservoir No. 2

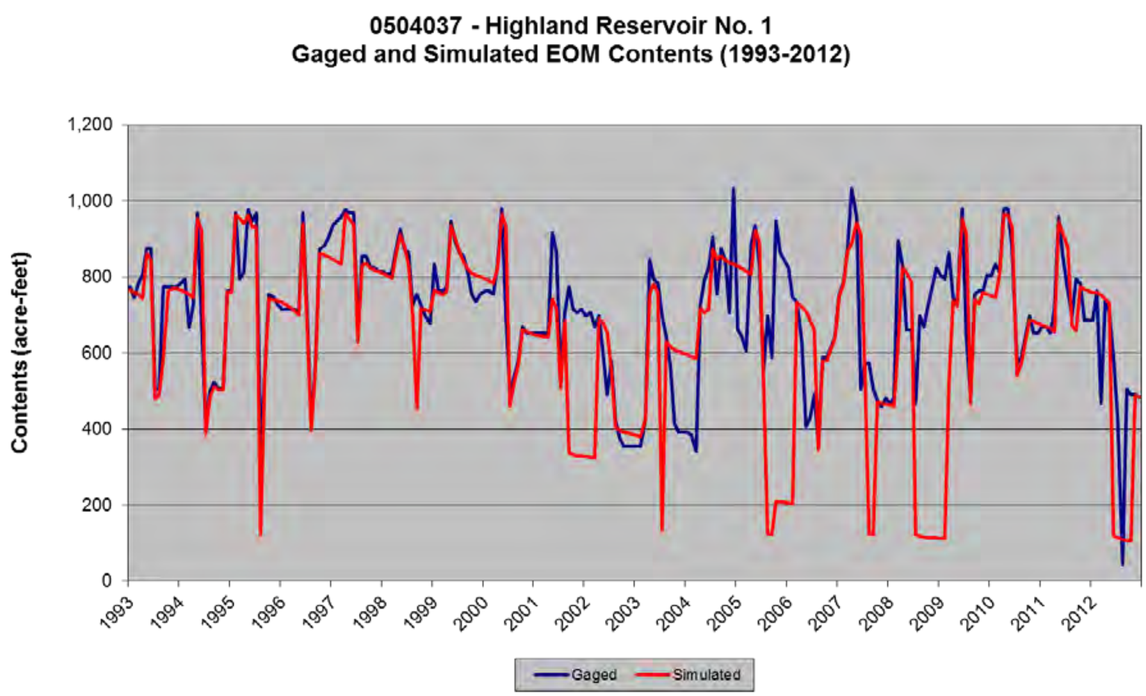


Figure 6-46: Highland Reservoir No. 1

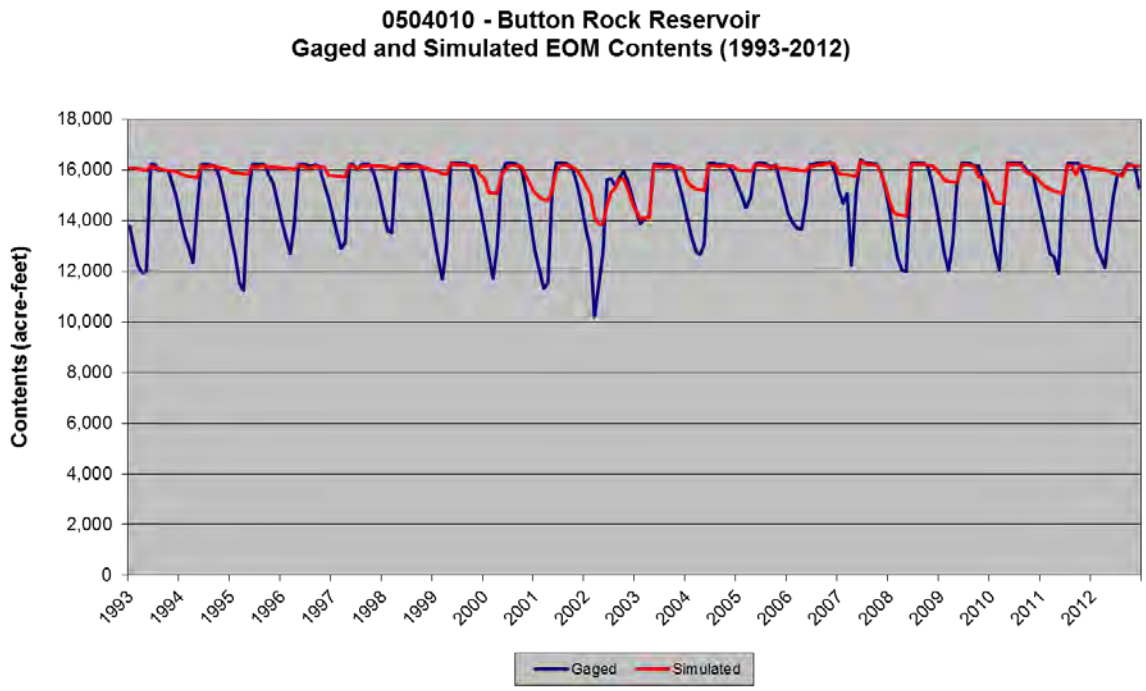


Figure 6-47: Button Rock Reservoir

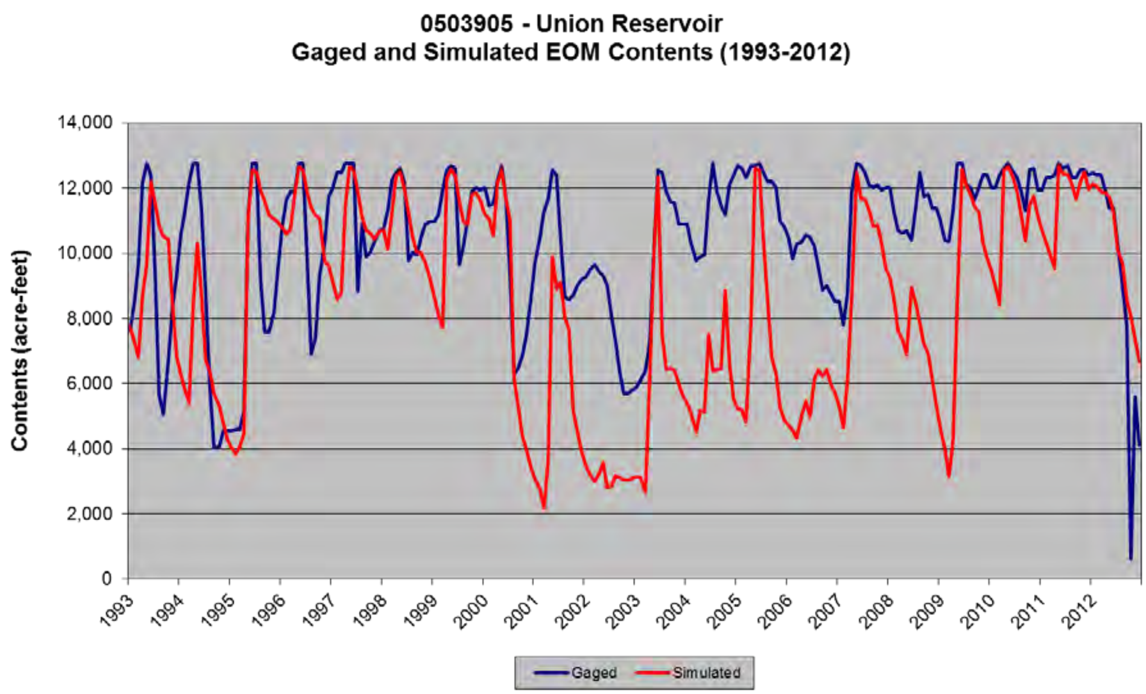


Figure 6-48: Union Reservoir

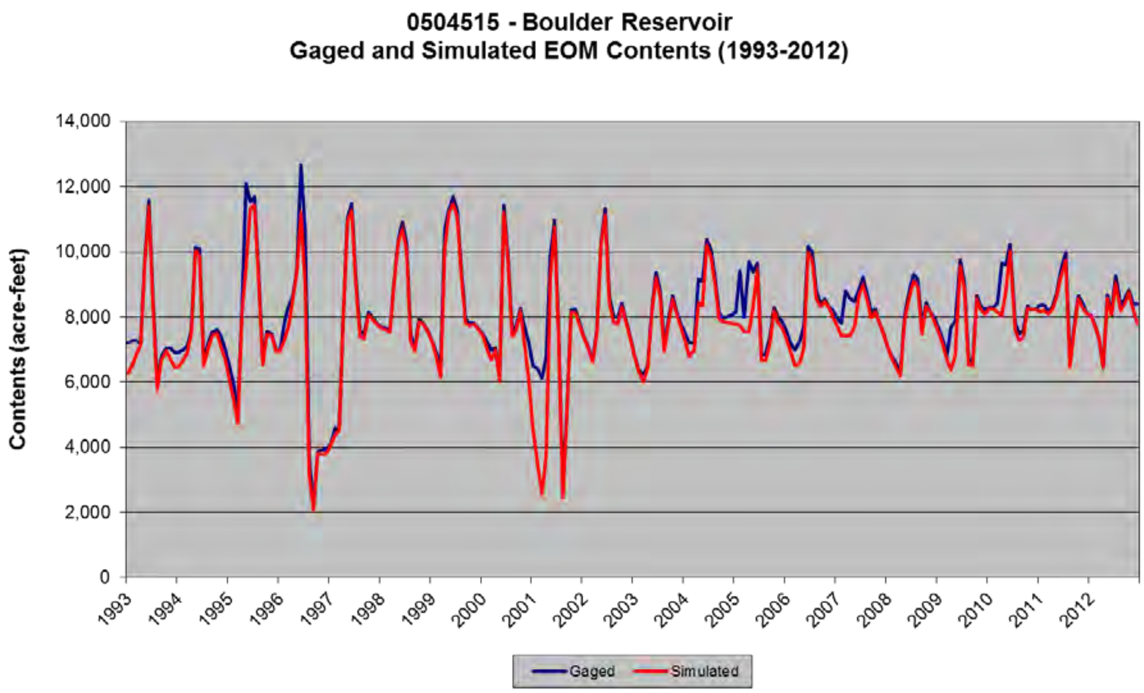


Figure 6-49: Boulder Reservoir

6.2.4.1 Left Hand Ditch (0500603) System

As outlined in Section 5.10.5.8, the Left Hand Ditch system is comprised of a primary carrier structure (0500603) on the St. Vrain Creek that carries between 10,000 af to 22,000 af of water annually over to the Left Hand Creek drainage basin for re-diversion by over a dozen ditches. The system historically operated as a mutual ditch company with the individual headgates considered more as turnouts than individual structures administered separately. As such, historical diversion records for the Left Hand Ditch system irrigators are not available in HydroBase. Additionally, the streamflow gages on Left Hand Creek have minimal recorded data and the Left Hand Ditch carrier had only 5 years of data within the study period. With all of this missing information, it was necessary to develop historical diversions from the South St. Vrain Creek and for the individual headgates. Ultimately, the calibration of the Left Hand Ditch system is considered good based on the information developed using the following processes.

- Diversion records for the South St. Vrain diversion were compiled from a number of different data types in HydroBase. A portion of the record was based on Streamflow and Administrative Flow records at the LEFTHDCO gage and infrequent diversions (0500603). These sources provide a fairly complete record from 1971 through 2012. 1950 through 1970 values and other missing values were filled with a pattern based on St. Vrain at Lyons gage.

- HydroBase records were available for a limited number of years for the individual Left Hand headgates. The available records were compared to the 0500603 diversion totals to develop a scale factor. In aggregate, individual headgate diversions were approximately 113 percent of 0500603. The extra 13 percent is likely diversions of return flows or native flow in Left Hand Creek. The proportions of total diversions at the individual headgates were also determined (e.g., on average Haldi Ditch diverts 25% of total Left Hand diversions). The diversions at each headgate were calculated by multiplying 0500603 by 1.13 and then multiplying by the individual proportion for the ditch on monthly basis.

- The Left Hand Water District (LHWD) operates two water treatment plants that receive deliveries of Left Hand system water and C-BT. The plants are represented in the model network as 0500619_a and 0500619_b. The Spurgeon plant (0500619_a) is fed by Haldi Ditch (0500565) and receives mostly Left Hand system water. The Dodd plant (0500619_b) is located east of the Williamson Ditch (0500575) and receives a majority of its water through a pipeline directly from the C-BT Boulder Feeder Canal. HydroBase records were available for the majority of the relevant time period but represented combined diversions at both plants. Missing records were filled using linear interpolation of annual data. Annual values were disaggregated to monthly values based on the distribution of monthly diversions from the available HydroBase data.

6.2.4.2 Foothills Reservoir and McIntosh Reservoir

Foothills Reservoir and McIntosh Reservoir are owned and operated by Highlands Irrigation District, and release water for irrigation via exchange to the Highlands Irrigation Demand. In general, both of these reservoirs are over-simulating and stay fuller than their historical contents reflect. This is occurring because the irrigation demand is already satisfied from direct diversions, reservoir releases from Highland Reservoirs 1 through 3, and C-BT supplies. Additional refinement may be needed to limit the amount of C-BT supplies made available to the Highland Ditch System or investigate additional demands that Foothills and McIntosh Reservoirs may serve. It is noteworthy that the historical diversions significantly short the consumptive use demand of the acreage under the Highland Ditch system. Although diversion records were reviewed to determine their accuracy, the ditch system may receive additional supplies that are either not diverted through the Highland Ditch headgate, or not recorded under the Highland Ditch headgate in HydroBase.

6.2.4.3 Baseflows with Boulder Creek Integration

As discussed in the Calibration Process section above, the sub-basin models were developed and calibrated independently and then integrated into an overall model. The St. Vrain Creek Basin (which included the historical gaged inflow from Boulder Creek) streamflow calibration at the lower St. Vrain Creek near Platteville (06731000) gage was good. Once the models were integrated, the combined Boulder Creek and St. Vrain Creek resulted in negative baseflow at the lower gage during the winter months, with the negative baseflow occurring more frequently in the recent years. Return flows that interacted between the basins were reviewed and adjusted, reducing the magnitude of the issue. Issues may remain either due to differences in return flow patterns between the two basins or calibration of off-channel reservoir systems or imports. It is recommended that additional refinement of the baseflow at this gage be performed.

6.2.4.4 C-BT Supplies in St. Vrain Basin

Colorado Big Thompson and Windy Gap supply enters the St. Vrain Creek Basin using four imports: deliveries directly to Longmont municipal demands (05_LongCBT), deliveries to Left Hand Ditch System (05_LHCBT), Boulder Feeder Canal to Boulder Reservoir (05_BRCBT), and St. Vrain Supply Canal deliveries to in-basin users. While initially the model was developed using operating rules that allocated C-BT deliveries based on a user's share ownership, only a single percent value could be used for the entire study period, which was known to be an over-simplification considering C-BT and Windy Gap units are frequently transferred.

The modeling approach was then adjusted to separate the demands into the four primary users in the basin, and allowing known recipients of C-BT and Windy Gap access to 100% of the supply of their respective import plan. The City of Longmont takes delivery of its supplies as its first priority, however the remaining users' priorities of C-BT deliveries are typically just junior to the users' most junior water right, assuming that a user would elect to divert in priority before using its C-BT supply.

Using this representation, the Longmont and Boulder Feeder Canal demands and operations use the full imported supply. At times, the model is over-simulating the amount of native and storage supplies to meet the Left Hand Ditch and St. Vrain Canal demands and under-simulating their use of imported supplies. As these demands are being satisified, the model is likely simulating the right amount of water but the "color" of water does not match historical estimates provided by Northern (i.e. direct diversions, storage supplies, C-BT deliveries). As demands in the basin are generally met, and the streamflow gages reflect good correlation, this is likely an issue of operational decisions by the users and does not impact the overall calibration of the basin.

6.2.4.5 City of Longmont

The City of Longmont municipal demand is met by four primary sources:

- C-BT (as discussed above),
- Changed water rights,
- Direct flow rights at three primary pipelines: Longmont North Pipeline (0500511) and Lyons Pipeline (0500512) located below Button Rock Reservoir on North St. Vrain Creek and Longmont South Pipeline (0500522) below Beaver Park Reservoir on South St. Vrain Creek,

- Reservoir storage in Button Rock and Union reservoirs.

The municipal demand was developed based on user-provided annual water treatment plant production values from 1970 through 2001 and monthly water treatment production values from 2002 through 2012. Prior to 1970, demand was estimated using population data and per capita use. These values were then compared to the sum of the historical supply data, and inconsistencies between the supply and demand were adjusted.

In general, the calibration of the South Pipeline is considered good, however the Longmont North Pipeline is under-simulating compared to historical diversions, primarily during summertime outdoor demands (Figure 6-52). The under-simulation is because the Longmont municipal demand is first met by C-BT deliveries, which, based on historical records, met the majority of the summer demand. There is likely an issue with either the C-BT delivery records or the HydroBase records, including the potential that the historical HydroBase records for the Longmont North Pipeline include a portion of the C-BT deliveries that are modeled as being directly delivered. This under-simulation at the pipeline is also the cause for the under-simulation of Button Rock releases to meet municipal supply via the North Pipeline. Although this was discussed with Northern and Water Commissioners during calibration efforts, it is recommended additional investigation take place to mitigate these differences.

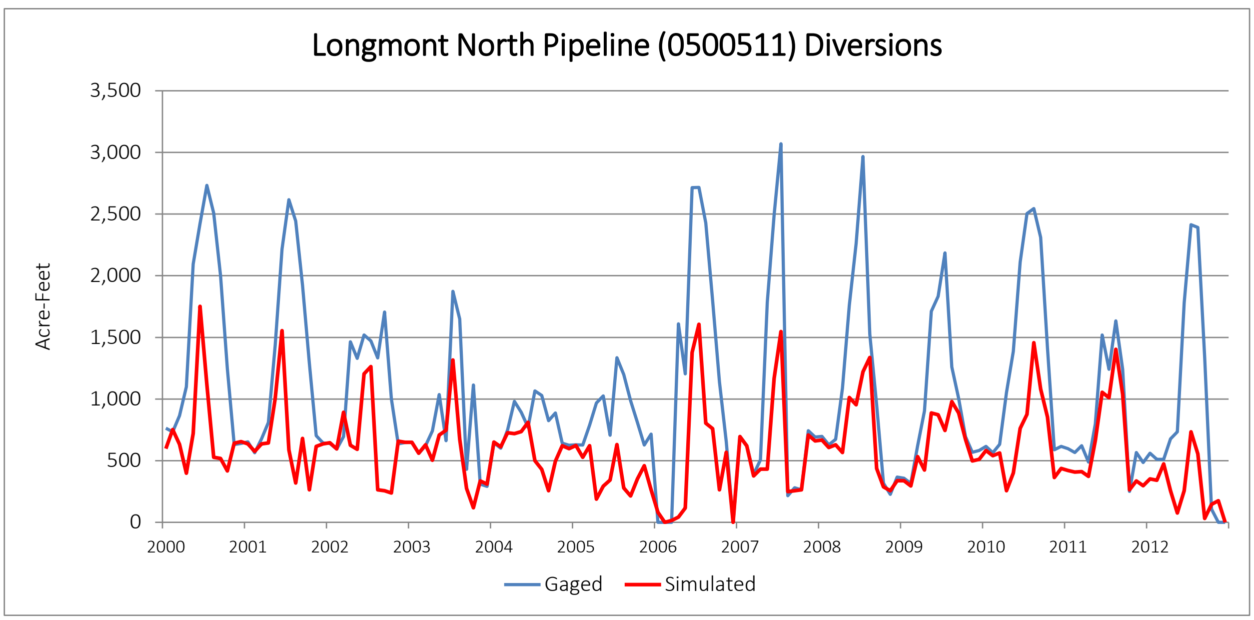


Figure 6-50: Longmont North Pipeline Calibration

6.2.5 Water District 6 (Boulder Creek) Calibration

The City of Boulder's municipal operations, transmountain imports, and irrigation uses are the primary operations in the Boulder Creek Basin. Adding to the complexity are the municipal operations of Lafayette and Louisville and the prevalence of minimum instream flow reaches in the basin. In general, the irrigation operations and their associated reservoirs reflect good calibration. Municipal operations are considered to be well calibrated, however significant calibration efforts were undertaken to reach this level of calibration, particularly for reservoir operations. Streamflow is being slightly under-simulated at the lower gages during peak runoff, however generally correlates very well overall with historical gaged streamflow. Specific calibration issues and recommendations are discussed in more detail below for many of the basin operations. Note that the calibration efforts on Moffat Tunnel, Gross Reservoir, and South Boulder Diversion Conduit are discussed in Section 6.1.2.1 and not reiterated here.

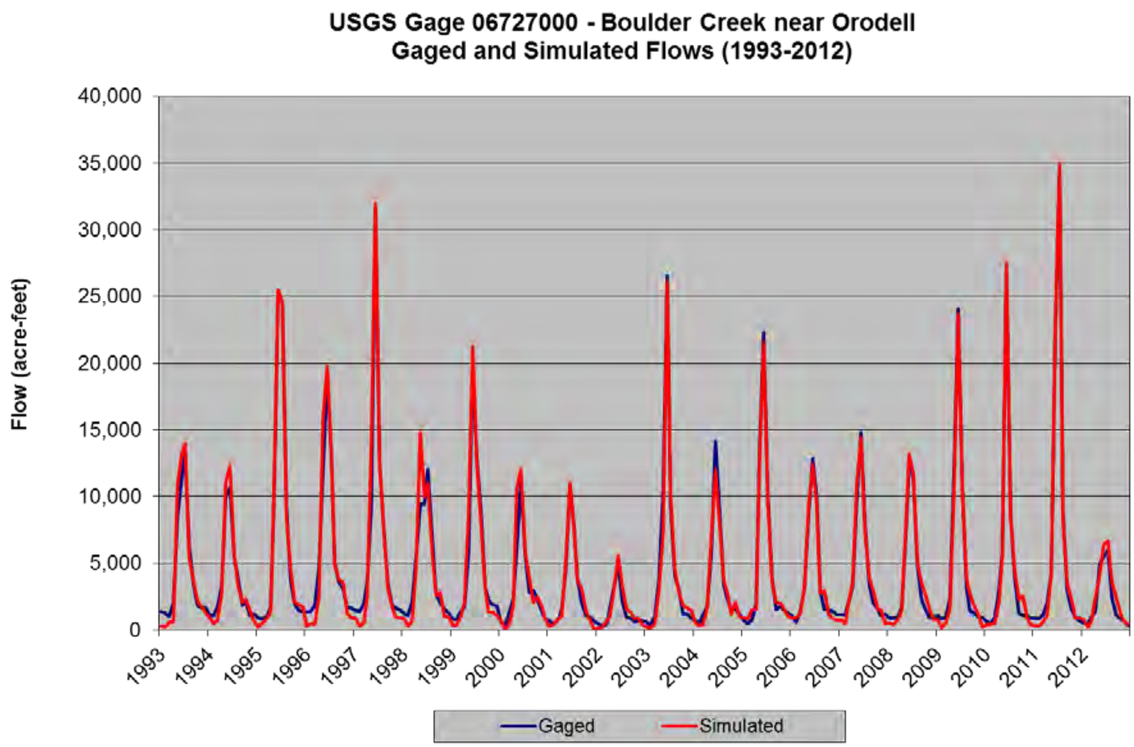
The following table presents the number of each structure type in the sub-basin:

	Diversions	Reservoirs	Well Only	Plans
Boulder	88	12	1	200

The following tables present the average annual surface and ground water demand (af), the percent of demand that was met, and the associated M&I and irrigation consumptive use over the 1993 to 2012 period. See Table 7-6 for more information on the demand and consumptive use for specific structures.

	SW Demand (AF)	GW Demand (AF)	Total Demand (AF)	Percent Demand Met
Boulder	154,000	260	154,300	97%

	Irrigation Consumptive Use (AF)	M&I Consumptive Use (AF)	Total Consumptive Use (AF)
Boulder	44,000	20,000	64,000



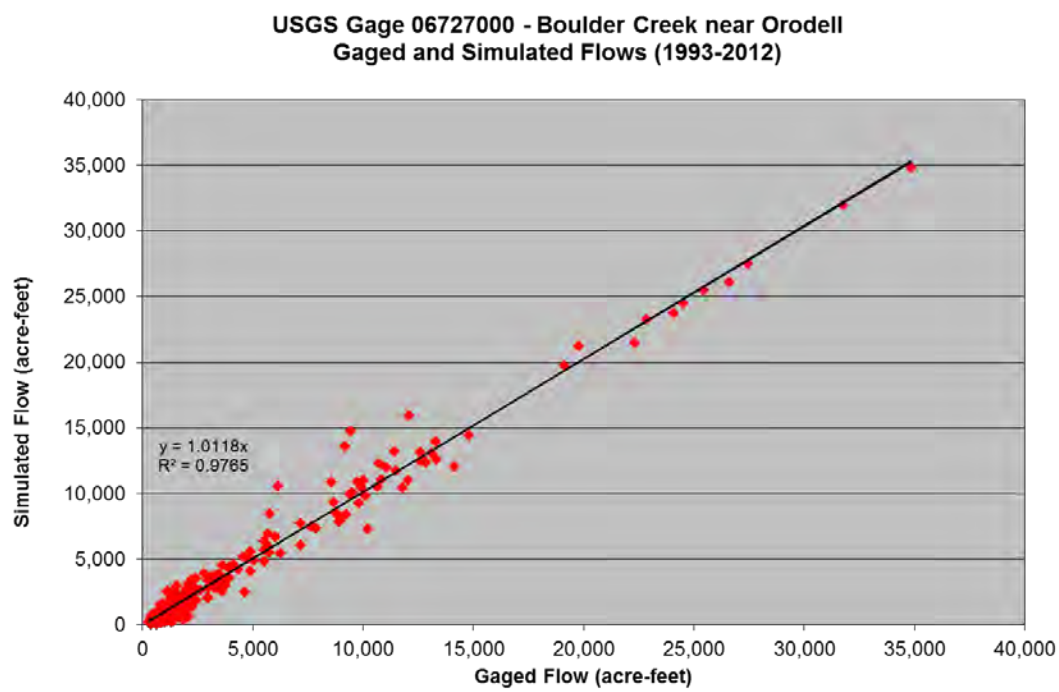
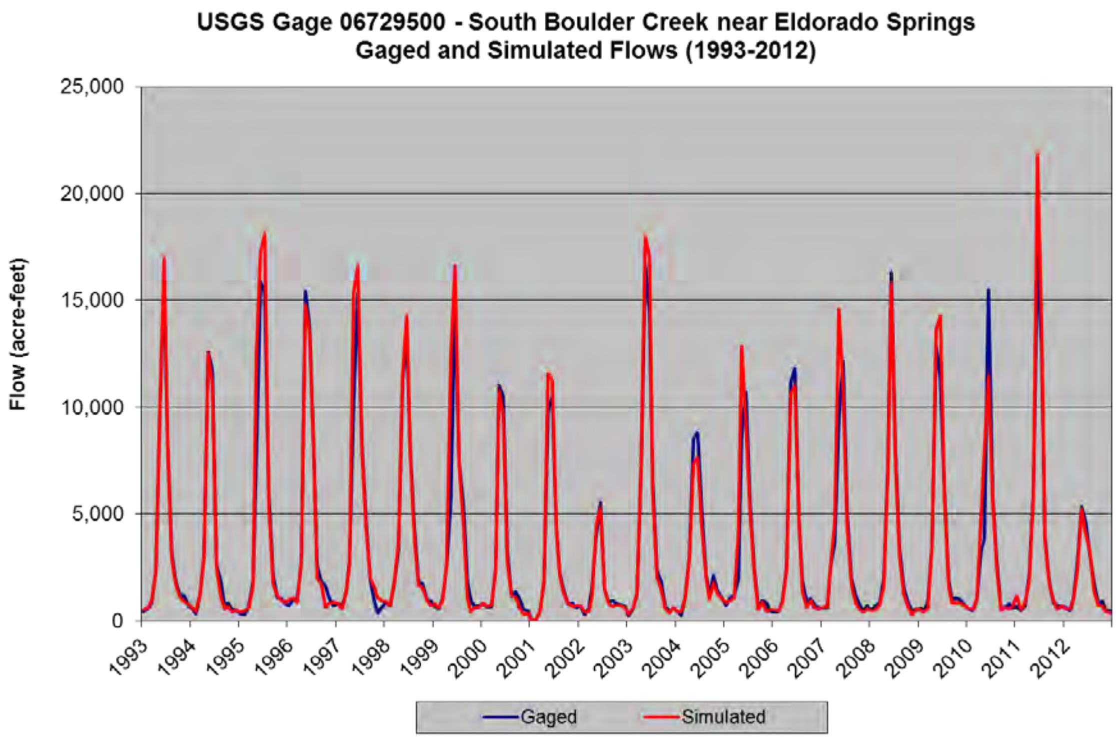


Figure 6-51: Boulder Creek near Orodell



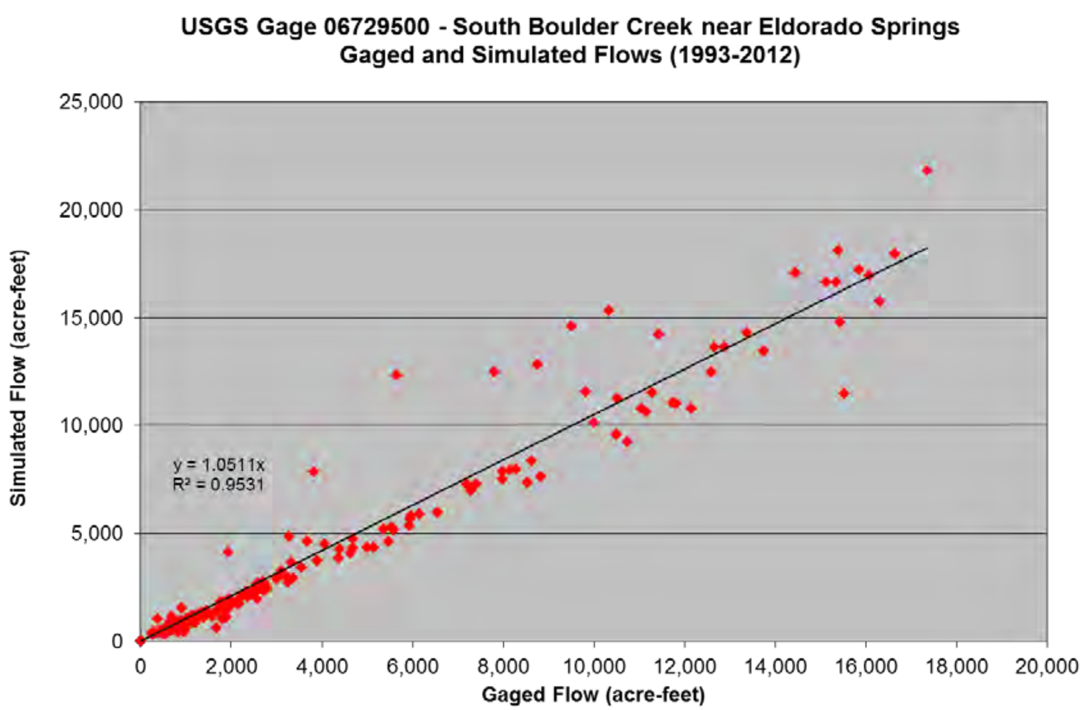
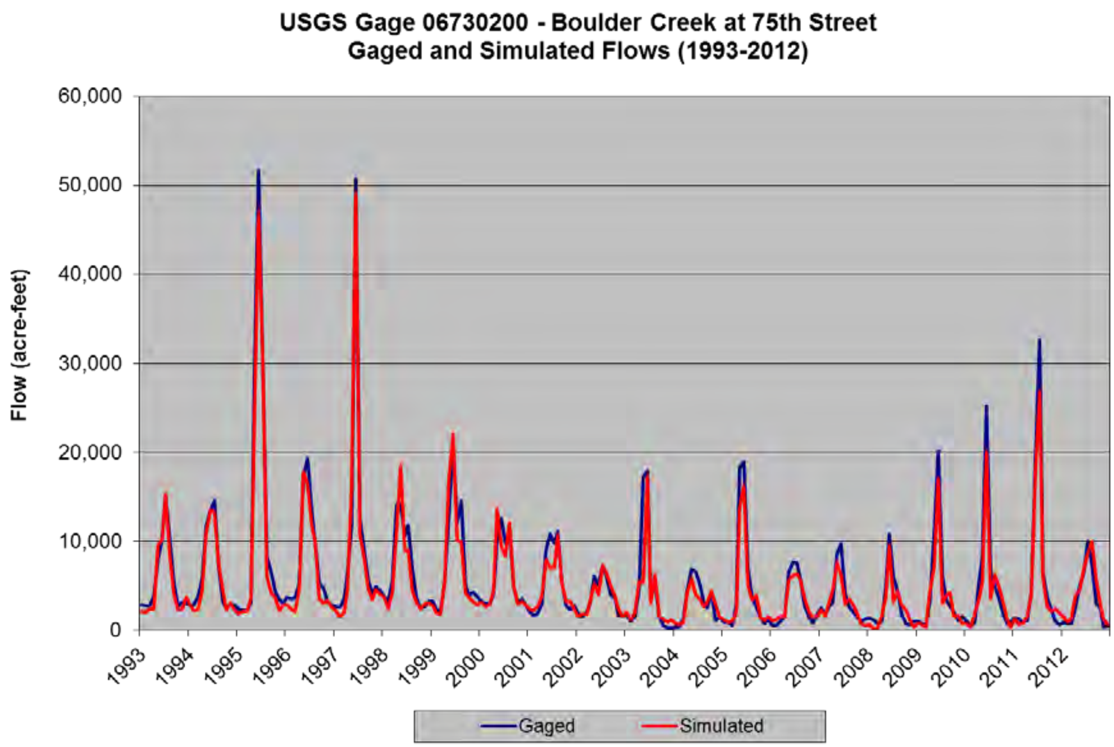


Figure 6-52: Boulder Creek near Eldorado Springs



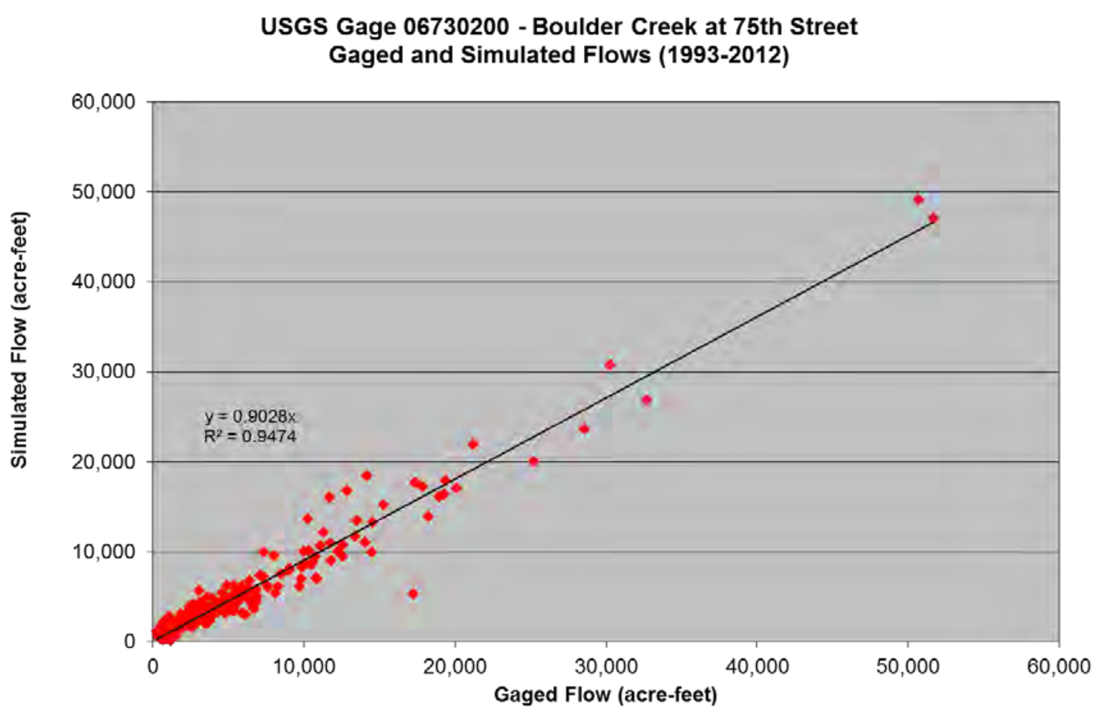
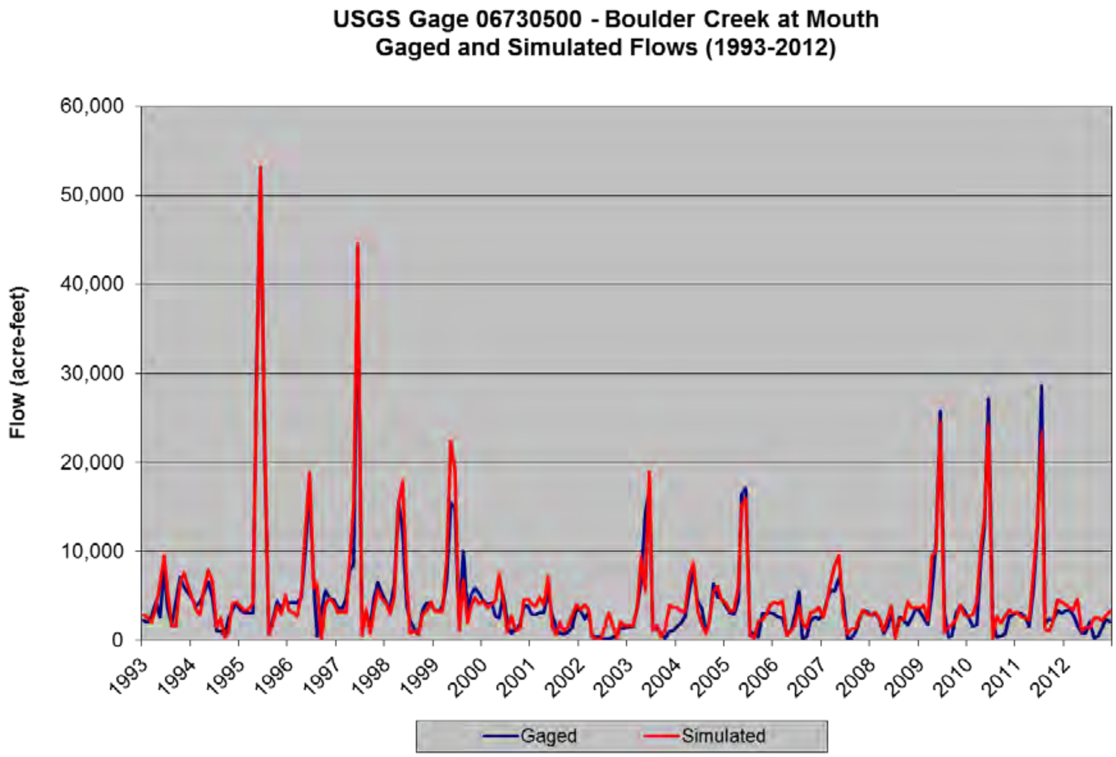


Figure 6-53: Boulder Creek at 75th Street



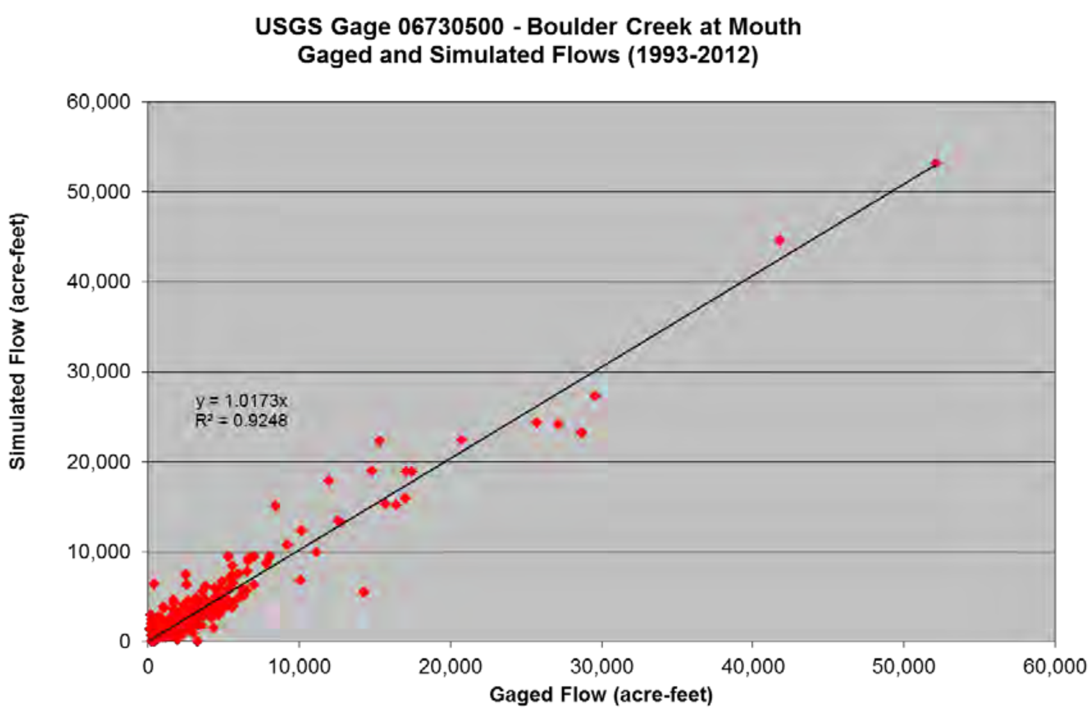


Figure 6-54: Boulder Creek at Mouth

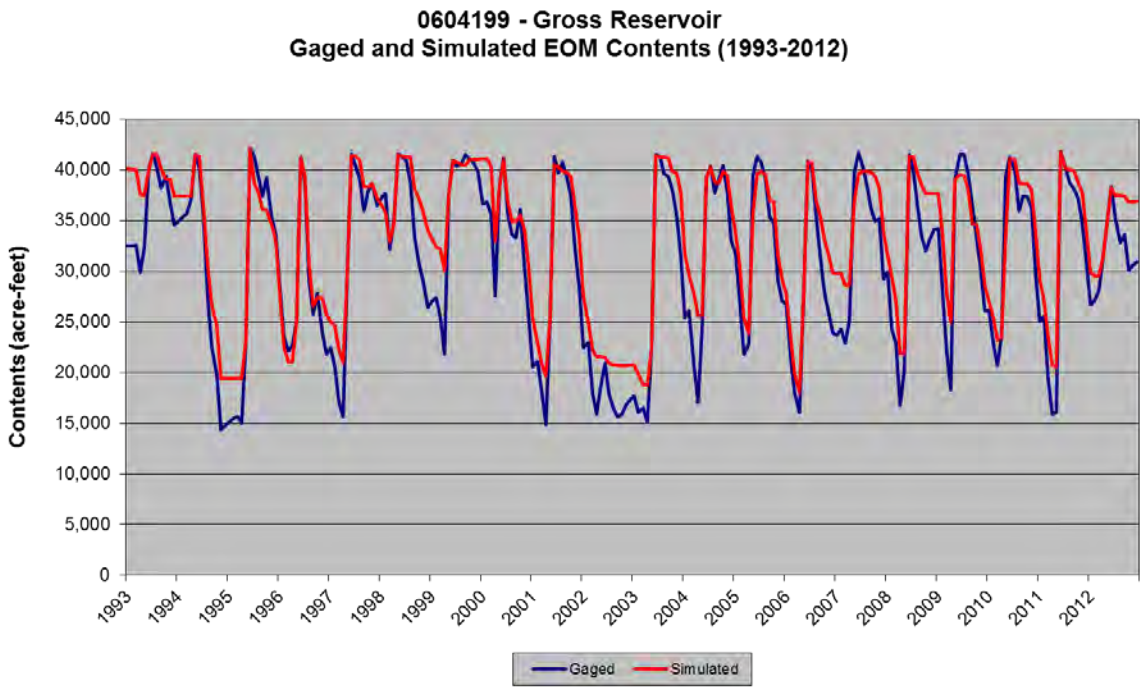


Figure 6-55: Gross Reservoir

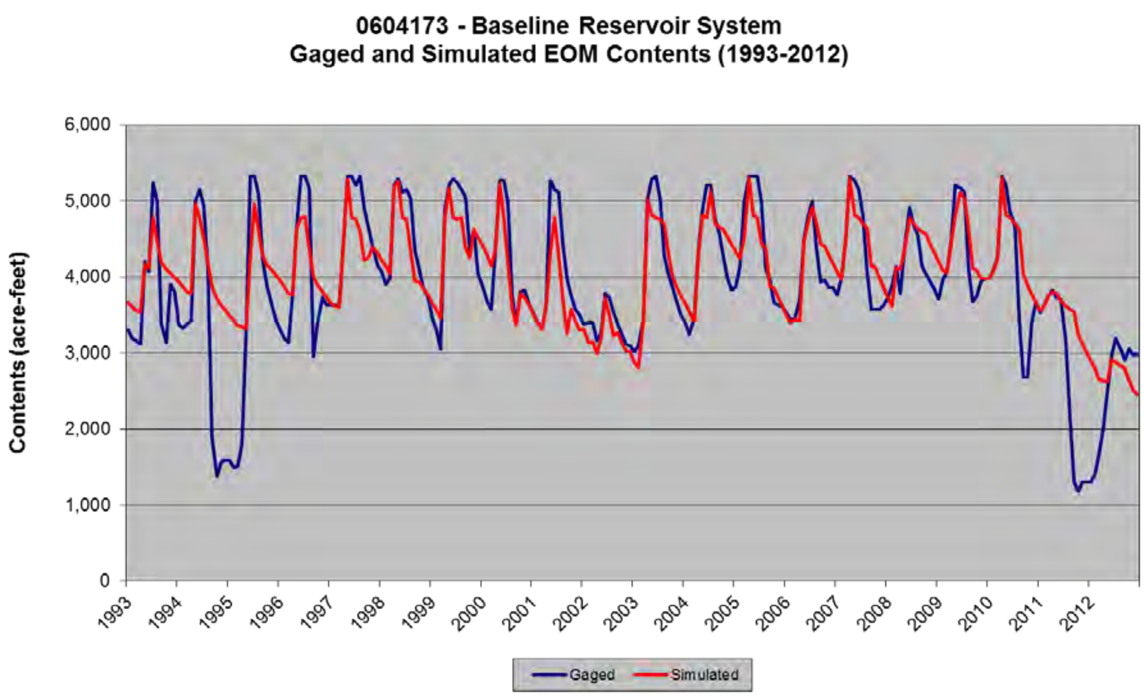


Figure 6-56: Baseline Reservoir System

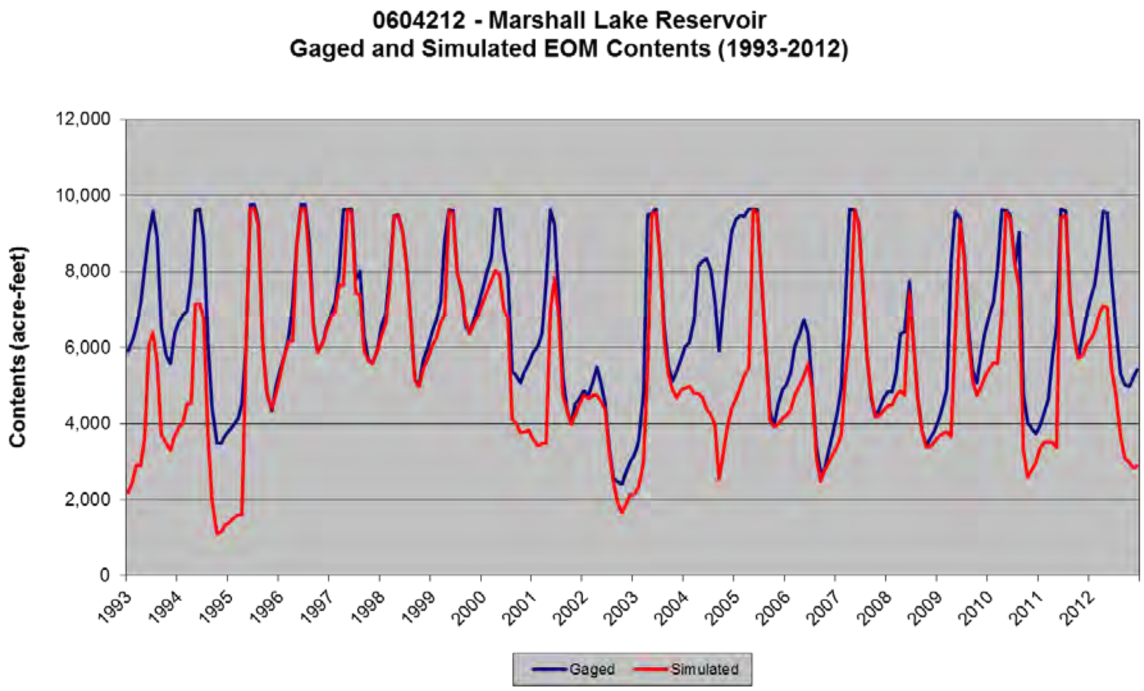


Figure 6-57: Marshall Lake Reservoir

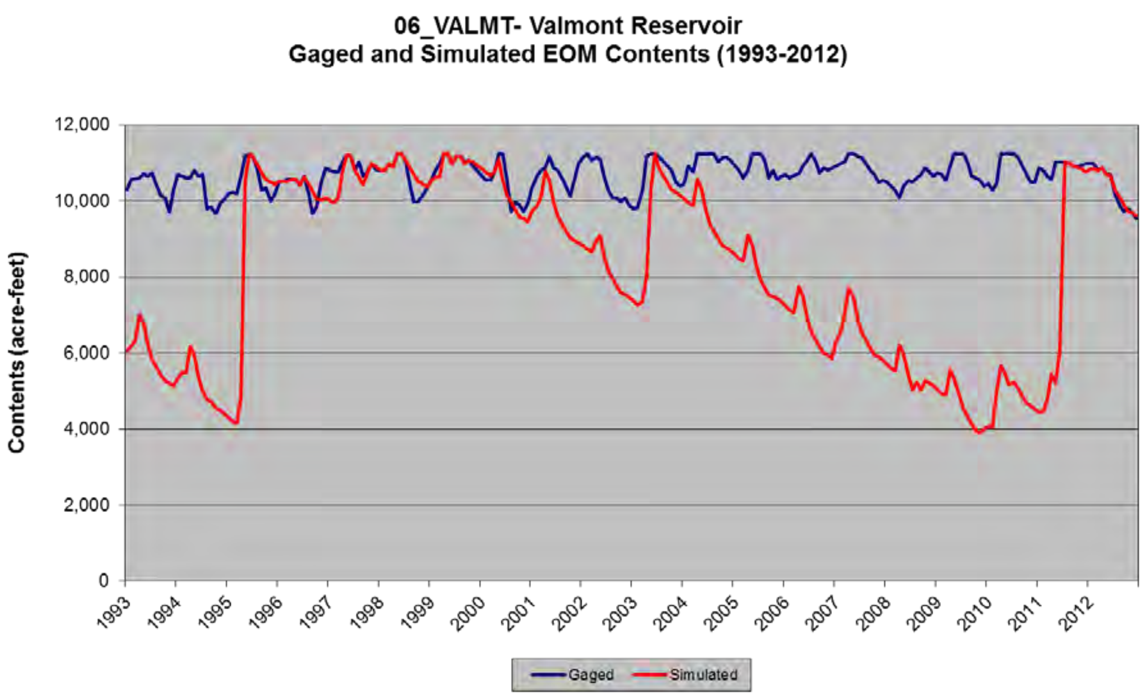


Figure 6-58: Valmont Reservoir

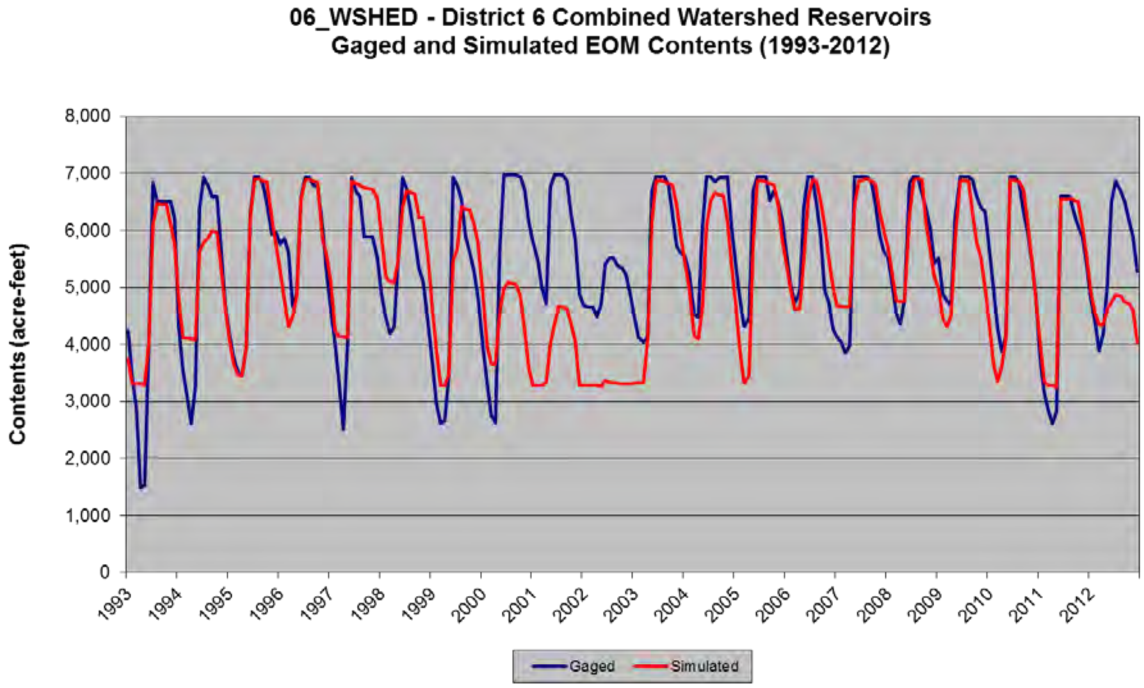


Figure 6-59: Combined Watershed Reservoirs

6.2.5.1 Streamflow Gages and Baseflows

As discussed in Section 4.7.2, three streamflow gages in the Boulder Creek Basin are not complete over the full study period (1950 – 2013) and could not be filled using the standard streamflow filling techniques. The preferred approach was to fill historical streamflow data before creating baseflows in StateMod; however regression with nearby gages yielded poor results for these gages. In order to improve the baseflows estimated on Boulder Creek, the streamflow gage data was left missing and baseflows were instead filled through regression with baseflow estimates from nearby gages. This yielded much better regression correlations and resulted in improved baseflow estimates along Boulder Creek.

One of these gages, Boulder Creek at North 75th St, Near Boulder (06730200) is impacted by the City of Boulder's WWTP discharge. In early 2003, the WWTP outfall was moved from upstream of the gage location to downstream, effectively moving approximately 12,000 af annually around the gage. In order to mitigate this issue, a demand structure (06BOULD_RTN) was added to the model to carry the WWTP outfall returns from 1950 to February, 2003 upstream of the gage. This operation improved the calibration of the simulated streamflow at this gage, particularly during the winter months.

6.2.5.2 C-BT Supplies

The Boulder Creek Basin receives C-BT using three structures in the South Platte Model; Southern Water Supply Pipeline (06_SWSP_IMP), direct deliveries to Boulder's WTP via Boulder Reservoir (060800_IMP) and the Boulder Creek Supply Canal deliveries (BCSC) (06_CBT_IMP). The first two supplies are fully used to meet demand (i.e. Windy Gap Cities' municipal demand modeled at aggregated municipal structures, and Boulder's municipal demand) within the basin. The BCSC imported supplies are split as they enter the basin. Twenty percent is allotted for the City of Boulder's uses and the remaining 80 percent is allotted for other users in the basin. This split was based primarily on calibration of Boulder's municipal operations, in order to limit the amount of C-BT supplies simulated as diverted by the city. Boulder's demands are generally met by the import supplies every year; however the model is over-simulating the amount of in-basin users' demands met by native and storage supplies and under-simulating the portion met from imported supplies as compared to historical operations. In general, the right amount of water is being diverted by the in-basin users but the "color" of water is different from historical (i.e. direct diversions, storage supplies, C-BT deliveries). As demands in the basin are generally met, and the streamflow gages reflect good correlation, this is likely an issue of operational decisions by the users and does not impact the overall calibration of the basin.

6.2.5.3 Baseline Reservoir and Dry Creek Carrier

Baseline Reservoir is located on Dry Creek, a tributary to Boulder Creek, and serves a variety of uses and users. Per CA12111, Baseline Reservoir can store water from Boulder Creek (via Anderson Ditch), Bear Creek (via Anderson Ext. Ditch), South Boulder Creek (via Dry Creek Carrier), and Dry Creek (on-channel). Dry Creek has very little native streamflow; a large majority of the supply for the Dry Creek irrigation structures are carried through the Dry Creek Carrier (0600902_C). Historical diversion records for Baseline Reservoir and Dry Creek Carrier are limited in HydroBase and initial calibration of the reservoir and Dry Creek were poor. Through discussions with the Water Commissioner, an approach was developed to fill diversions to storage and carried diversions at the Dry Creek Carrier, which include direct supply for the City of Lafayette. In general, HydroBase diversions to storage were used at the Anderson Ditch and Ext. structures. The remainder of the diversions to storage plus the total diversions to the Dry Creek ditches and Lafayette's diversions were used to fill the historical diversions at the Dry Creek Carrier. Note that releases from Baseline Reservoir to Dry Creek irrigation demands were excluded from the carried water. This effort greatly improved the baseflows surrounding this structure, however they may have over-estimated the baseflow on South Boulder Creek, where the Dry Creek Carrier is located, if native flows or diversions from Anderson Ditch and Ext. are greater than represented.

Operations of the reservoir have changed over time, as the reservoir was purchased by Boulder and Lafayette around 1990. Boulder continues to lease some of their shares back to Lower Boulder Ditch irrigators. Several operating rules are used to simulate the municipal uses currently decreed for the reservoir; however the historical irrigation uses were not being simulated. Additional "pre-1990" operating rules to release for irrigation prior to the reservoir's purchase to simulate those operations were added. This reduced the shortages simulated for the Dry Creek irrigators historically and improved the overall calibration.

Note also that the generation of natural flows and representation of Dry Creek Carrier operations also impacts the water availability to the Valmont Power Plant and Reservoir System. Additional calibration of natural flows that results in greater water availability on this tributary may result in better correlation of reservoir levels at Valmont Reservoir System.

6.2.5.4 City of Boulder

The City of Boulder takes delivery of its in-basin supplies through two primary pipelines; Boulder Pipeline No. 3 (0600943) located below Barker Reservoir on Middle Boulder Creek and City of Boulder Pipeline (0600599) below the combined Watershed Reservoirs on North Boulder Creek. The operations for these pipelines are managed by Boulder based on several variables, including available storage, projected demands, and streamflow conditions. These operational decisions cannot be completely modeled, however priorities of operating rules were adjusted to best calibrate the diversions at each of the pipelines. As shown in and Figure 6-62 and Figure 6-63 below, the City of Boulder Pipeline diversions are over-simulating compared to historical, and the Boulder Pipeline No. 3 is in turn under-simulating. Although partially caused by operational decisions, this issue is likely a result of estimated natural flow distribution on North and Middle Boulder Creeks and instream flow operations. There are no long term gages on North Boulder Creek; baseflow was calibrated based on limited streamflow gage records from years prior to the construction of the Watershed Reservoirs. Hydropower and minimum bypass operations associated with Barker Reservoir are represented by instream flow demands, however they likely do not capture the complete operations. Note that although the calibration of these pipelines could be improved; the calibration of streamflow below the pipelines at the Boulder Creek near Orodell gage is very good.

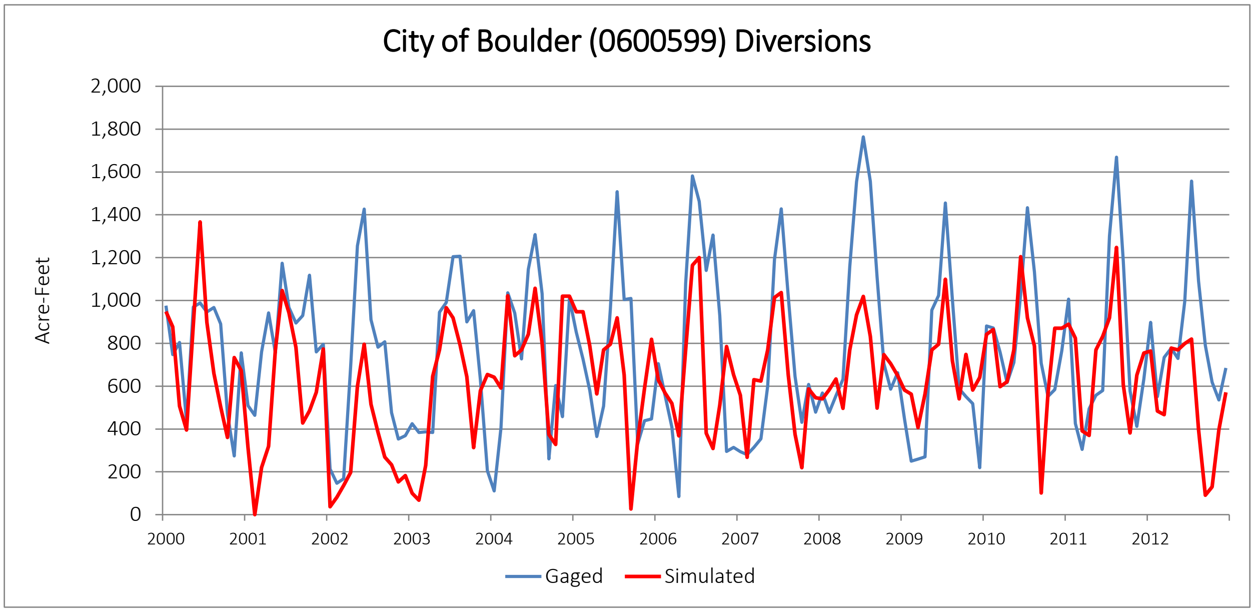


Figure 6-60: City of Boulder Pipeline Calibration

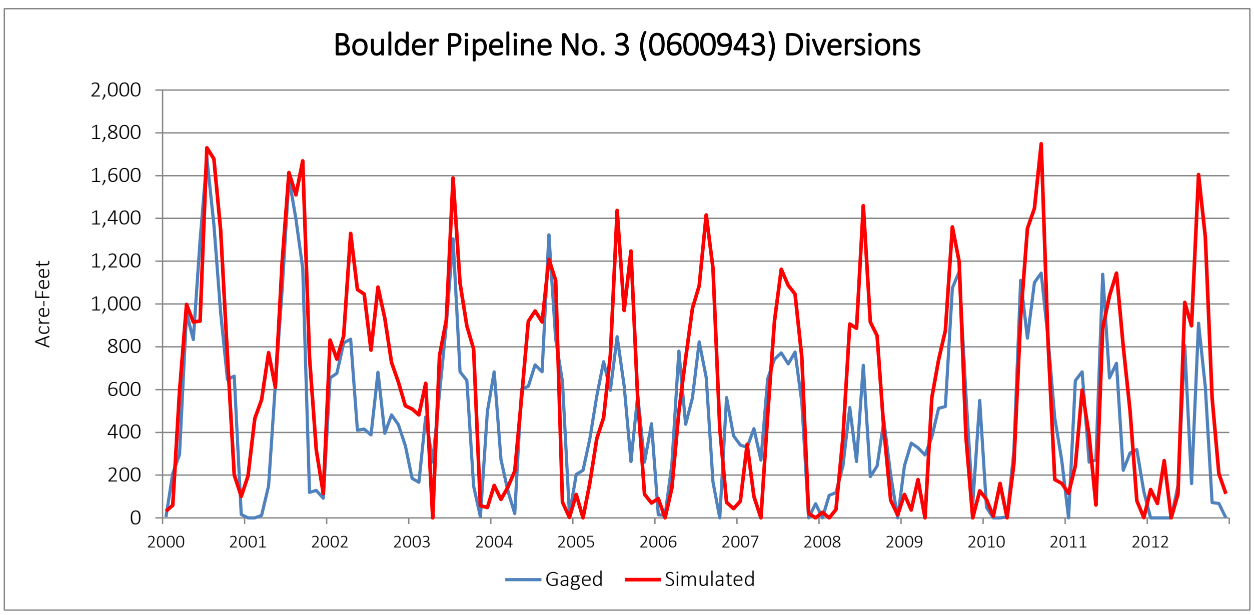


Figure 6-61: Boulder Pipeline No. 3 Calibration

6.2.5.5 Changed Water Rights and Irrigation Shortages

Municipalities have changed shares in nearly three-quarters of the ditches in the Boulder Creek Basin, and many of those changed water rights are not leased back to the irrigation demands if not used by the municipalities. The South Platte Model represents current operations; therefore, the changed water rights are simulated over the entire model period. In some instances, the minimal shortages experienced by the irrigation demand are caused by the operation of the changed water rights before they historically occurred. As discussed throughout the document, these operational decisions cannot be completely modeled. Therefore, no additional calibration is recommended to mitigate the minimal shortages experienced by the irrigators in Boulder Creek.

6.2.6 Water District 7 (Clear Creek) Calibration

The Clear Creek Basin operations are dominated by municipal and industrial operations, including the "Standley Lake Cities" (Thornton, Westminster, and Northglenn), Coors Brewing Company, City of Golden, PSCo Cherokee Power Plant, and imported supplies. The basin has seen many Water Court cases and model representation associated with these operations is complex, requiring several structures and operating rules to accurately reflect the operations in both baseflows and simulation datasets.

The municipal demands are well calibrated, reflecting no shortages over the calibration period. Additionally the streamflow calibration at the Golden and Derby gages is good, however the irrigation demands in the basin are experiencing significant shortages and many of the reservoirs are not staying as full as historical conditions. Note that almost all the ditches in the Clear Creek Basin are represented as carriers with multiple demands. Significant calibration efforts were made to improve the simulated diversions at each of these ditches. Their overall calibration is impacted by their demand-driven operations, considerable changes to irrigated acreage over time, and flexibility the municipal users have with their changed water rights in each of their ditches. In general, the reservoirs in the basin calibrated well considering the complexity of the operations. Specific calibration issues and recommendations are discussed in more detail below for many of the basin operations.

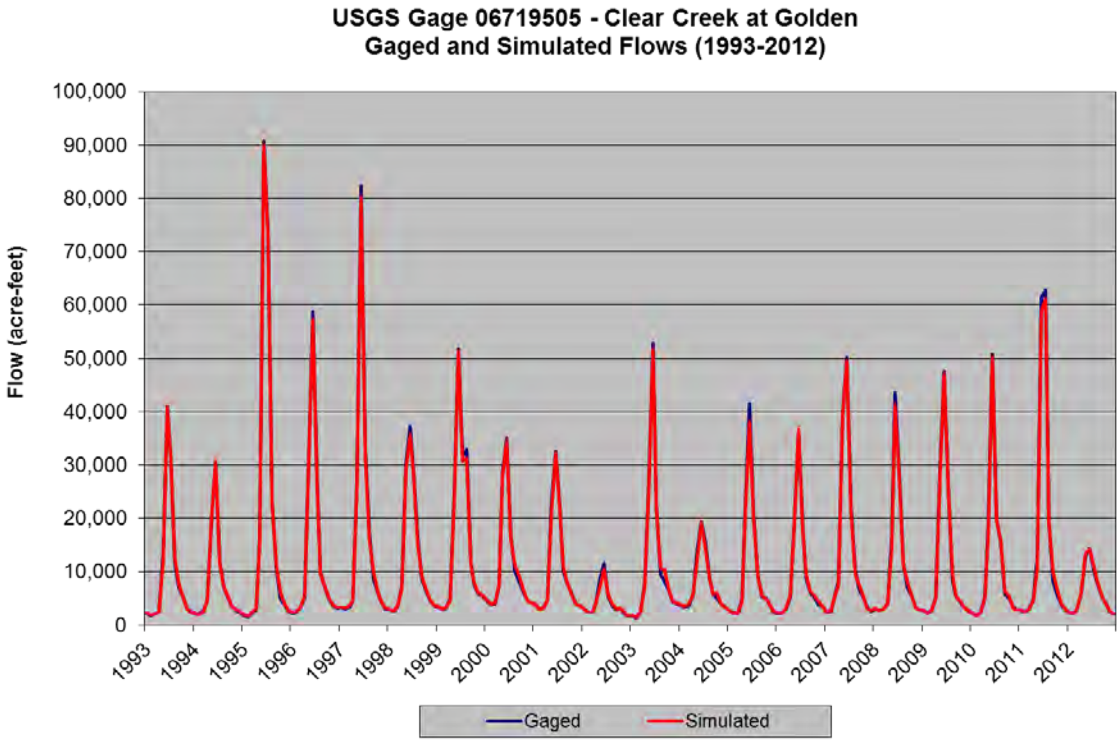
The following table presents the number of each structure type in the sub-basin:

	Diversions	Reservoirs	Well Only	Plans
Clear Creek	71	12	2	171

The following tables present the average annual surface and ground water demand (af), the percent of demand that was met, and the associated M&I and irrigation consumptive use over the 1993 to 2012 period. See Table 7-6 for more information on the demand and consumptive use for specific structures. The Clear Creek sub-basin receives approximately 2,000 af of imported supplies on average annually.

	SW Demand (AF)	GW Demand (AF)	Total Demand (AF)	Percent Demand Met
Clear Creek	97,500	3,000	100,500	93%

	Irrigation Consumptive Use (AF)	M&I Consumptive Use (AF)	Total Consumptive Use (AF)
Clear Creek	18,600	18,900	37,500



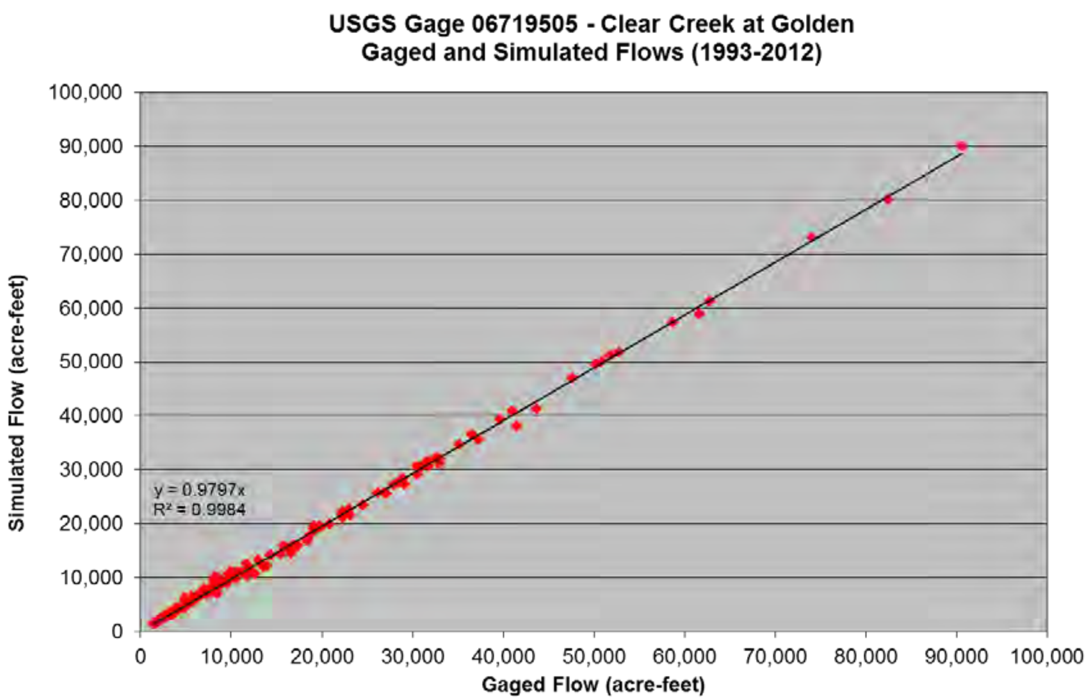
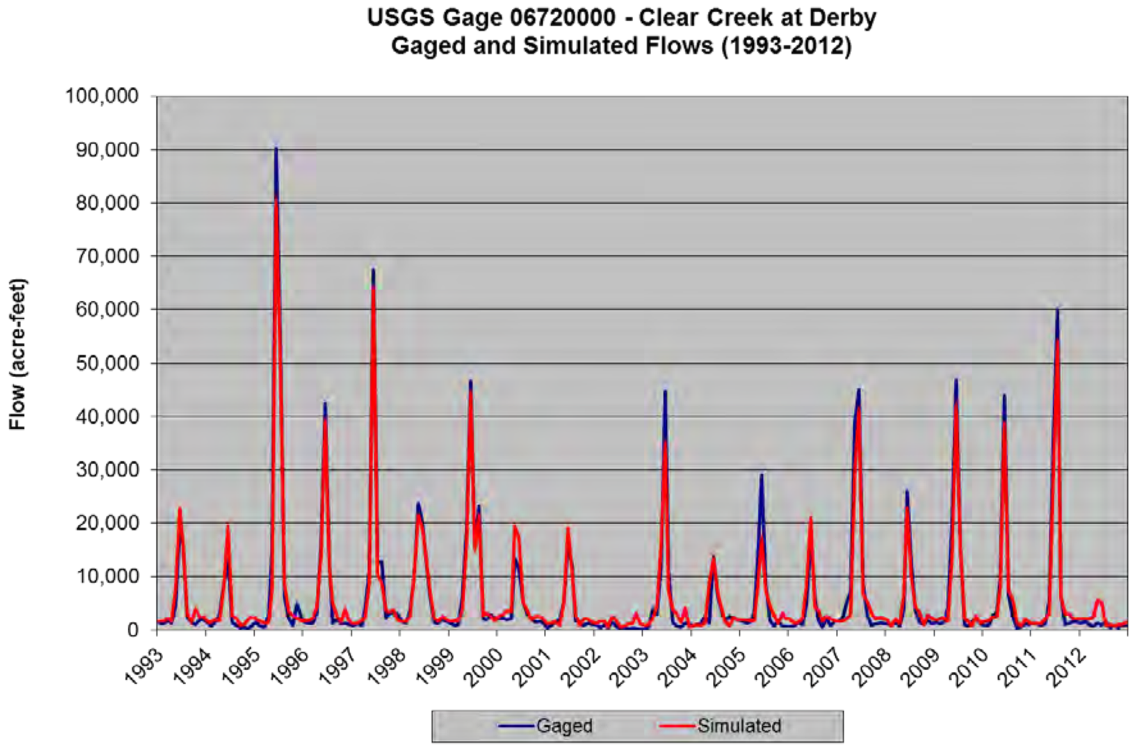


Figure 6-62: Clear Creek at Golden



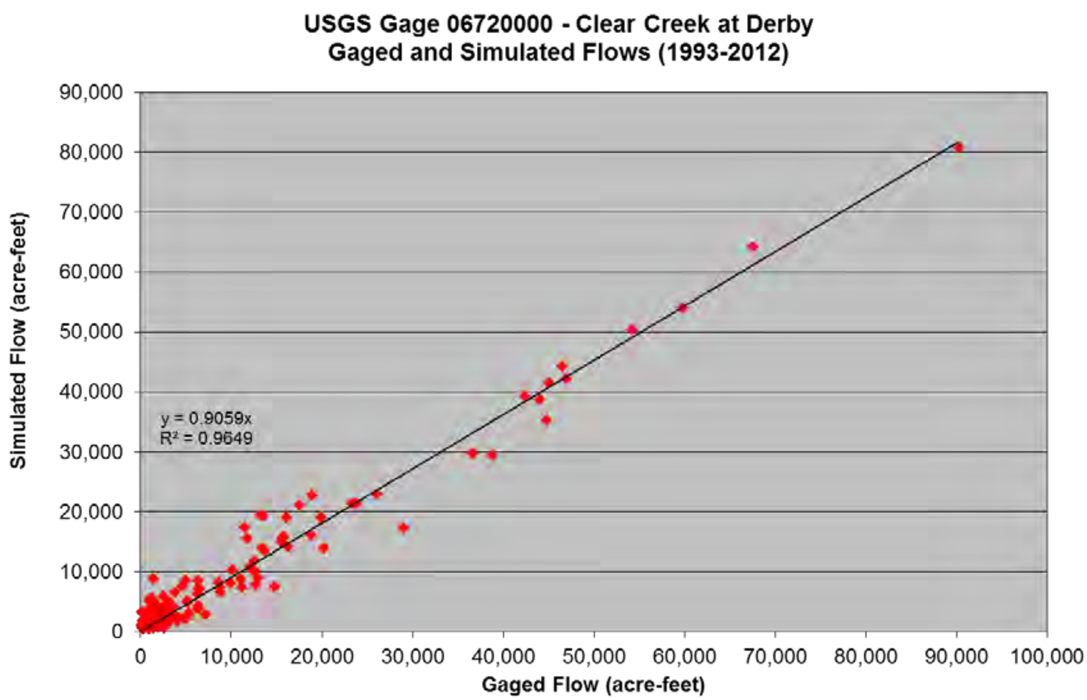


Figure 6-63: Clear Creek at Derby

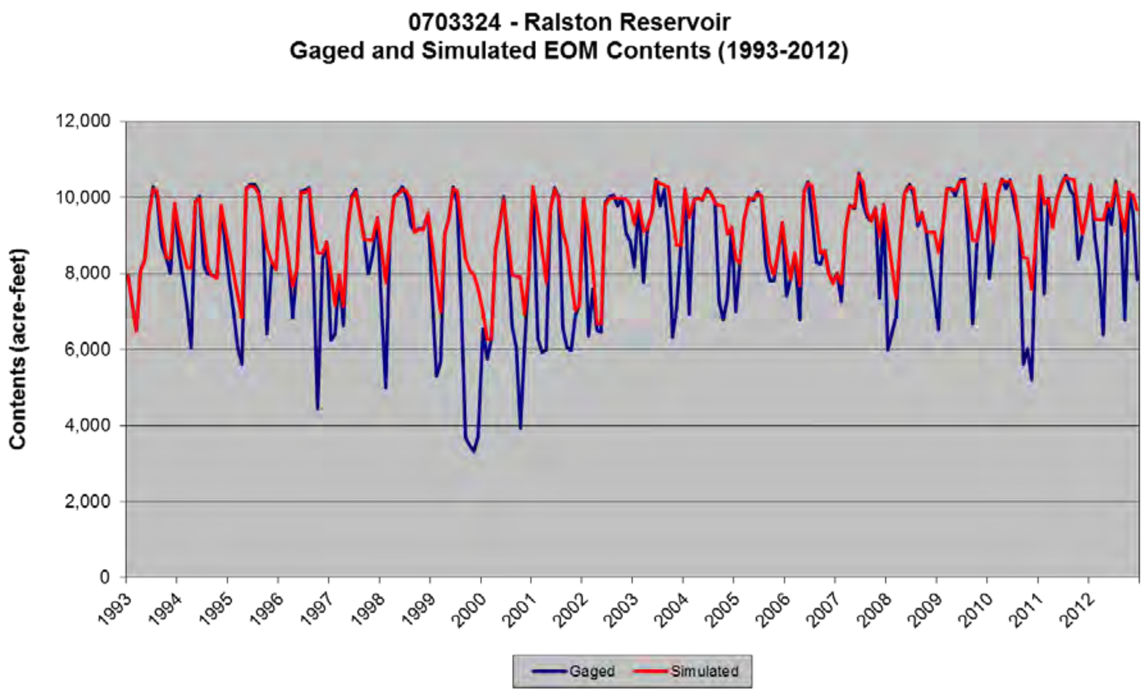


Figure 6-64: Ralston Reservoir

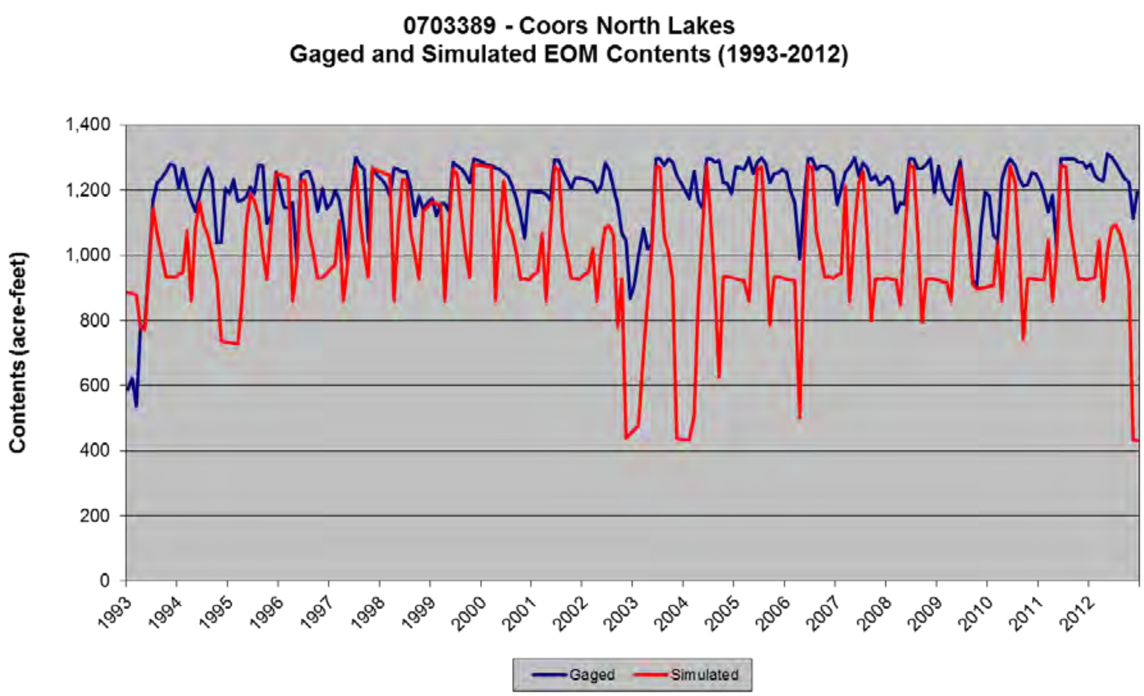


Figure 6-65: Coors North Lakes

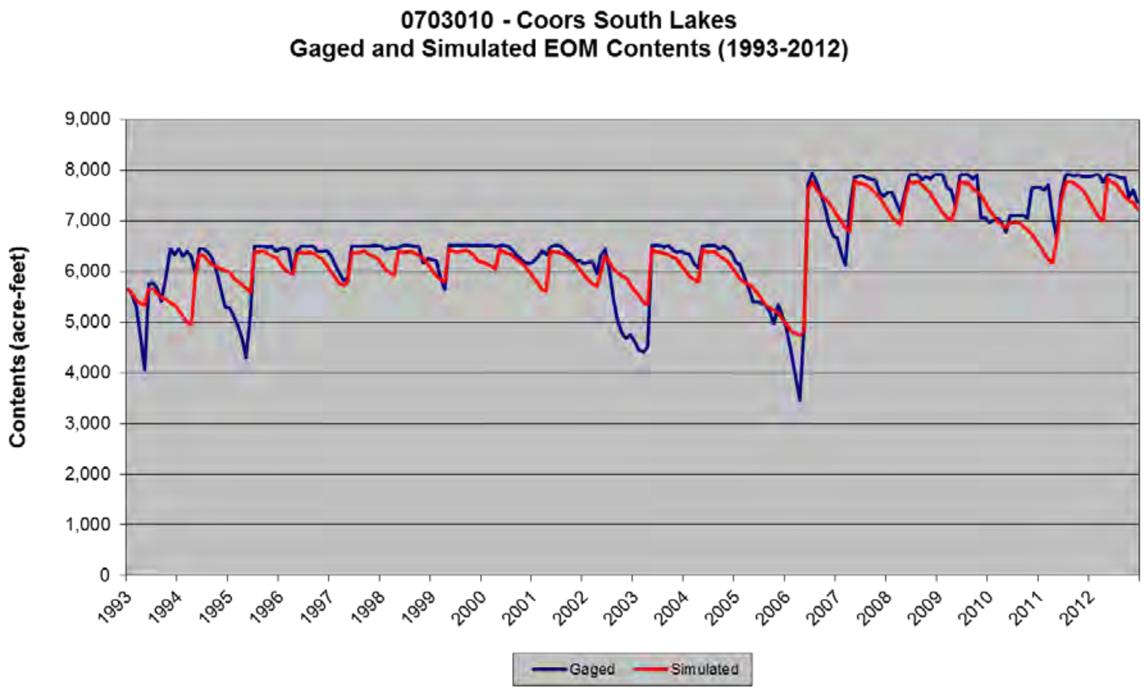


Figure 6-66: Coors South Lakes

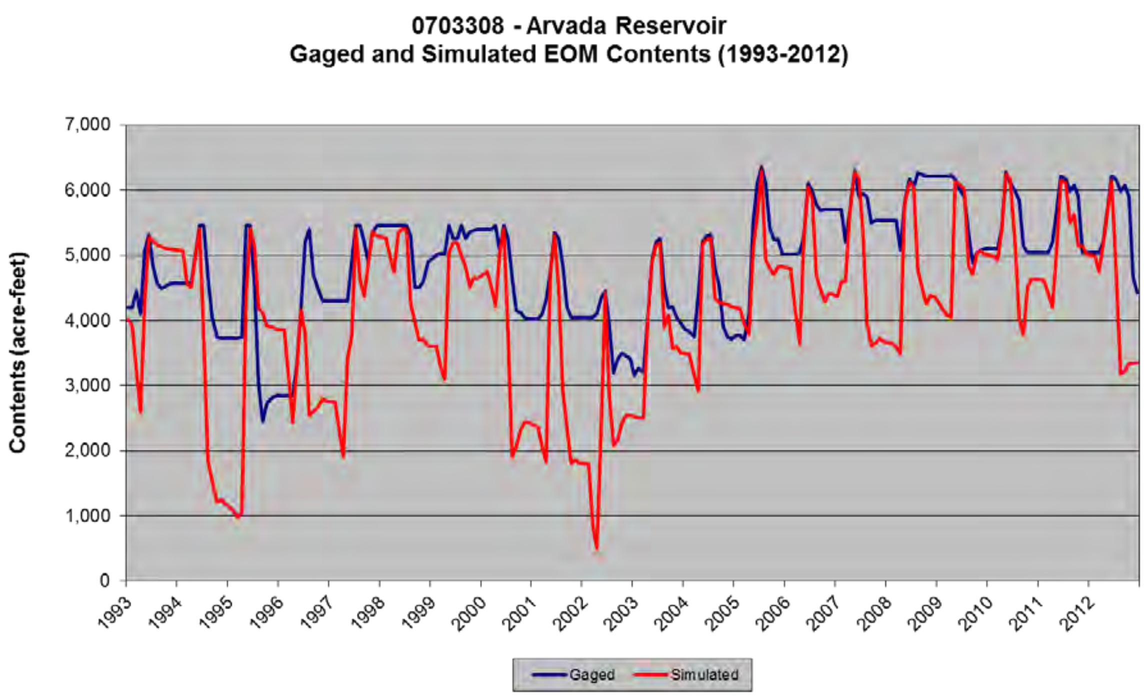


Figure 6-67: Arvada Reservoir

6.2.6.1 Carrier Structures (Farmers Highline Example)

A majority of the Clear Creek ditches carry for irrigation and return changed water rights at augmentation stations. Additionally, some structures also carry to storage. These multiple demands can be difficult to calibrate, particularly as the model represents current operations over the entire model period. Farmers Highline Canal serves as a good example of these operations; Figure 6-70 and Figure 6-71 reflect the calibration of the Farmers Highline Canal total diversions and the portion of the diversions used to meet irrigation demands. The ditch carries storage diversions to Standley Lake, serves irrigation demands, and has several changed water rights operations. As indicated in the Calibration Structure Summary (Section 7.6), the irrigation demands (0700569_I) are shorted. As shown in the graphs, the shortage is not caused by significant under-simulation of diversions at the headgate. The irrigation demand can only be supplied by the remaining un-changed shares on the ditch or excess diversions not used to meet municipal demand, and in certain months the supply is not sufficient.

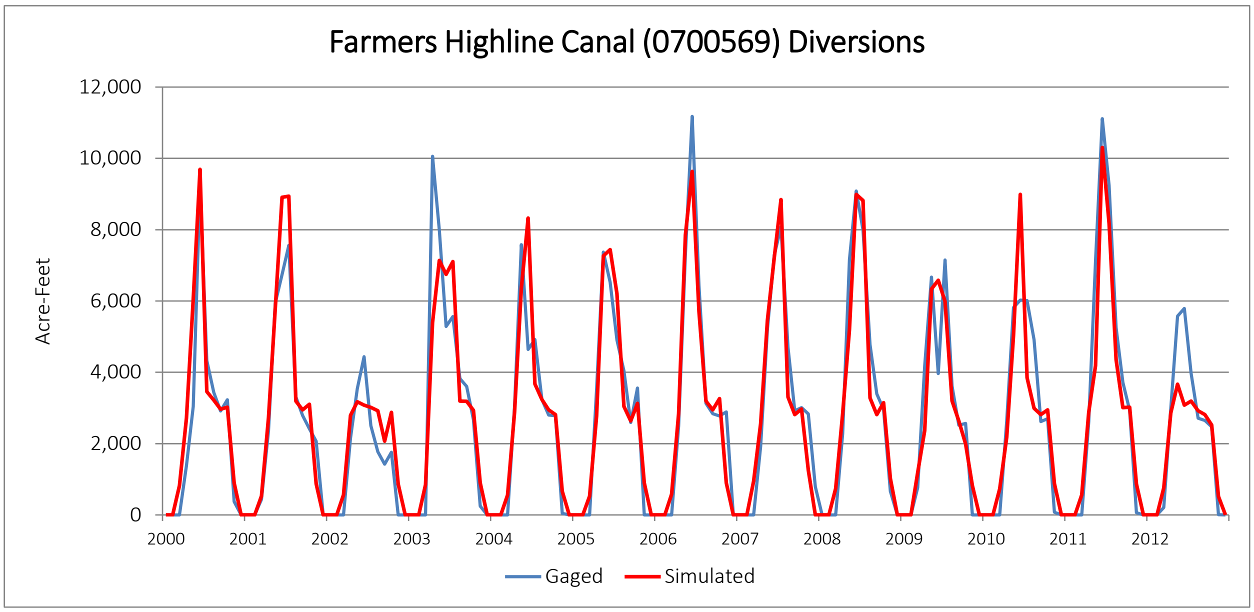


Figure 6-68: Farmers Highline Canal Calibration

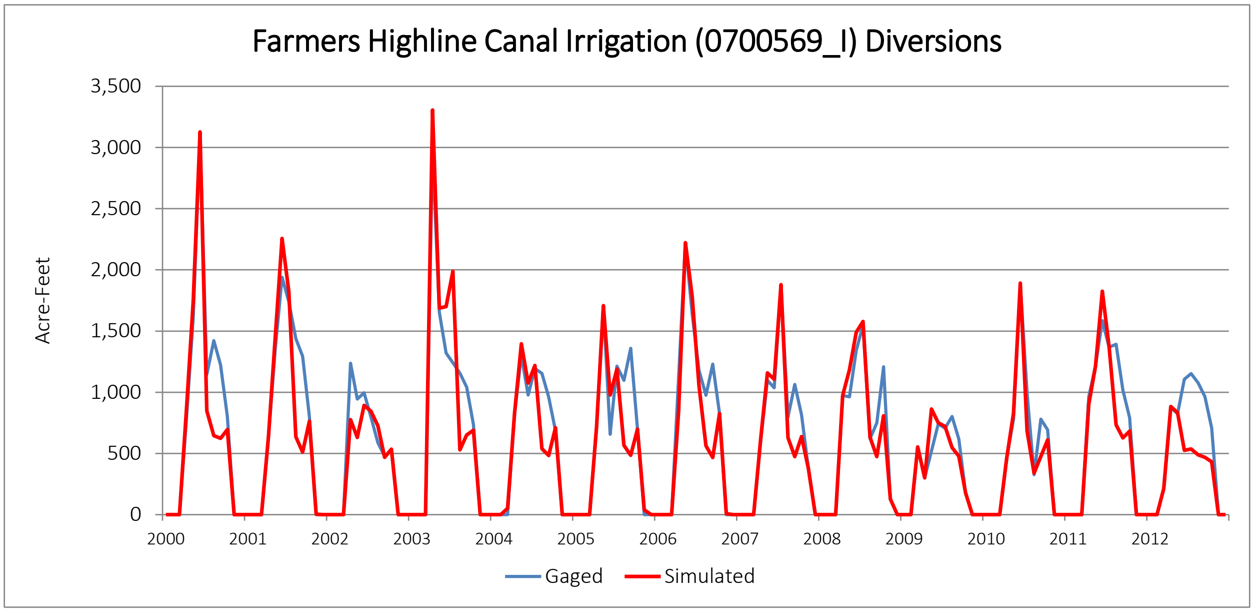


Figure 6-69: Farmers Highline Canal Irrigation Calibration

This example is a reflection of the level of calibration of the ditches in the Clear Creek Basin. The ditches may benefit from refining the split of diversions to irrigation, changed water rights, and storage, which would likely decrease the shortages experienced by the irrigation demand.

6.2.6.2 Irrigation Efficiencies

As discussed in Section 4.5.2.1, there are irrigation structures in the Clear Creek Basin that did not have representative irrigated acreae assigned in the CDSS acreage assessments. This issue was identified during initial calibration when the monthly efficiencies were reviewed. The acreage-based irrigation demand was small compared to the irrigation diversions, resulting in monthly system efficiencies between 5 and 15 percent. Those efficiencies are outside the range generally experienced by irrigation structures, therefore higher efficiencies were set and acreage-based demands were not used. This approach resulted in fewer return flows and improved the Clear Creek streamflow calibration.

6.2.6.3 Streamflow Calibration and the COSMIC Operations

In general, the streamflow calibration at the Derby gage is relatively good, however there are several months when the calibration is poor. This calibration issue was traced to the representation of the COSMIC agreement, which involves operations to release West Gravel Lake storage from specific accounts during the Croke season. These operations are essentially used to make reservoir capacity available to store the Golden and Coors bypassed flows, and are further complicated by the 4-Way Agreement and storage operations in Standley Reservoir. Actual operations of West Gravel Lakes include bookovers in lieu of these releases; however the modeled approach was taken due to the necessity of "coloring" specific water associated with the COSMIC operations. Significant effort has been spent on calibrating the COSMIC operations and additional calibration is not recommended at this time. Any future enhancements to bookover operations in StateMod should be reviewed for their application to the COSMIC operations.

6.2.6.4 Model Representation

As mentioned above, the complex operations in the Clear Creek Basin require an equally complex model representation. The South Platte Model was developed using the most recent StateMod version available, however "work arounds" were required to model the many operations. For example, the changed water right operations in StateMod are designed to divert the full consumptive use amount off of the river and replace the return flow obligations from a separate supply. For municipalities that do not have separate supplies to offset the obligations, they divert only the consumptive use portion. This operation in StateMod requires separate plan and diversion structures to model it accurately. Future enhancements to StateMod that may simplify these operations should be considered during future revisions to the South Platte Model.

6.2.7 Water Districts 1 and 64 (Lower South Platte River) Calibration

The Lower South Platte River Basin operations are dominated by irrigation use, off-channel reservoirs, augmentation plans and recharge, and the South Platte Compact. In general, the calibration of the irrigation structures and reservoirs is considered good, however the model is over-simulating streamflow into Water Districts 1 and 64. As shown in the graphs below, the over-simulation of streamflow at the Kersey gage is carried through the system down to the Julesburg gage. Specific calibration issues and recommendations are discussed in more detail below. model refinements that help mitigate streamflow calibration issues upstream will benefit the Lower South Platte calibration.

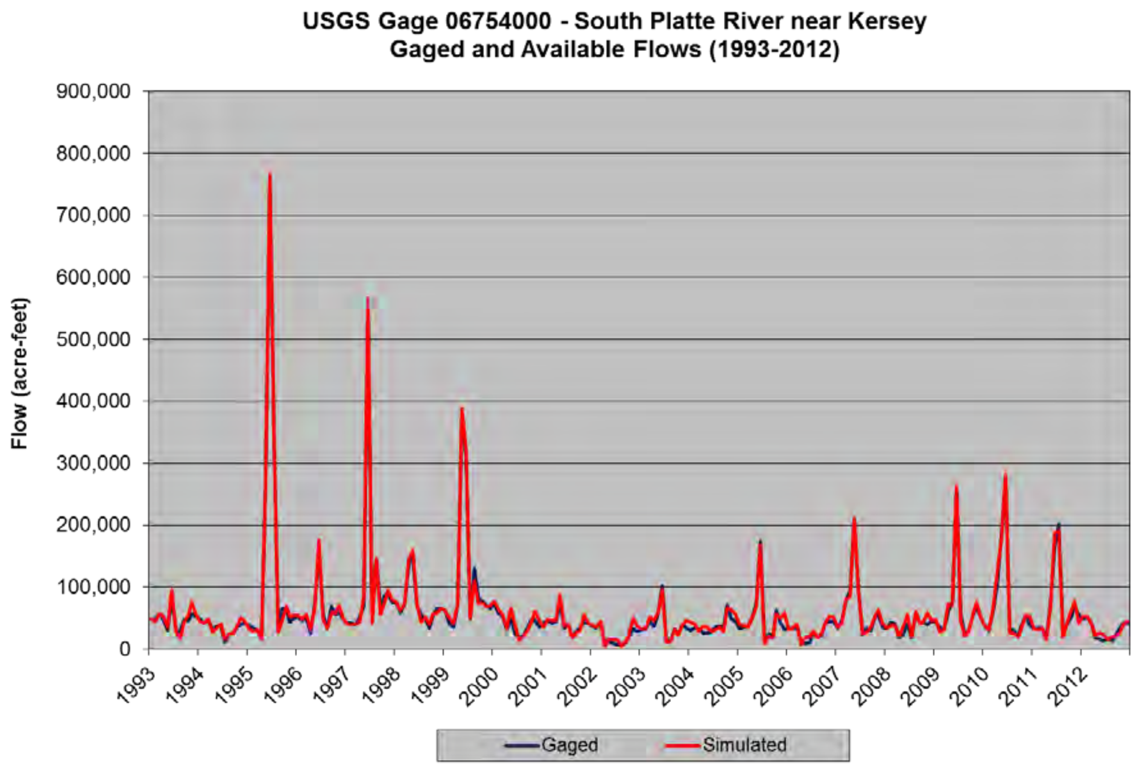
The following table presents the number of each structure type in the sub-basin:

	Diversions	Reservoirs	Well Only	Plans
Lower South Platte	58	46	83	111

The following tables present the average annual surface and ground water demand (af), the percent of demand that was met, and the associated M&I and irrigation consumptive use over the 1993 to 2012 period. See Table 7-6 for more information on the demand and consumptive use for specific structures.

	SW Demand(AF)	GW Demand (AF)	Total Demand (AF)	Percent Demand Met
Lower South Platte	636,000	410,000	1,046,000	100%

	Irrigation Consumptive Use (AF)	M&I Consumptive Use (AF)	Total Consumptive Use (AF)
Lower South Platte	535,000	21,000	556,000



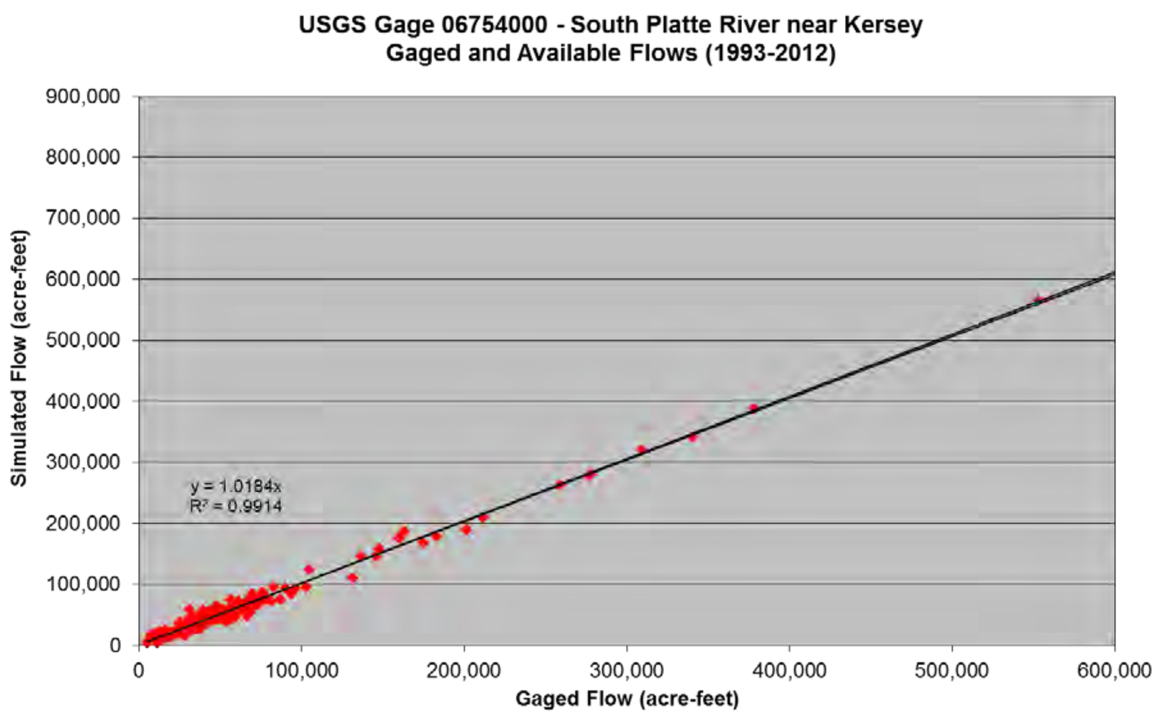
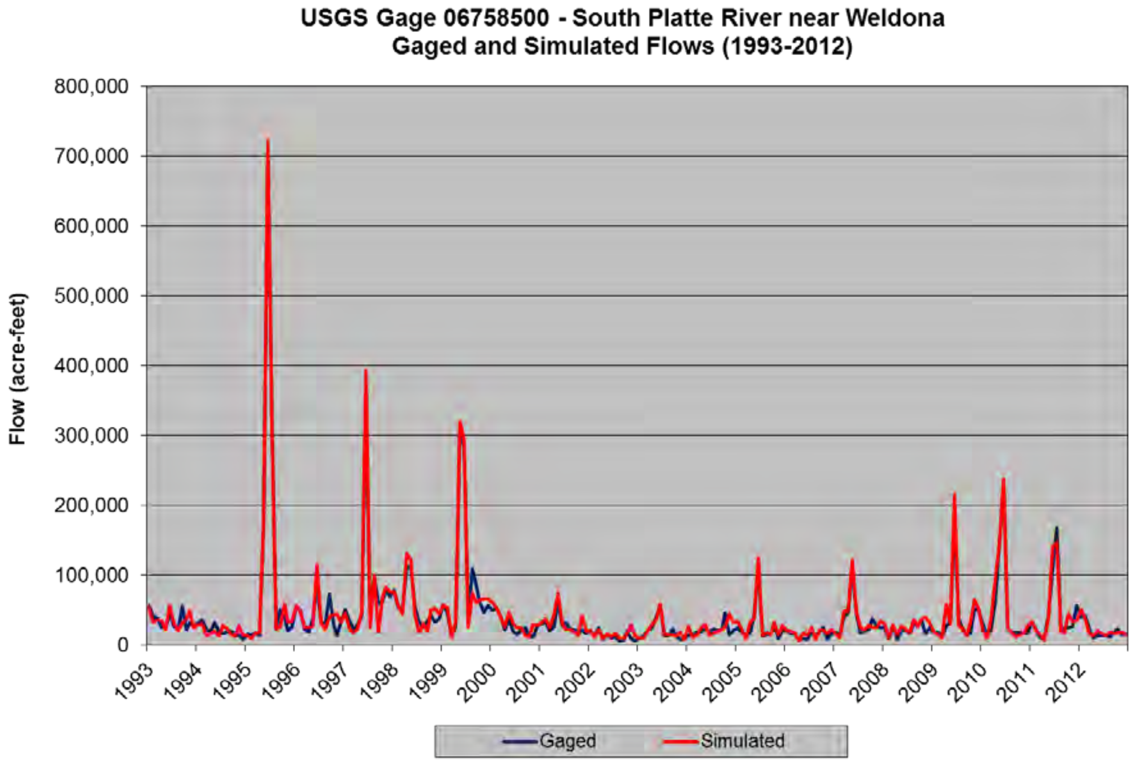


Figure 6-70: South Platte River near Kersey



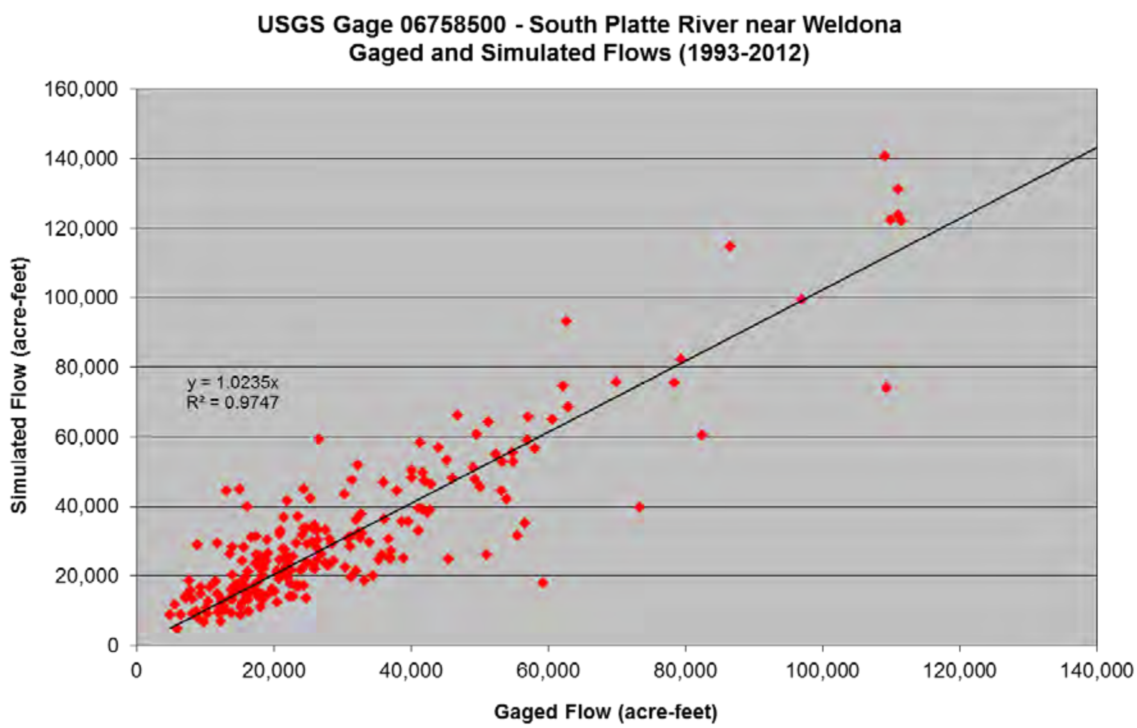
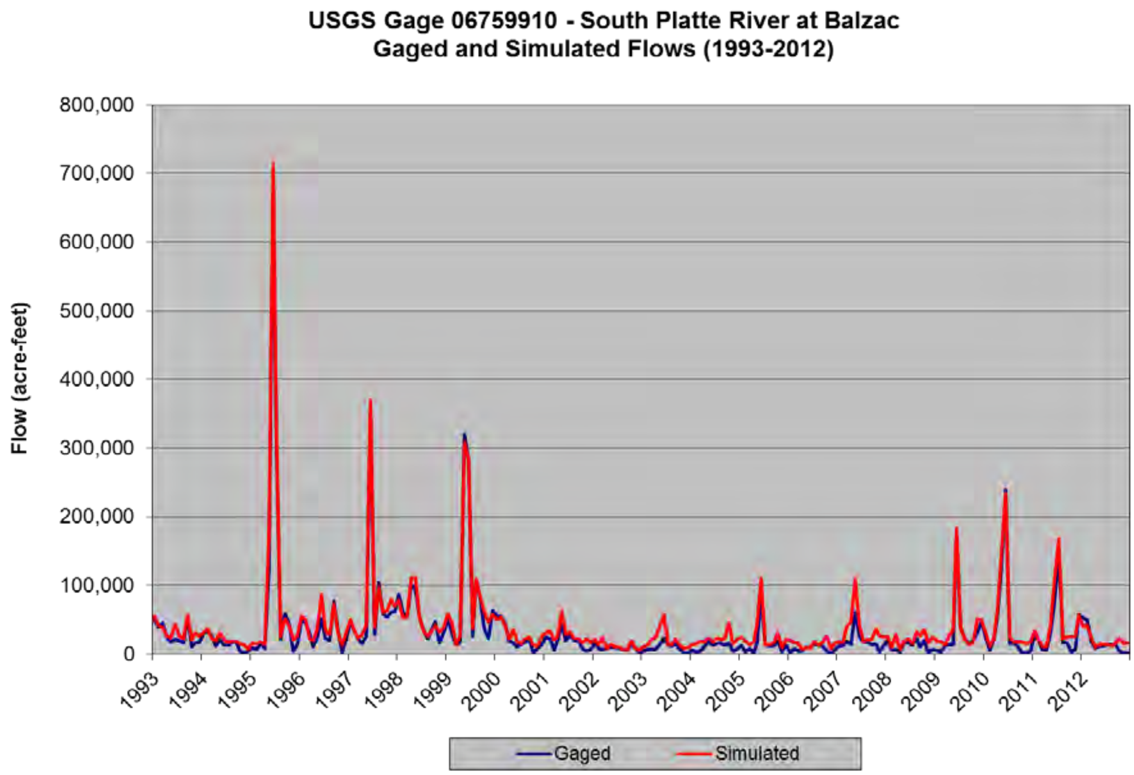


Figure 6-71: South Platte River near Weldona



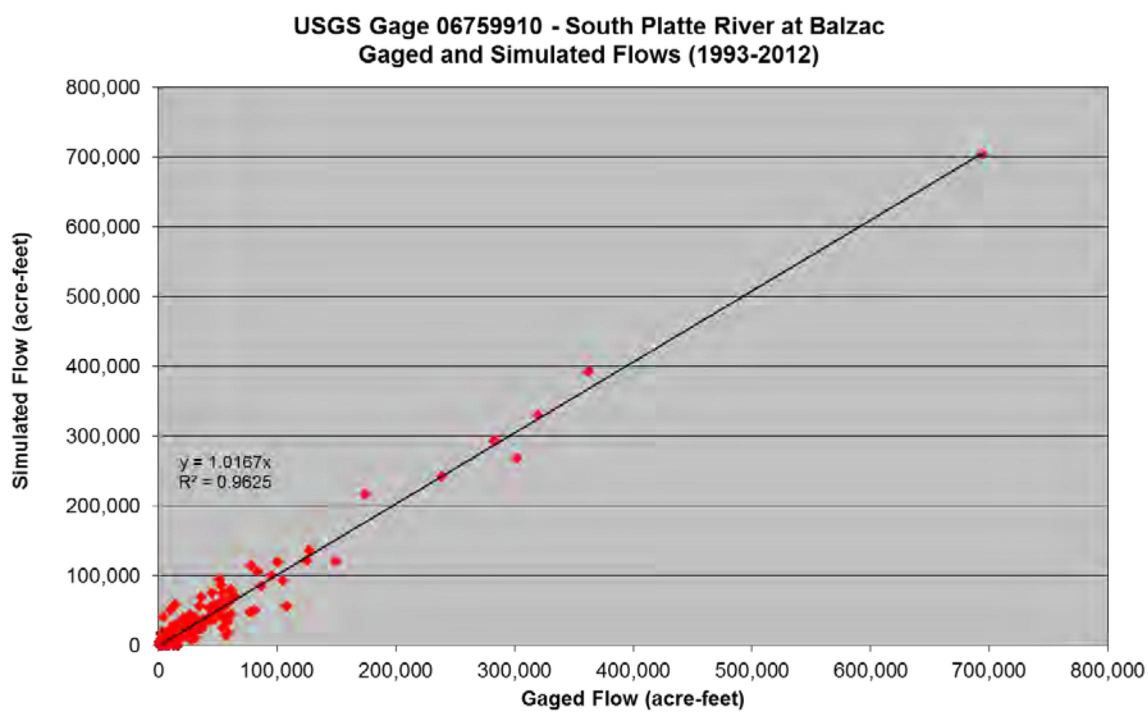
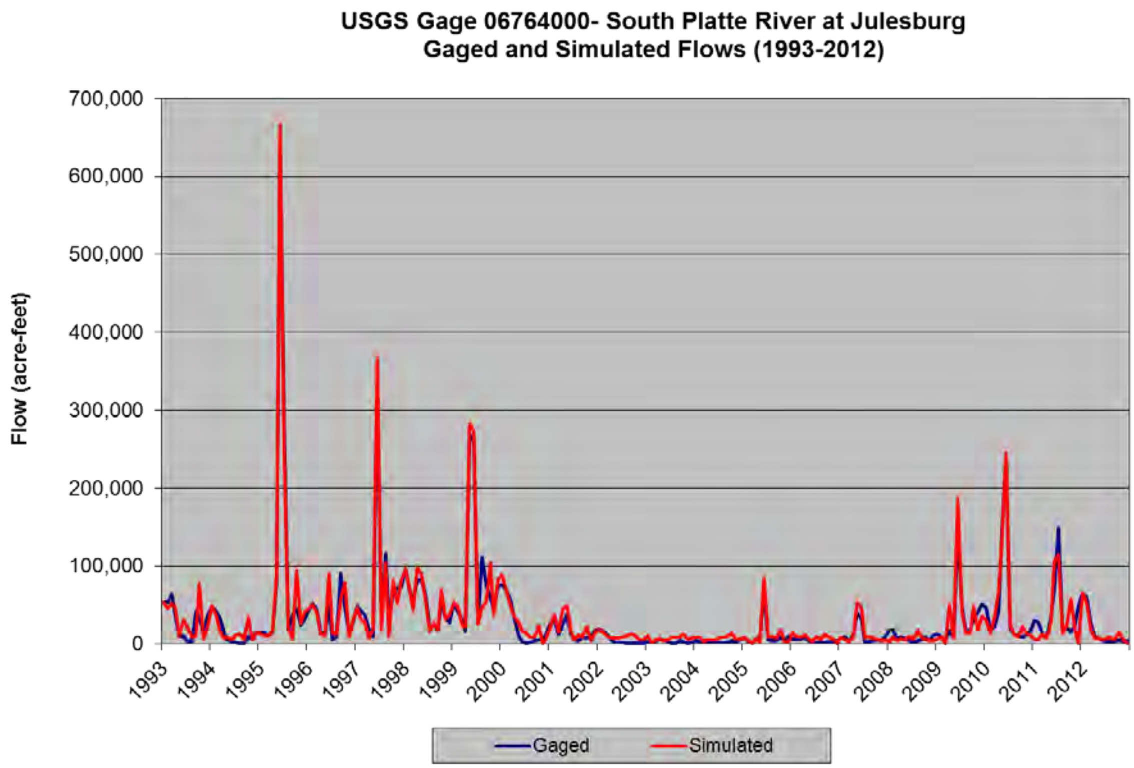


Figure 6-72: South Platte River at Balzac



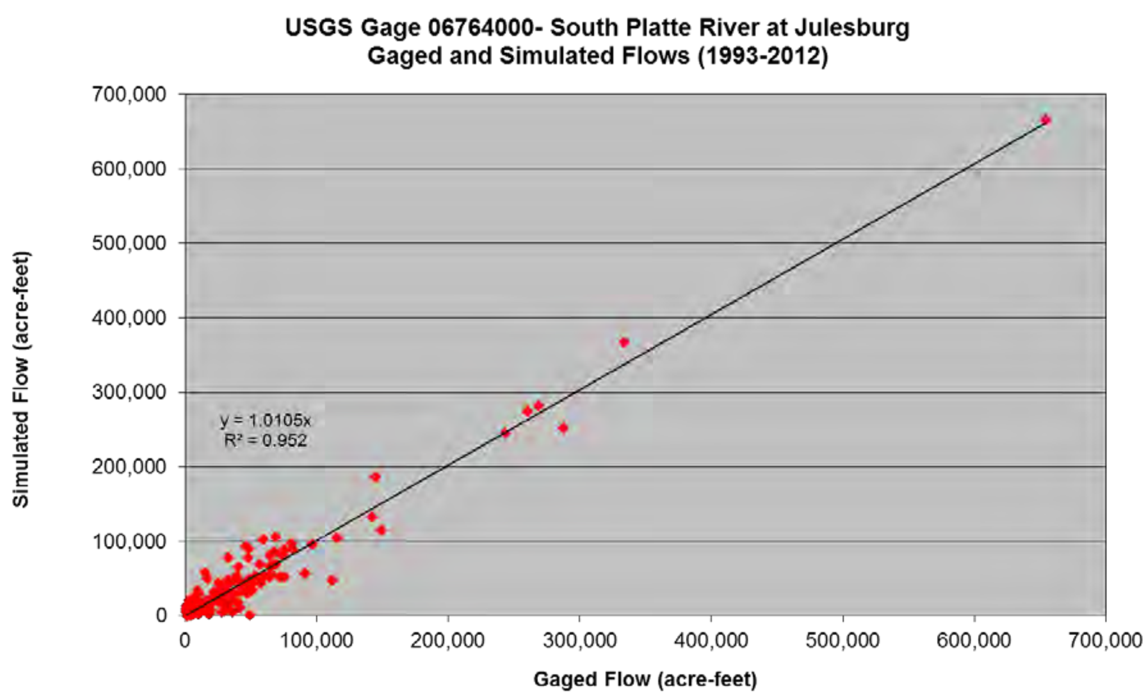


Figure 6-73: South Platte River at Julesburg Streamflow

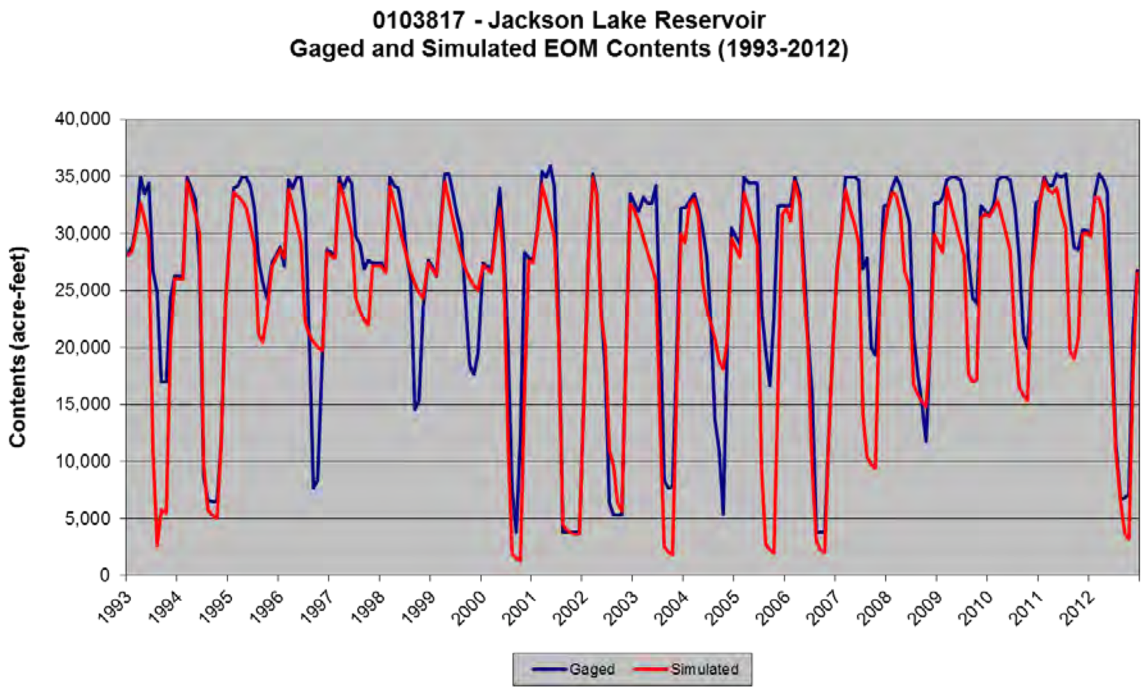


Figure 6-74: Jackson Lake Reservoir

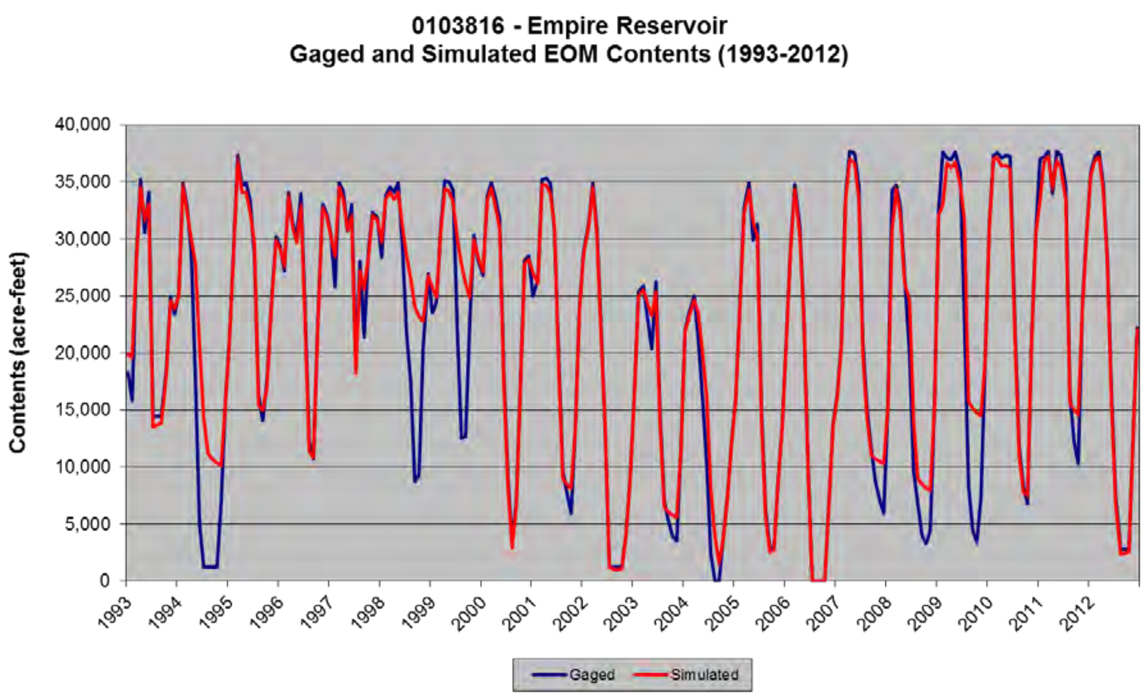


Figure 6-75: Empire Reservoir

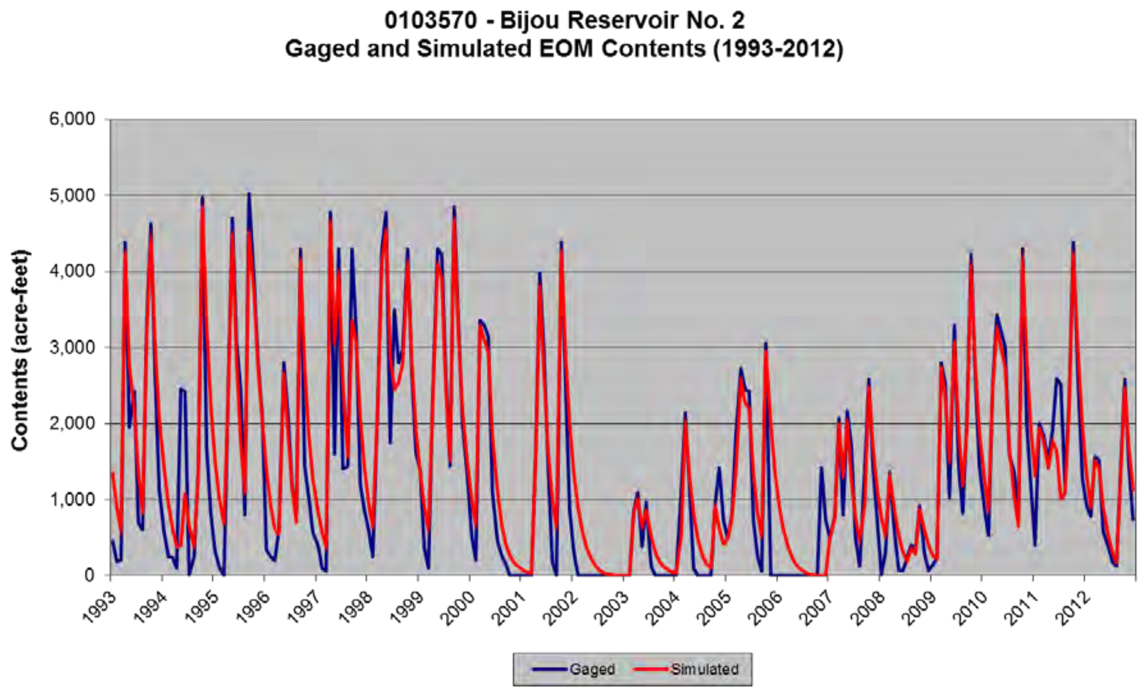


Figure 6-76: Bijou Reservoir No. 2

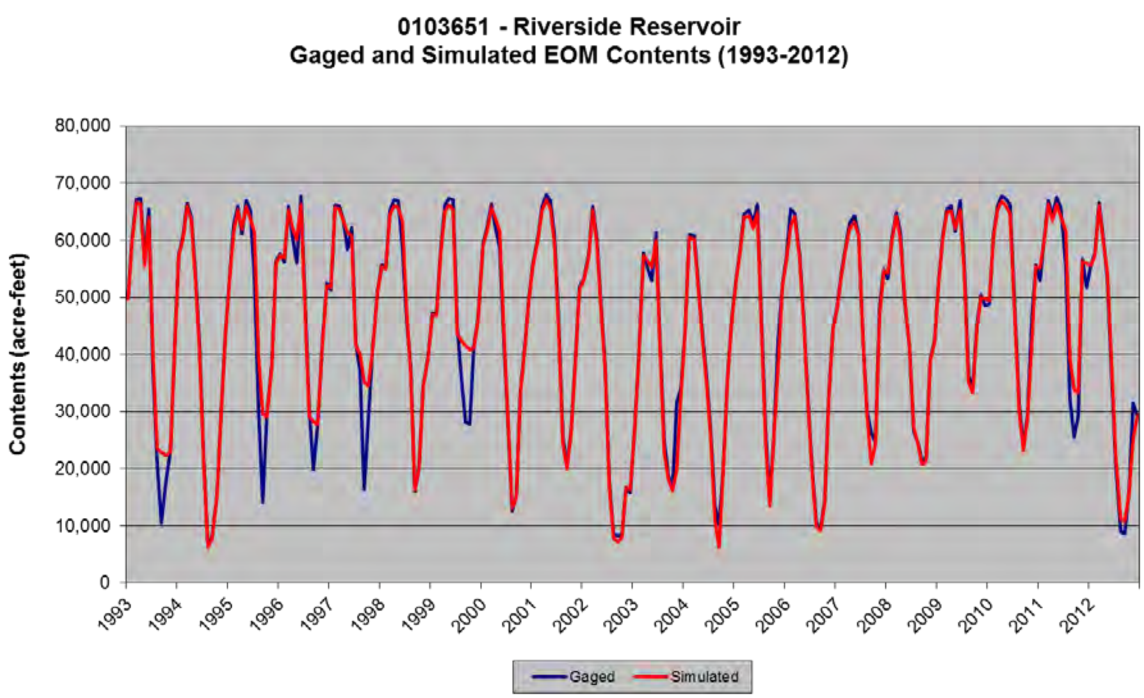


Figure 6-77: Riverside Reservoir

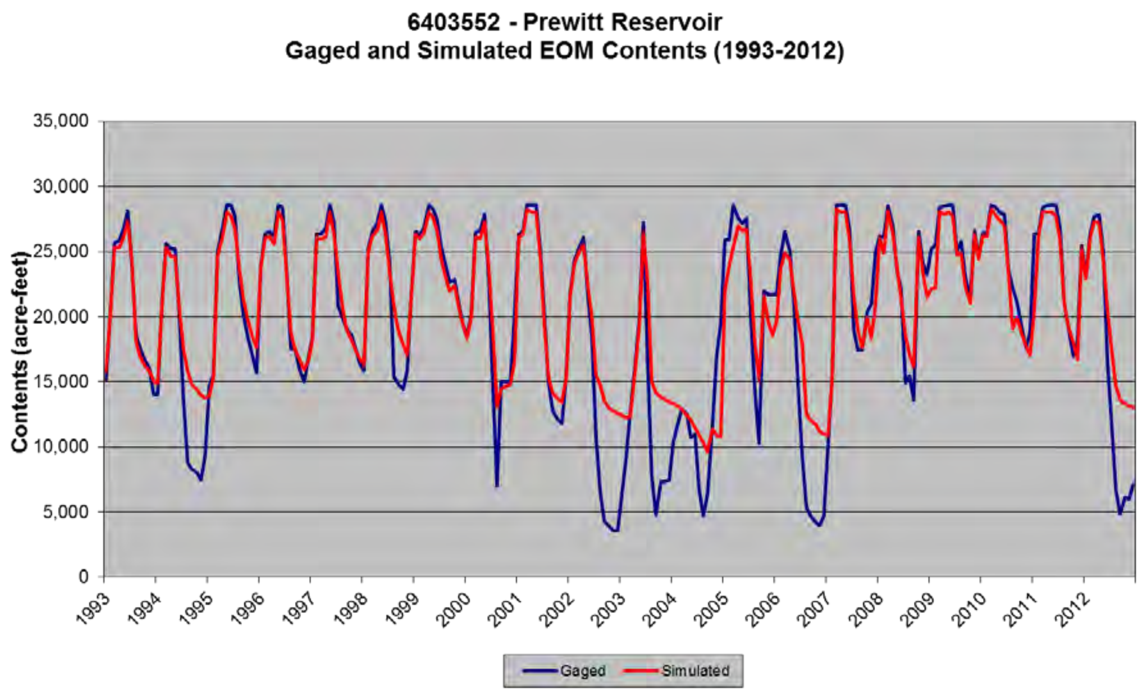


Figure 6-78: Prewitt Reservoir

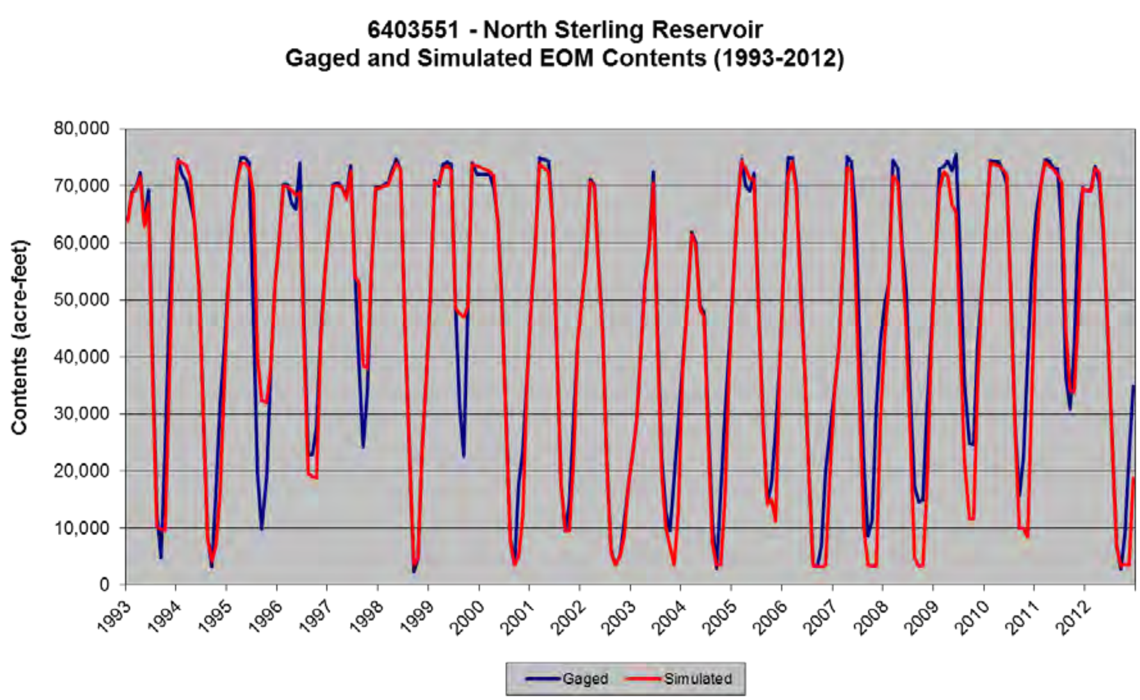


Figure 6-79: North Sterling Reservoir

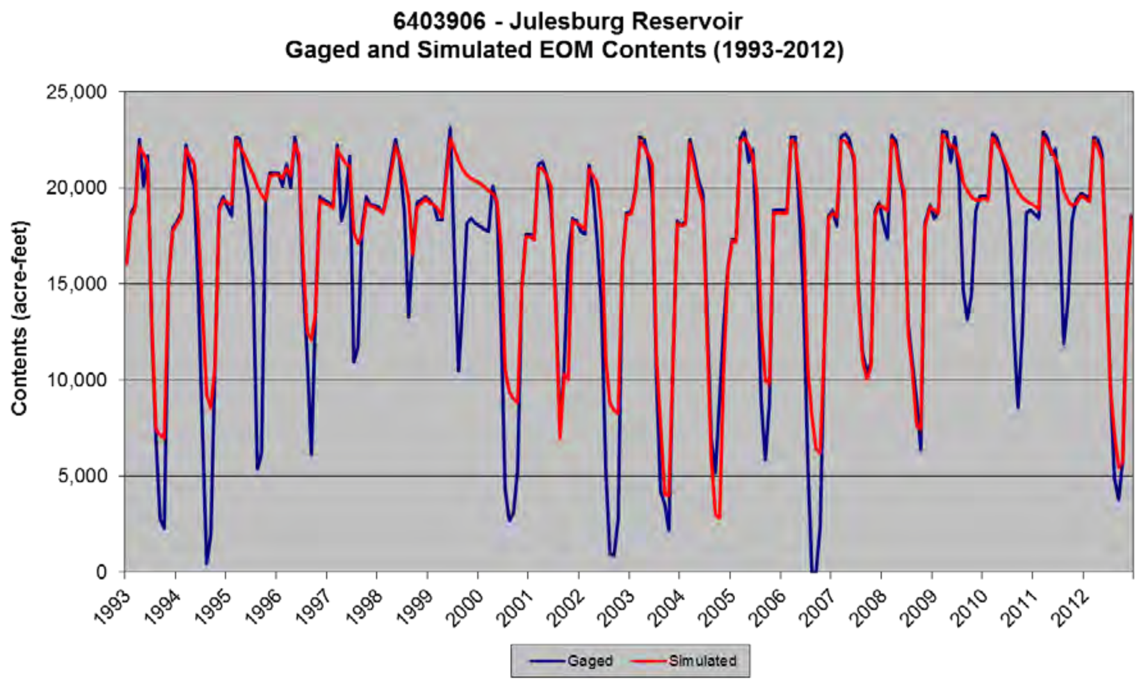


Figure 6-80: Julesburg Reservoir

6.2.7.1 Irrigation Use

There are over 300,000 irrigated acres in Water Districts 1 and 64; therefore irrigation operations were the focus of calibration. The Lower South Platte calibration is considered good, as the major reservoirs are simulating close to their historical contents and irrigation demands are generally met over the entire study period. Calibration issues that were encountered include:

- *Diversions to Multiple Demands.* Many of the structures in the Lower South Platte carry diversions to multiple demands, including irrigation, reservoir storage, and recharge. The diversions are simulated by the model based on the individual water rights decreed for each use according to strict priority, limited by the diversion structure capacity and the demands. The amount of storage water released from off-channel reservoirs to irrigation is not generally measured, therefore the model may over or under predict reservoir storage and releases. As shown in Figure 6-83 below, the result is poorer calibration of the total diversions on a monthly basis; even though irrigation demand is satisfied and calibration of off-channel reservoir contents is good. Additional constraints, including volumetric/seasonality limitations or variable recharge demands, could be added to the operating rules to better calibrate these diversions, however it would reduce the flexibility of these rules during future scenarios.

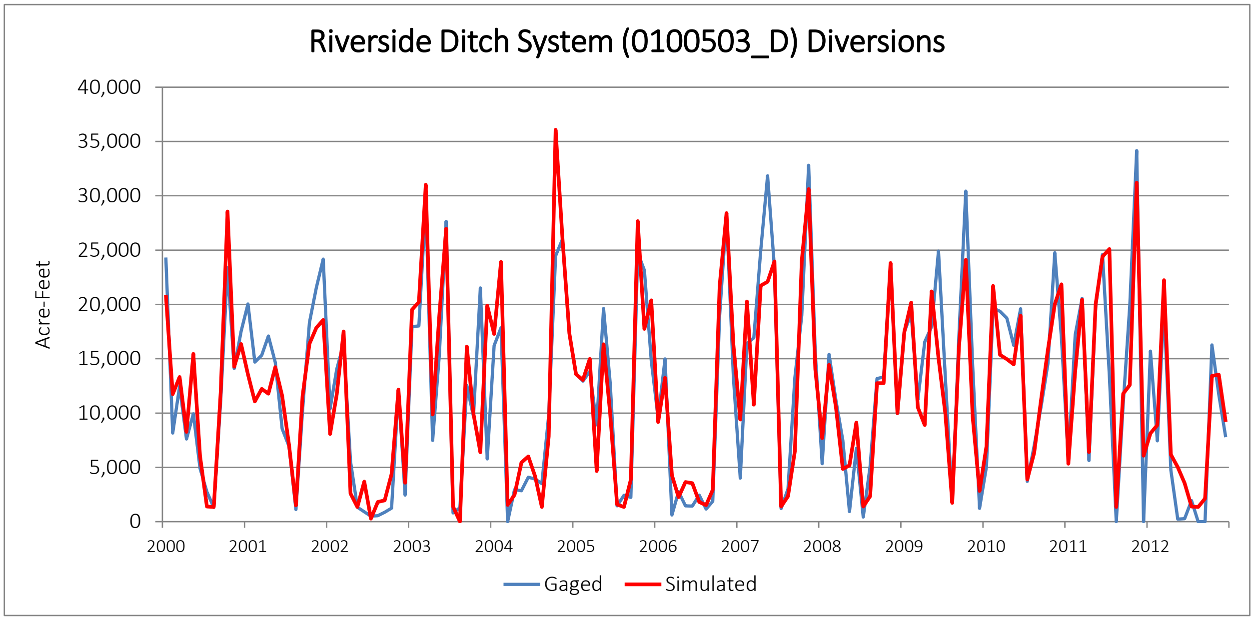


Figure 6-81: Riverside Ditch System Calibration

- *Reservoir Seepage*. SPDSS Task 5 interviews with reservoir operators indicated that Prewitt Reservoir, Bijou No. 2 Reservoir, Riverside Reservoir, Empire Reservoir and Jackson Reservoir incur significant seepage. Reservoir operators provided estimated seepage losses in either percent of volume or rate per day; these estimates were translated to seepage based on reservoir volume for use in StateMod during initial model development. Initial model results using this approach indicated the seepage estimates were greater than what has occurred historically. Therefore, during calibration, the reservoir seepage volumes were reduced in order to more closely calibrate diversions to storage and reservoir contents. In particular, seepage in Bijou No. 2 Reservoir, which is used as a supply for the Bijou Augmentation Plan, required significant calibration. An overestimate of seepage resulted in an overestimate of diversions; an underestimate of seepage resulted in an overestimate of reservoir contents. The seepage volumes currently included in the model were calibrated to a level that best reflected historical diversions at Bijou Canal and end-of-month contents at the reservoir, however there is still an over-simulation of total diversions at Bijou Canal.

- *Alternate Point to Well Operations*. There are diversion structures in the Lower South Platte that historically diverted surface water for irrigation, however the diversion structure no longer exists and wells have been decreed as alternate points of diversions for these water rights. Initial model development included a placeholder for a specific operating rule that would simulate the alternate point to well operations, however full implementation of this rule was not completed. Therefore the surface water rights were assigned to the wells for these alternate points so they could pump under the more senior right. While this accurately reflects how these alternate point wells are administered, future enhancement of StateMod code to handle these operations using specific operating rules is recommended.

- *Ground Water Pumping*. Pumping is estimated by StateCU based on crop irrigation water requirement for lands with either supplemental or ground water only supplies. As pumping records become available in HydroBase, estimated and metered pumping should be compared to determine if calibration of pumping estimates is necessary.

- *Intermittent Tributaries*. There are several creeks in the Lower South Platte that flow intermittently during large precipitation events or from irrigation return flows. These creeks generally have very limited or no streamflow records that could be used to verify the natural flow estimation. Creeks on the north side of the river, including Cedar, Pawnee, Crow, Cottonwood, Wildcat, Sand, and Lodgepole Creeks, are dry for much of the year and serve as the supply for a limited amount of irrigated acreage. Although these tributaries are included in the model, along with their respective surface water diversions and irrigated acreage, natural flow estimates were not developed for these tributaries and the irrigation demands can only be met by local return flows; therefore are shorted due to this lack of natural supply. Creeks on the south side of the river, including Lost, Kiowa, Bijou, and Camp Creeks, are within Designated Basins and, therefore, are modeled as hydrologically disconnected from the mainstem South Platte River. The acreage in these basins are primarily irrigated by ground water only, however there is a limited amount of acreage served by surface water. Similar to the north side creeks, natural flow was not developed for these tributaries and irrigation demands from surface water in these basins were shorted in the model. If streamflow records become available in the future, or the model is used to review operations on creeks specifically, then it is recommended natural flow estimates be developed for these creeks.

6.2.7.2 Augmentation Plans and Recharge Operations

Augmentation plan operations were specifically added to the StateMod code to support the development of the South Platte Model. The new functionality built on existing canal and reservoir seepage operations, allowing these depletions and accretions to be tracked using two specific plan types; augmentation plans and special augmentation plans. The largest 25 augmentation plans in the basin were modeled explicitly; depletions associated with the remainder of the augmentation plans are tracked in aggregate augmentation plans, however no supplies are included to offset these depletions.

The augmentation plans in the Lower South Platte model generally divert junior water rights to numerous recharge areas, and receive augmentation “credit” for in-ditch and recharge area seepage as it accrues to the river. Analysis of available historical diversion records indicate there is significant variability in the quantity of recharge actually diverted when in priority, and in the recharge areas under each ditch where the water is stored. This variability presented issues when calibrating the augmentation plan operations. During original model development, the full recharge water right was diverted when in-priority to an aggregate recharge area. As the seepage factor was set to empty the recharge area within the month, the recharge area always had an unmet demand (i.e. end-of-month target) and the model would continue to divert throughout the monthly time-step to meet this demand. This resulted in significant over-simulation of diversions to recharge that did not mimic historical operations. Therefore, the diversions to recharge were limited in order to better represent current operations. Historical records of diversions to recharge are not available over a long period in HydroBase; therefore the monthly averages from 2010 to 2012 were used for the entire model period. These calibration limits should be reviewed and/or revised before developing future scenarios.

In general, the approach discussed above provides sufficient accretions to meet the augmentation plan depletions. Note, however, the model does not “look forward” to curtail pumping if augmentation plan supplies are not sufficient to meet lagged depletions. Review of the plan summary output (*.xpl) does indicate shortages occur in some months in recent years, however they are not frequent or of significant magnitude. Periods when the recharge supplies are in excess of augmentation plan depletions are far more frequent, which is expected because diversions to recharge occur without future knowledge of streamflow conditions. Future refinement of the augmentation plan operations is recommended, potentially through review of augmentation plan accounting and additional calibration of Lower South Platte operations.

6.3 Future Enhancements

This section discusses the recommended future enhancements to the South Platte Model that should be considered during the next extension and/or revision to the model. Some of the enhancements listed below reflect StateMod code enhancements; the model should be revised to reflect the new functionality once implemented in the code. Note that there are some operational or structure-specific recommendations discussed in the Operating Rights File (Section 5.10) and Calibration Results (Section 6.2) that may not be fully captured in this section. They should however be reviewed and potentially addressed during the next model extension or revision if the specific structures or operations are impacted.

- *Cache la Poudre River Basin*. The Cache la Poudre Basin was excluded from the initial modeling effort due to the ongoing planning and permitted efforts in the basin. As the planning and permitting projects are finalized, this basin should be fully modeled during future model revisions

- *Irrigated Acreage Assessments in Municipal Areas*. It was identified during model calibration that the irrigation water requirement for some structures in Water Districts 7 and 8 was not representative of the diversions to irrigation. The irrigation water requirement is based on irrigated acreage assigned in the CDSS irrigated acreage coverages. These coverages generally exclude irrigated acreage within municipal boundaries, including parks and cemeteries. Water in these Districts irrigate acreage within municipal boundaries, it is likely that a portion of the acreage served by these ditches has not been identified in the acreage coverages, resulting in low ditch demand estimates. This issue was discussed with DWR staff during model calibration efforts; it is recommended this issue continue to be investigated as new CDSS acreage assessments are developed.

- *Create consistency between sub-basins.* Individual sub-basin models were developed independently by separate contractors and there are inconsistencies in the detail of modeled operations and the level of calibration achieved. Examples of these inconsistencies include varying approaches on developing return flow patterns; representation of changed water rights and return flow obligations; representation of diversions to recharge and augmentation for baseflows; and use of beginning/ending years for specific operations. It is recommended that during future updates, approaches be reviewed and a consistent approach adopted and implemented throughout the model.

- *Refinement of uses of imported supplies*. As discussed throughout the Calibration section, the operation of imports impacted calibration in every basin that received supplies. These issues stemmed from both operational decisions made by users regarding their imported supplies as well as the ease in which some imports can be transferred or leased among users. Although it is unlikely the model will achieve perfect calibration with these supplies, there are additional refinement efforts that can be taken to improve the use of these supplies. Review of the current model representation and results by major transmountain importers (e.g. Northern Water, Denver Water Board, and Aurora) is recommended in order to further refine the operations.

- *Recharge operation refinement*. The approach to recharge operations was adjusted during the South Platte Model development in order to limit the amount of recharge that was diverted to the aggregate recharge areas. The volumetric limits were based on recent diversion to recharge records available in HydroBase. Additional refinement of these limits could be made to better represent a longer term average of diversions, or StateMod enhancements could be made to provide an alternative method for limiting recharge diversions.

- *Inclusion of Prairie Waters Project*. Aurora Water's reuse project, Prairie Waters Project, was not included in the South Platte River basin model because it became fully operational after the 1950 – 2012 study period. This project is critical to both Aurora's municipal operations as well as the representation and administration of the South Platte River in the model and should be included in the next iteration of the model.

- *Lower St. Vrain Creek and Big Dry Creek baseflow gains and losses*. As discussed in the Calibration section, the baseflows at the St. Vrain Creek near Platteville (06731000) and the Big Dry Creek at Westminster (06720820) were problematic, resulting in significant negative baseflows during the winter months. Additional calibration efforts are recommended to mitigate remaining baseflow issues at these locations.

- *Integration with the SPDSS Ground Water Model.* The SPDSS consumptive use, surface water, and ground water models are integrated through the transfer of consumptive use, pumping, and return flow/recharge information. As the different modeling efforts have occurred in phases, there are integration components that have not been update and should be outlined and integrated during future ground water and/or surface water model revisions. These include but are not limited to:

  - Return flow patterns and locations currently in the surface water model were developed for each sub-basin using varying approaches. The ground water model should be used to develop return flow patterns and locations (i.e. unit response functions) for integration into the surface water model.

  - Revised irrigation return flow recharge, canal seepage, and co-mingled pumping information based on revised diversions reflected in the surface water model. In general, the total diversions were not adjusted, rather the portion of diversions to irrigation were revised to better reflect diversions to recharge and storage. These revisions impact the irrigation return flows, particularly during shoulder months of the irrigation season when these diversions are more frequent.

- *Update StateCU Documentation.* The SPDSS historical consumptive use analysis was revised during the surface water model development for irrigation structures. Revisions since the last documented dataset (SP2008) include extension from 2006 to 2012; inclusion of the 1997 and 2010 acreage coverages; refined ground water supply information; and refined diversion to irrigation estimates. Scope and budget was not allocated to develop the documentation for the revised dataset. It is recommended documentation be developed for this dataset and included on the CDSS website.

- *StateMod Code and DMI Tool Enhancements*. The StateMod, StateDMI, and TSTool codes were significantly enhanced during the development of the South Platte Model. There are additional recommended enhancements that were not addressed at the time because modelers developed options to “work-around” the code limitations or because of budget limitations. The enhancements that would be most applicable and valuable to the South Platte Model include:

  - Changed water rights operations that allow for only the consumptive use portion to be put into a plan structure. Currently the full changed water right amount is put into a plan and return flow obligations are supplied by other sources. This enhancement would simplify operations in Water District 2 and 7.

  - Water balance reporting to correctly account for water released from plans using a Type 27 rule. An issue with the water balance summary report (*.xwb) was identified during the Colorado River StateMod Model update and also affects the South Platte Model. This is only a reporting issue and does not impact the internal water balance.

  - Operating rules that allow tracking of reusable supplies associated with imported supplies. Additional plan structures were used in the South Platte Model to accomplish these operations; however implementation of this functionality would simplify import operations.

  - Operating rules that allow the release of changed water rights to meet augmentation requirements. Additional recharge areas were used in the South Platte Model to accomplish these operations; however implementation of this functionality would simplify augmentation operations in Water Districts 1, 2, and 64.

  - Correctly handle monthly import values equal to zero; they are currently reset in StateMod with an errant value. Zero values were reset to 1 af to allow simulation. Correction of this issue is recommended to avoid confusion associated with the revised values.

  - Enhance the functionality of the recharge and augmentation well operating rules (Type 37 and 44) to allow volumetric limits.

  - Complete the implementation of ground water only aggregate processing in StateDMI. Due to the problematic nature of processing ground water only aggregates based on irrigated parcels, a revised approach was developed to use well IDs to process the aggregates. The approach was implemented for the development of the well files (*.wes and *wer), but has not been completed for the acreage files (*.cds and *ipy) files. This implementation should be completed prior to the revision or extension of the SPDSS StateMod or StateCU models.

  - Implement a data-centered approach to developing the plan to well data file (*plw) in StateDMI. The process for developing this file, which associates well rights to augmentation plans based on information from HydroBase, currently requires external database/spreadsheet processing as documented in Section 7.8.

- *Daily Model*. A daily Model is typically developed to be able to simulate large and small flow events that occur within a monthly time step; investigate demands that vary within a monthly time step; or simulate demands served by junior water rights that may only be in-priority for a portion of the month. Ultimately a daily model will need to be developed for the South Platte River Basin in order to maximize its applicability for future planning efforts in the basin.

6.4 Future Scenarios

The South Platte Model is one representation of the historical operations in the basin. Users may choose to take the model and revise the operations or model representation to reflect specific operations or add detail to a specific tributary. For example, a municipal user may add detail to account for specific “color” of water associated with their operations, or alter the order of operations associated with their supplies. This would result in a modified historical dataset specific to their modeling needs.

Other uses may choose to develop “what-if” scenarios, in which a future operation is added to the model and the simulated results are compared to the original dataset results to determine the impact of the future operation. In these scenarios, generally only one modeling parameter is changed/revised during each simulation to isolate the impact of that specific operation. Some potential “what-if” scenarios include:

- *Revision to C-BT distribution*. The model can be revised to reflect different distribution of C-BT supplies to each sub-basin and/or water user. For example, one scenario may be to model C-BT deliveries based on current share ownership, as opposed to the historical distribution included in the model that reflects change in share ownership over time.

- *Revision to ground water supplies.* The ground water demands can be revised to reflect different scenarios. For example, a scenario may be to reflect current quotas/limitations on ground water pumping demands over the whole period.

- *Order of Operations.* The operating rules can be revised to reflect a different order of operations to meet municipal supplies. For example, a scenario may reflect the impact of taking a reservoir or water treatment plant out of operation for maintenance issues or dam restrictions. Alternatively, a model scenario can include new supplies and future demands to assist in water supply planning efforts to meet build-out demands.

7. Appendices

7.1 Direct Diversion Station File Summary

The table below summarizes the structures in the diversion station file (*.dds); see Section 5.4.1. for discussion regarding this summary table.

Table 7-1: Direct Diversion Station Summary (Average 1993 - 2012)

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
1	0100501	Empire Canal	450	0	0	0	Carrier
2	0100503_D	Riverside Div System	600	0	0	0	DivSys,Carrier
3	0100503_I	Riverside Irrigation	456	27,943	40	87,383	Irr
4	0100507_D	Bijou Div System	380	0	0	0	DivSys,Carrier
5	0100507_I	Bijou Irrigation	506	27,877	48	81,800	Irr
6	0100511	WELDON VALLEY DITCH	168	7,844	34	42,583	Irr
7	0100513	Jackson Lake Inlet	350	0	0	0	Carrier
8	0100514	Ft Morgan Canal	320	10,318	31	58,357	Irr
9	0100515	UPPER PLATTE BEAVER CNL	183	10,134	48	32,789	Irr
10	0100517	DEUEL SNYDER CANAL	35	1,439	43	6,784	Irr
11	0100518	LOWER PLATTE BEAVER D	173	12,362	51	27,464	Irr
12	0100519_D	Tremont Div System	83	3,847	47	8,874	Irr,DivSys
13	0100520	GILL STEVENS DITCH	1	559	61	0	Irr
14	0100524	TROWELL DITCH	90	514	63	0	Irr
15	0100525	TETSEL DITCH	30	1,127	40	5,972	Irr
16	0100526	JOHNSON EDWARDS DITCH	34	2,175	51	2,866	Irr
17	0100565	MAGUIRE DITCH	4	88	45	142	Irr
18	0100570	EAST GULCH DITCH	7	174	48	0	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
19	0100620	CONSOLIDATED LARSON D	4	284	53	67	Irr
20	0100687	N Sterling Div System	600	0	0	0	Carrier
21	0100687_I	N Sterling Irrigation	800	39,009	45	89,062	Irr
22	0100688	UNION DITCH	36	1,105	42	3,113	Irr
23	0100829	Prewitt Res Inlet	450	0	0	0	Carrier
24	0103576	BRAMKAMP RES	1	0	64	0	Irr
25	0103817_I	Jackson Irrigation	500	342	44	293	Irr
26	01_ADP037	South Platte River below	1	806	63	0	Irr,Agg
27	0200800	Farmers Gardeners Ditch	11	0	36	275	Carrier
28	0200802	Burlington Canal	614	0	0	0	Carrier
29	0200805	Denver Hudson Canal	357	0	0	0	Carrier
30	0200805_I	Henrylyn Irrigators	999	25,909	62	26,135	Irr
31	0200806	Gardeners Ditch	11	0	36	0	Irr
32	0200808	Fulton Ditch	162	0	0	0	Carrier
33	0200808_A	Fulton Aug Stn	999	0	0	0	Carrier
34	0200808_I	Fulton Irrig Div	999	6,736	49	28,147	Irr
35	0200809	BRANTNER DITCH	86	3,850	45	19,816	Irr
36	0200810	Brighton Ditch	50	0	0	0	Carrier
37	0200810_A	Brighton Aug Stn	999	0	0	0	Carrier
38	0200810_I	Brighton Irrig Div	999	1,592	41	9,008	Irr
39	0200812	Lupton Bottom Ditch	111	0	0	0	Carrier
40	0200812_A	Lupt Btm Aug Stn	999	0	0	0	Carrier
41	0200812_I	Lupton Bottom Irrig Div	999	3,172	38	16,375	Irr
42	0200813	Platteville Ditch	120	0	0	0	Carrier

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
43	0200813_A	Platteville Aug Stn	999	0	0	0	Carrier
44	0200813_I	Platteville Irrig Div	999	3,586	38	21,705	Irr
45	0200817	Evans No 2 Ditch	264	0	0	0	Carrier
46	0200817_I	Evans No 2 Irrigators	999	13,568	66	24,263	Irr
47	0200821	MEADOW ISLAND 1 DITCH	52	1,151	32	6,905	Irr,Carrier
48	0200821_A	Mdw Isl 1 Aug Stn	999	0	0	0	Carrier
49	0200822	MEADOW ISLAND DITCH	59	2,422	50	11,114	Irr
50	0200822_A	Mdw Isl 2 Aug Stn	999	0	0	0	Carrier
51	0200824	Farmers Indep Ditch	115	0	0	0	Carrier
52	0200824_A	Farm Ind Aug Stn	999	0	0	0	Carrier
53	0200824_I	Farmers Indep Irrig Div	999	4,709	47	16,355	Irr
54	0200825	Hewes Cook Ditch	118	0	0	0	Carrier
55	0200825_A	Hewes Cook Aug Stn	999	0	0	0	Carrier
56	0200825_I	Hewes Cook Irrig Div	999	5,879	54	19,860	Irr
57	0200826	JAY THOMAS DITCH	18	207	26	1,025	Irr
58	0200828	Union Ditch	159	0	0	0	Carrier
59	0200828_I	Union Ditch Irrigators	999	4,578	38	23,472	Irr
60	0200830	SECTION NO 3 DITCH	58	1,184	33	8,613	Irr,Carrier
61	0200830_A	Sec No 3 Aug Stn	999	0	0	0	Carrier
62	0200834	Lower Latham Ditch	251	0	0	0	Carrier
63	0200834_I	Lower Latham Irrigators	999	9,470	49	35,613	Irr
64	0200836	PATTERSON DITCH	28	660	30	5,359	Irr
65	0200837	Highland Ditch	25	0	0	0	Carrier
66	0200837_A	Highland Aug Stn	999	0	0	0	Carrier
67	0200837_I	Highland Irrig Div	999	502	34	3,686	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
68	0200871	WHIPPLE DITCH	137	5,447	46	16,145	Irr
69	0200872	GERMAN DITCH	18	647	48	1,870	Irr
70	0200873	BIG DRY CREEK DITCH	13	678	49	944	Irr
71	0200874	YOXALL DITCH	10	321	51	498	Irr
72	0200915	Little Burlington	150	4,408	49	12,418	Irr
73	0200992	Westminster Standley PL2	999	0	0	0	Carrier
74	0200993	Northglenn Standley PL	999	0	0	0	Carrier
75	0200994	Thornton Standley PL	999	0	0	0	Carrier
76	0203837_C	O'Brian Canal	319	0	0	0	Carrier
77	0203837_I	Barr Irrigators	999	19,795	65	41,125	Irr
78	0203876_I	Milton Irrigators	999	11,350	66	19,832	Irr
79	02_ADP003	WD2 Agg SW Divn	999	373	30	4,303	Irr,Agg
80	02_ChrkPP	Cherokee Power Plant	17	0	75	9,250	M/I
81	02_Nglenn_I	Northglenn Indoor Dem	999	0	10	3,060	M/I
82	02_Nglenn_O	Northglenn Outdoor Dem	999	0	83	2,067	M/I
83	02_Thorn_I	Thornton Indoor Dem	999	0	10	11,091	M/I
84	02_Thorn_O	Thornton Outdoor Dem	999	0	83	8,513	M/I
85	02_VRNPP	Ft St Vrain Power Plant	6	0	80	2,940	M/I
86	02_Westy_I	Westy Indoor Dem	999	0	10	8,887	M/I
87	02_Westy_O	Westy Outdoor Dem	999	0	83	8,605	M/I
88	0400501	Barnes Ditch	735	0	0	0	Carrier
89	0400502	BIG T PLATTE R DITCH	71	1,351	36	10,070	Irr
90	0400503	BIG THOMPSON DITCH & MAN	32	790	40	4,329	Irr
91	0400511	Loveland Pipeline	72	0	0	0	Carrier
92	0400517	EVANSTOWN DITCH	32	245	26	8,778	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
93	0400518_I	Estes Park Indoor Dem	999	0	10	1,022	M/I
94	0400518_O	Estes Park Outdoor Dem	999	0	83	568	M/I
95	0400519	FARMERS IRRIGATION CANAL	40	1,741	48	5,411	Irr
96	0400520	George Rist Ditch	713	0	0	0	Carrier
97	0400520_I	George Rist Irrigation	713	291	58	790	Irr
98	0400521	Handy Ditch	2471	0	0	0	Carrier
99	0400521_I	Handy Irrigation	2471	8,659	61	11,113	Irr
100	0400522	HILL BRUSH DITCH	23	447	42	2,038	Irr
101	0400523	HILLSBOROUGH DITCH	109	5,897	49	15,782	Irr
102	0400524	Home Supply Ditch	325	0	0	0	Carrier
103	0400524_I	Home Supply Irrigation	325	16,013	60	18,748	Irr
104	0400530	Louden Ditch	940	0	0	0	Carrier
105	0400530_I	Louden Irrigation	128	2,247	59	8,568	Irr
106	0400532	Loveland Greeley Ditch	220	0	0	0	Carrier
107	0400532_I	Loveland Greeley Irrigat	920	16,275	63	31,539	Irr
108	0400534	MARIANA DITCH	3	17	35	239	Irr
109	0400540	DILLE TUNNEL	365	0	0	0	Carrier
110	0400541	RIST GOSS DITCH	10	11	37	206	Irr
111	0400543	South Side Ditch	196	0	0	0	Carrier
112	0400543_I	South Side Irrigation	19	1,037	60	2,159	Irr
113	0400561	BLACK CANNON DITCH	3	91	49	149	Irr
114	0400574	BUCKHORN HIGHLINE DITCH	6	8	44	163	Irr
115	0400578	KIRCHNER DITCH	4	25	49	197	Irr
116	0400580	PERKINS DITCH	8	156	54	171	Irr
117	0400582	UNION DITCH	15	59	38	145	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
118	0400583	VICTORY IRR CNL	11	145	47	136	Irr
119	0400587	BEELINE DITCH	40	0	0	1,791	Irr
120	0400588	Boulder Larimer Ditch	400	0	0	0	Carrier
121	0400588_I	Boulder Larimer Irrigati	300	2,632	56	5,462	Irr
122	0400592	EAGLE DITCH	7	70	40	191	Irr
123	0400596	JIM EGLIN DITCH	4	201	47	153	Irr
124	0400599	MINER LONGAN DITCH	12	162	44	563	Irr
125	0400600	OSBORNE CAYWOOD DITCH	7	120	29	737	Irr
126	0400601	ROCKWELL D ROCKWELL P P	9	177	42	968	Irr
127	0400602	SUPPLY LATERAL DITCH	15	1,006	50	1,171	Irr
128	0400603	W R BLOWER DITCH 1	7	238	49	477	Irr
129	0400691	Hansen Feeder Canal	930	0	0	0	Carrier
130	0400691_I	Hansen Feeder Irrigation	999	1,834	63	1,608	Irr
131	0400691_L	Hansen Fdr to Lvlnd Res	67	0	0	0	Carrier
132	0400691_X	HansenFdrTtoHorse	485	0	100	0	Export
133	0400692	St. Vrain Supply Canal	999	0	0	0	Carrier
134	0400692_I	St. Vrain Irrigation	999	444	60	1,408	Irr
135	0400692_L1	StVrTurnoutToLittleT	85	0	0	0	Return
136	0400692_L2	St Vr divn to Hertha Res	25	0	0	0	Carrier
137	0400692_X	ExportToStVr&BldrCk	462	0	100	0	Export
138	0400702	Greeley Boyd Filter Plan	999	0	100	0	M/I
139	0401000	Olympus Tunnel	587	0	0	0	Carrier
140	0401000_R	Return point for Olympus Tunnel	1	0	0	0	Return
141	0401001	Big T Power Plant	500	0	0	63,238	Return
142	0401002	Hansen Feeder Wasteway	900	0	0	9,867	Return

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
143	0404634	Adams Tunnel	550	0	0	0	Import
144	04_AUP002_I	Little T Wtr Dist In	999	0	10	2,091	M/I,Agg
145	04_AUP002_O	Little T Wtr Dist Out	999	0	83	1,648	M/I,Agg
146	04_Lovelnd_I	Loveland Indoor Dem	999	0	10	6,359	M/I
147	04_Lovelnd_O	Loveland Outdoor Dem	999	0	83	7,085	M/I
148	0500511	LONGMONT NORTH PIPELINE	50	0	0	0	Carrier
149	0500512	LYONS PIPELINE	3	0	0	0	Carrier
150	0500513	DAVE MILLER DITCH	3	25	45	102	Irr
151	0500519	REESE STILES DITCH	4	32	44	194	Irr
152	0500520	SOUTH LEDGE DITCH	11	99	44	687	Irr
153	0500522	LONGMONT SOUTH PIPELINE	3	0	0	0	Carrier
154	0500523	SUPPLY DITCH	141	4,594	47	9,686	Irr
155	0500526	HIGHLAND DITCH	335	0	0	0	Carrier
156	0500526_I	Highland Ditch Irrigation	335	28,843	60	35,043	Irr
157	0500527	ROUGH READY DITCH	77	1,682	48	5,655	Irr
158	0500528	ST VRAIN PALMERTON DITCH	28	874	39	5,178	Irr
159	0500529	SWEDE DITCH	48	1,565	50	3,463	Irr
160	0500530	SMEAD DITCH	14	250	41	852	Irr
161	0500531	MONTGOMERY PRIVATE DITCH	4	0	31	14	Irr
162	0500532	FOOTHILLS INLET	85	0	0	0	Carrier
163	0500534	GOSS PRIVATE DITCH 1	5	161	48	340	Irr
164	0500535	CLOUGH/TRUE DITCH	6	62	29	268	Irr
165	0500536	CLOUGH PRIVATE DITCH	8	49	36	560	Irr
166	0500537	WEBSTER MCCASLIN DITCH	5	169	47	539	Irr
167	0500538	TRUE WEBSTER DITCH	5	52	38	549	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
168	0500539	JAMES DITCH	19	579	49	2,011	Irr
169	0500542	DAVIS DOWNING DITCH	15	496	44	1,847	Irr
170	0500545	LONGMONT SUPPLY DITCH	37	182	39	2,395	Irr
171	0500546	CHAPMAN MCCASLIN DITCH	8	164	43	761	Irr
172	0500547	OLIGARCHY DITCH	216	0	0	0	Carrier
173	0500547_I	Oligarchy Irrigation	665	1,408	58	4,584	Irr
174	0500548	DENIO TAYLOR DITCH	9	83	41	764	Irr
175	0500549	RUNYAN DITCH	5	36	30	438	Irr
176	0500550	PECK DITCH	27	256	45	762	Irr
177	0500551	PELLA DITCH	27	84	45	404	Irr
178	0500552	CLOVER BASIN DITCH	15	56	48	245	Irr
179	0500553	HAGERS MEADOW DITCH	6	38	26	832	Irr
180	0500554	NIWOT DITCH	17	235	39	975	Irr
181	0500557	NORTHWEST MUT INS CO D	3	50	36	480	Irr
182	0500558	SOUTH FLAT DITCH	12	169	42	1,007	Irr
183	0500559	CUSHMAN DITCH	6	31	38	169	Irr
184	0500560	BECKWITH DITCH	12	32	34	655	Irr
185	0500561	ISLAND DITCH	4	0	36	254	Irr
186	0500563	BONUS DITCH	21	465	34	1,765	Irr
187	0500564	LAKE DITCH	27	0	0	0	Carrier
188	0500564_I	Lake Ditch Irrigation	23	674	59	1,500	Irr
189	0500565	HALDI DITCH	51	339	28	3,749	Irr
190	0500568	CROCKER DITCH	6	653	42	304	Irr
191	0500569	TABLE MOUNTAIN DITCH	19	760	43	1,777	Irr
192	0500570	BADER DITCH 1 & 2	3	123	42	285	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
193	0500571	JOHNSON DITCH	4	162	42	393	Irr
194	0500572	STAR DITCH	17	707	42	1,599	Irr
195	0500573	HINMAN DITCH	11	537	42	1,092	Irr
196	0500574	HOLLAND DITCH	25	1,472	42	2,289	Irr
197	0500575	WILLIAMSON DITCH	25	877	42	2,298	Irr
198	0500589	LAST CHANCE DITCH	76	1,440	38	11,609	Irr
199	0500601	ZWECK TURNER DITCH	23	260	33	2,251	Irr
200	0500602	JAMES MASON DITCH	3	0	43	178	Irr
201	0500603	LEFT HAND DITCH DIVERSIO	400	0	0	15,272	Carrier
202	0500619_a	SPURGEON TREATMENT PLANT	999	0	88	2,194	M/I
203	0500619_b	DODD TREATMENT PLANT DEM	999	0	88	1,965	M/I
204	0500648	TOLL GATE DITCH	11	294	41	968	Irr
205	0500939	Goosequill Pump Station	8	0	0	0	M/I
206	05LONG_IN	LONGMONT INDOOR DEMAND	500	0	10	8,886	M/I
207	05LONG_OUT	LONGMONT OUTDOOR DEMAND	500	0	83	5,868	Irr,M/I
208	05_ADP001	Aggregated Diversion Str	500	416	47	3,188	Irr,Agg
209	05_ADP002	Aggregated Diversion Str	500	54	48	1,068	Irr,Agg
210	05_BRCBT	BOULDER RESERVOIR C-BT	500	0	0	0	Import
211	05_GLRIN	GOLD LAKE INLET	500	0	0	0	Carrier
212	05_LHBR	Boulder Res Left Hand In	64	0	0	0	Carrier
213	05_LHCBT	LEFT HAND C-BT INFLOW	500	0	0	0	Import
214	05_LHVRIN	LEFT HAND VALLEY RES INL	500	0	0	0	Carrier
215	05_LongCBT	LONGMONT C-BT DELIVERY	500	0	0	0	Import
216	05_SBRANCH	South Branch Diversion S	261	0	0	0	Carrier
217	05_SVCBT	ST VRAIN C-BT INFLOW	500	0	0	0	Import

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
218	0600501	Anderson Carrier	31	0	0	0	Carrier
219	0600501_C	Anderson Carrier	27	0	0	0	Carrier
220	0600501_I	Anderson Irrigation	17	30	25	1,660	Irr
221	0600513	BOULDER LEFT HAND DITCH	18	1,262	47	1,723	Irr
222	0600515_D	Boulder and Weld Co Ditch	35	2,079	44	3,197	Irr,DivSys
223	0600516	Boulder White Rock Carrier	100	0	0	0	Carrier
224	0600516_I	Boulder White Rock Irrig	113	5,699	60	14,379	Irr
225	0600518	BUTTE MILL DITCH	14	316	42	992	Irr
226	0600520_D	CARR TYLER DITCH	6	0	48	213	DivSys
227	0600523	DELEHANT DITCH	4	95	46	262	Irr
228	0600525	FARMERS DITCH	56	1,464	47	5,037	Irr,Carrier
229	0600527	GODDING DAILEY PLUMB D	32	508	47	2,810	Irr
230	0600528	GREEN DITCH	16	370	40	2,297	Irr
231	0600532	HIGHLAND SOUTH SIDE DITC	47	554	47	4,490	Irr
232	0600534	HOUCK 2 DITCH	7	10	32	337	Irr
233	0600536	HOWELL DITCH	6	93	40	642	Irr
234	0600537	Leggett Carrier	56	0	0	0	Carrier
235	0600537_I	Leggett Irrigation	45	3,225	63	6,030	Irr
236	0600538_D	Lower Boulder Ditch	211	0	0	0	DivSys,Carrier
237	0600538_I	Lower Boulder Irrigation	114	5,280	61	13,273	Irr
238	0600542	MC CARTY DITCH	4	0	30	118	Irr
239	0600543	N BOULD FARMER DITCH	36	501	38	5,158	Irr
240	0600551	RURAL DITCH	50	497	32	7,002	Irr
241	0600553	SMITH EMMONS DITCH	22	300	45	1,048	Irr
242	0600554	SMITH GOSS DITCH	7	5	50	723	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
243	0600560	ANDREWS FARWELL DITCH	6	76	45	203	Irr
244	0600564_D	Community Ditch	189	0	0	0	DivSys
245	0600564_I	Community Ditch	97	2,845	60	4,740	Irr
246	0600565	Leyner Cottonwood Carrier	49	0	0	0	Carrier
247	0600565_C	Leyner Cottonwood Carrier	4	0	0	0	Carrier
248	0600565_I	Leyner Cottonwood Irriga	36	1,342	60	1,903	Irr
249	0600566	COTTONWOOD DITCH 2	17	571	45	2,054	Irr
250	0600567	DAVIDSON DITCH	64	504	41	2,278	Irr
251	0600569_D	DRY CREEK DAVIDSON DITCH	15	677	44	1,575	Irr,DivSys
252	0600570	DRY CREEK NO 2 DITCH	20	341	50	796	Irr
253	0600575	EAST BOULDER DITCH	22	57	42	275	Irr
254	0600576	ENTERPRISE DITCH	13	111	47	942	Irr
255	0600580	HOWARD DITCH	20	190	31	1,491	Irr
256	0600582	JONES DONNELLY DITCH	10	316	43	1,080	Irr
257	0600585	MARSHALVILLE DITCH	17	990	44	1,316	Irr
258	0600586	MCGINN DITCH	14	1,195	45	1,191	Irr
259	0600588	S BOULDER BEAR CR DITCH	11	228	37	800	Irr
260	0600590	South Boulder Conduit	999	0	0	0	Export,Carrier
261	0600592	SCHEARER DITCH	24	382	47	1,231	Irr
262	0600593	S BOULDER CANON DITCH	34	1,229	44	1,975	Irr
263	0600597	Lafayette PL	2	0	0	0	Carrier
264	0600598	Louisville PL	5	0	0	0	Carrier
265	0600599	BOULDER CITY PL	29	0	0	0	Carrier
266	0600603	SILVER LAKE DITCH	10	324	59	770	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
267	0600606	CHURCH DITCH(UPPER)	12	0	48	58	Irr
268	0600608_D	EGGLESTON NO 1 DITCH	6	91	49	255	Irr,DivSys
269	0600610	ERIE COAL CR DITCH	14	508	44	483	Irr
270	0600611	HARRIS DITCH	5	30	45	225	Irr
271	0600612	KERR DITCH NO 1	4	47	42	389	Irr
272	0600613	KERR DITCH NO 2	3	5	32	122	Irr
273	0600615	LAST CHANCE DITCH	43	0	48	1,273	Irr
274	0600621	WILLIAM C HAKE DITCH	4	71	38	366	Irr
275	0600622	T N WILLIS DITCH	4	37	44	272	Irr
276	0600650	GOODHUE DITCH	51	1,550	43	1,847	Irr
277	0600663	Idaho Creek	72	0	0	0	Carrier
278	0600753	ANDERSON EXTENSION DITCH	5	0	0	0	Carrier
279	0600800	Boulder Res Intake	20	0	0	0	Carrier
280	0600800_SV	BOULDER RES MUNICIPAL DE	500	0	0	0	M/I,Carrier
281	0600878	Lafayette Boulder Creek	16	0	0	0	Carrier
282	0600902_C	Dry Creek Carrier	96	0	0	0	Carrier
283	0600943	BOULDER PL 3 AT BARKER R	41	0	0	0	Carrier
284	0604173_C	Baseline Res to Lafayette	999	0	0	0	Carrier
285	0604212_C	Marshall Res to Louisville	9	0	0	0	Carrier
286	060800_IMP	Boulder C-BTImport Locat	999	0	0	0	Import
287	06BOULDER_I	Boulder Indoor	21	0	7	12,451	M/I
288	06BOULDER_O	Boulder Outdoor	54	0	83	8,405	M/I
289	06BOULD_RTN	Boulder Return	22	0	0	6,515	Return
290	06LAFFYT_I	Lafayette Indoor	3	0	7	1,927	M/I
291	06LAFFYT_O	Lafayette Outdoor	11	0	83	2,082	M/I

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
292	06LOUIS_I	Louisville Indoor	3	0	7	2,249	M/I
293	06LOUIS_O	Louisville Outdoor	7	0	83	2,071	M/I
294	06_AMP001_I	WD 6 Agg Muni Indoor	999	0	10	3,183	M/I,Agg
295	06_AMP001_O	WD 6 Agg Muni Outdoor	999	0	83	2,501	M/I,Agg
296	06_AUP001_I	WD 6 Unincorp Indoor	999	0	10	4,417	M/I,Agg
297	06_AUP001_O	WD 6 Unincorp Outdoor	999	0	83	3,470	M/I,Agg
298	06_BOU_RF	Constant Winter RF	999	0	0	216	Return
299	06_BWRCBT	C-BTBWR Turnout	54	0	0	0	Carrier
300	06_CBT_IMP	C-BTImport Location	999	0	0	0	Import
301	06_ELDORA	Eldora Ski Resort	1	0	20	180	M/I
302	06_MOF_IMP	Moffat Import Location	999	0	0	0	Import
303	06_SWSP_IMP	C-BTSWSP Location	999	0	0	0	Import
304	06_VALMPP	PSCO	10	0	100	3,000	M/I
305	06_VALMT_C	Combined Valmont Res Inlet	142	0	0	0	Carrier
306	0700502	AGRICULTURAL DITCH	66	0	0	0	Carrier
307	0700502_A	Ag Ditch Aug Stn	999	0	0	0	Carrier
308	0700502_I	Ag Ditch Irrigators	999	454	43	5,401	Irr
309	0700527_D	Slough Ditches	50	117	43	7,515	Irr,DivSys
310	0700527_D_A	Slough Aug Stn	999	0	0	0	Carrier
311	0700540	CHURCH DITCH	98	0	0	0	Carrier
312	0700540_A	Church Aug Stn	999	0	0	0	Carrier
313	0700540_C	Church D to Standley	42	0	0	0	Carrier
314	0700540_I	Church Ditch Irrigators	999	372	43	5,774	Irr
315	0700542	Golden City Ditch	12	0	0	0	Carrier
316	0700547	Lower Clear Ck D	120	0	0	0	Carrier

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
317	0700547_I	Lower Clear Ck D Irrigat	999	858	41	5,298	Irr
318	0700549	Colorado Ag D	41	0	0	0	Carrier
319	0700549_I	Colorado Ag Ditch Irriga	999	66	43	4,125	Irr
320	0700551	CORT GRAVES HUGHES DITCH	7	0	43	146	Irr
321	0700553	Croke Canal	194	0	0	0	Carrier
322	0700553_Arv	ArvadaReleaseFromCroke	999	0	0	0	Carrier
323	0700569	FARMERS HIGHLINE CNL	254	0	0	0	Carrier
324	0700569_A	FHL Aug Stn	999	0	0	0	Carrier
325	0700569_C	FHL Canal to Standley	154	0	0	0	Carrier
326	0700569_I	FHL Canal Irrigators	999	2,262	44	9,683	Irr
327	0700570	FISHER DITCH	35	0	0	0	Carrier
328	0700570_A	Fisher Aug Stn	999	0	0	0	Carrier
329	0700570_C	Fisher D to PSCO	13	0	0	0	Carrier
330	0700570_I	Fisher Ditch Irrigators	999	13	43	3,233	Irr
331	0700597	KERSHAW DITCH	17	0	0	0	Carrier
332	0700597_A	Kershaw Aug Stn	999	0	0	0	Carrier
333	0700597_I	Kershaw Ditch Irrigators	999	13	43	622	Irr
334	0700601	Lee Stewart Eskins Ditch	17	0	0	0	Carrier
335	0700601_I	Lee Stewart Eskins Irrig	999	41	43	773	Irr
336	0700614	MANHART DITCH	13	13	43	905	Irr
337	0700632	OUELETTE DITCH	7	0	43	133	Irr
338	0700647	RENO JUCHEM DITCH	15	57	43	734	Irr
339	0700652	ROCKY MOUNTAIN DITCH	160	0	0	0	Carrier
340	0700652_A	Rocky Mtn Aug Stn	999	0	0	0	Carrier
341	0700652_I	Rocky Mtn Ditch Irrigato	999	12	43	5,463	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
342	0700669	SOUTH SIDE DITCH	999	0	48	80	Irr
343	0700681	Georgetown D	999	0	100	201	M/I
344	0700698	Wannamaker Ditch	27	0	0	0	Carrier
345	0700698_A	Wannamaker Aug Stn	999	0	0	0	Carrier
346	0700698_I	Wannamaker Irrigators	999	254	31	1,673	Irr
347	0700699	WELCH DITCH	28	86	26	1,046	Irr,Carrier
348	0700699_A	Welch Aug Stn	999	0	0	0	Carrier
349	0700725	Coors Ind Ditch	103	0	0	0	M/I,Carrier
350	0700726	Coors Ind Ditch	1	0	0	0	M/I
351	0700903	Straight Creek Tunnel	999	0	0	0	Import
352	0700903_C	Straight Ck Tun Divn	999	0	0	0	Carrier
353	0704625	Berthoud Pass Divn	999	0	0	0	Import
354	0704625_C	Berthoud Pass Divn	999	0	0	0	Carrier
355	0704626	Vidler Tunnel	999	0	0	0	Import
356	0704626_C	Vidler Tunnel Divn	999	0	0	0	Carrier
357	0704650	Gumlick Tunnel	999	0	0	0	Import
358	0704650_C	Gumlick Tunnel Divn	999	0	0	0	Carrier
359	07_ADP001	WD7 Agg SW Irrig	999	142	45	1,062	Irr
360	07_AMP001_I	WD7 Upper Agg Muni In	999	0	10	514	M/I,Agg
361	07_AMP001_O	WD7 Upper Agg Muni Out	999	0	83	404	M/I,Agg
362	07_AUP001_I	WD7 Upper Agg Uninc In	999	0	10	5,683	M/I,Agg
363	07_AUP001_O	WD7 Upper Agg Uninc Out	999	0	83	4,465	M/I,Agg
364	07_Arvada_I	Arvada Indoor Dem	999	0	10	9,919	M/I
365	07_Arvada_O	Arvada Outdoor Dem	999	0	83	9,051	M/I

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
366	07_ConMut_I	ConMutual Indoor Dem	999	0	10	2,126	M/I
367	07_ConMut_O	ConMutual Outdoor Dem	999	0	83	1,671	M/I
368	07_CoorsB	Coors Malting Potable Demand	8	0	30	5,975	M/I
369	07_CoorsC	Coors Cooling Demand	103	0	100	765	M/I
370	07_Golden_I	Golden Indoor Dem	999	0	10	1,634	M/I
371	07_Golden_O	Golden Outdoor Dem	999	0	85	1,283	M/I
372	07_LSA	Loveland Ski Area	999	0	20	113	M/I
373	0801001	Aurora Intake	125	0	0	0	M/I,Carrier
374	0801001_A	0801001 Aug Stn	999	0	0	0	Carrier
375	0801002_D	Denver Conduit 20	338	0	0	0	DivSys,Carrier
376	0801004	HIGHLINE CNL	295	501	40	17,826	Irr
377	0801006	Last Chance Pump Stn	999	0	0	0	M/I,Carrier
378	0801007	LAST CHANCE DITCH 2	39	35	47	1,468	Irr
379	0801008	CITY DITCH PL	50	51	47	5,173	Irr,Carrier
380	0801009_D	Nevada Ditch	36	92	47	3,351	Irr,DivSys
381	0801013	Englewood Intake	27	0	0	0	M/I,Carrier
382	0801014	Arapahoe Power Plant	6	0	80	2,047	M/I
383	0801015	EPPERSON DITCH/PUMP	2	0	48	258	Irr
384	0801017	Denver Conduit 26	396	0	0	0	Carrier
385	0801100	Chatfield Pumps	999	0	0	613	M/I
386	0801124	HAYLAND DITCH	2	15	42	156	Irr
387	0801125	FAIRVIEW DITCH	10	191	46	357	Irr
388	0801127	OLD TIME DITCH	2	15	40	101	Irr
389	0801128	GARDEN DITCH	1	15	44	49	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
390	0801235	RED ROCK DITCH	3	25	33	239	Irr
391	0801237	SPRING CREEK DITCH	4	52	36	263	Irr
392	0801240	RATCLIFF DILLON DITCH	4	52	45	77	Irr
393	0801241	DAKAN DITCH	2	52	44	76	Irr
394	0801362	JOHN JONES DITCH	3	79	42	376	Irr
395	0801400	ALDERMAN DITCH	5	36	51	155	Irr
396	0801403	HEISER DITCH	1	77	50	25	Irr
397	0801404	MCCRACKEN DITCH	3	103	54	23	Irr
398	0801405	SMITH DITCH	3	33	47	40	Irr
399	0801406	SCHREIBER DITCH	1	11	34	8	Irr
400	0801412	SIXTY SEVEN DITCH	7	94	36	640	Irr
401	0801413	CRAWFORD DITCH	2	27	38	290	Irr
402	0801414	BIRMINGHAM DITCH	2	101	44	51	Irr
403	0801416	GOODRICH DITCH	5	47	45	212	Irr
404	0801417	ROCKY RIDGE DITCH	3	0	48	22	Irr
405	0801492	IZZARD DITCH	4	24	46	93	Irr
406	0802300	Bi-City WWTP	999	0	100	0	M/I
407	08_ADP002	WD8 CherryCk Agg SW Divn	999	496	46	418	Irr,Agg
408	08_ADP003	WD8 SPR Agg SW Divn	999	44	43	225	Irr,Agg
409	08_ADP004	WD8 Plum Ck Agg SW Divn	999	298	38	2,205	Irr,Agg
410	08_Aurora_I	Aurora Indoor Dem	999	0	10	28,402	M/I
411	08_Aurora_O	Aurora Outdoor Dem	999	0	83	20,949	M/I
412	08_Denver_I	Denver Indoor Dem	999	0	13	129,727	M/I
413	08_Denver_O	Denver Outdoor Dem	999	0	90	91,198	M/I

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
414	08_Englwd_I	Englewood Indoor Dem	999	0	10	3,687	M/I
415	08_Englwd_O	Englewood Outdoor Dem	999	0	83	2,897	M/I
416	0900535	BERGEN DITCH	26	22	36	720	Irr
417	0900731_D	Arnett/Harriman Ditch	67	836	46	2,367	Irr,DivSys
418	0900752	HODGSON DITCH	2	23	28	455	Irr
419	0900767	INDEPENDENT HIGHLINE DIT	6	101	49	306	Irr
420	0900816	MCBROOM DITCH	3	0	48	730	M/I
421	0900903	WARRIOR/HARRIMAN D TK CR	6	0	48	121	M/I
422	0900958	WARD DITCH	14	619	48	1,951	Irr
423	0900963_D	Warrior/Harriman Ditch	38	0	18	3,466	Irr,DivSys
424	0901700	Marston WTP	403	0	0	0	Irr,M/I,Carrier
425	09_ADP003	WD9 Agg SW Divn	999	23	57	5	Irr,Agg
426	09_AMP001_I	WD9 Lower Agg Muni In	999	0	10	3,418	M/I,Agg
427	09_AMP001_O	WD9 Lower Agg Muni Out	999	0	83	2,685	M/I,Agg
428	09_AUP001_I	WD9 Lower Agg Uninc In	999	0	10	5,608	M/I,Agg
429	09_AUP001_O	WD9 Lower Agg Uninc Out	999	0	83	4,406	M/I,Agg
430	2003	FordRechargeDivn	20	0	0	0	Carrier
431	2300500	PLATTE STATION DITCH	9	42	38	612	Irr
432	2300760	SACRAMENTO DITCH	21	68	42	910	Irr
433	2300902	PETRIE DITCH	22	155	44	684	Irr
434	2300904	LINK DITCH	19	81	45	323	Irr
435	2300922	HOLST DITCH 2	12	62	41	540	Irr
436	2300923	HOLST PACKER D	12	77	41	611	Irr
437	2300924	HOLST DITCH 1	9	62	42	495	Irr
438	2300926	PACKER BONIS DITCH	6	27	41	371	Irr
439	2300991	TAYLOR DITCH	17	155	40	978	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
440	2300993	GIBSON DITCH	4	158	45	243	Irr
441	2300994	CROSIER TAYLOR DITCH	12	283	52	485	Irr
442	2302900	SOUTH FORK OF SOUTH PLAT	208	3	43	0	Irr,DivSys
443	2302900_A	2302900 Aug Stn	999	0	0	0	Carrier
444	2302901	FOUR MILE CREEK NEAR HAR	56	0	43	0	Irr,DivSys
445	2302901_A	2302901 Aug Stn	999	0	0	0	Carrier
446	2302902	MIDDLE FORK SOUTH PLATTE	110	0	48	0	Irr,DivSys
447	2302902_A	2302902 Aug Stn	999	0	0	0	Carrier
448	2302903	SOUTH PLATTE RIVER ABOVE	190	0	46	0	Irr,DivSys
449	2302903_A	2302903 Aug Stn	999	0	0	0	Carrier
450	2302904	FOUR MILE AT HIGH CREEK	68	0	39	0	Irr,DivSys
451	2302904_A	2302904 Aug Stn	999	0	0	0	Carrier
452	2302905	Beery Ditch	1	0	0	0	M/I
453	2302906	TARRYALL CREEK AT US 285	113	123	46	0	Irr,DivSys
454	2302906_A	2302906 Aug Stn	999	0	0	0	Carrier
455	2302907	MICHIGAN CREEK ABOVE JEF	48	156	49	0	Irr,DivSys
456	2302907_A	2302907 Aug Stn	999	0	0	0	Carrier
457	2302908	JEFFERSON CREEK NEAR JEF	74	549	50	0	Irr,DivSys
458	2302908_A	2302908 Aug Stn	999	0	0	0	Carrier
459	2302909	TARRYALL CREEK AT BORDEN	30	0	40	0	Irr,DivSys
460	2302909_A	2302909 Aug Stn	999	0	0	0	Carrier
461	2302910	OHLER GULCH NEAR JEFFERS	6	0	51	0	Irr,DivSys
462	2302910_A	Ohler Aug Stn	999	0	0	0	Carrier
463	2302911	TROUT CREEK NEAR GARO	5	18	48	0	Irr,DivSys
464	2302911_A	2302911 Aug Stn	999	0	0	0	Carrier
465	2302912	SPRING BRANCH ABOVE CONF	4	0	31	0	Irr,DivSys

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
466	2302912_A	2302912 Aug Stn	999	0	0	0	Carrier
467	2302913	MIDDLE FORK SOUTH PLATTE	183	0	48	0	Irr,DivSys
468	2302913_A	2302913 Aug Stn	999	0	0	0	Carrier
469	2302914	FRENCH CREEK ABOVE CONFL	9	0	24	0	Irr,DivSys
470	2302914_A	2302914 Aug Stn	999	0	0	0	Carrier
471	2302915	ROCK CREEK ABOVE CONFLUE	37	0	34	0	Irr,DivSys
472	2302915_A	2302915 Aug Stn	999	0	0	0	Carrier
473	2302916	SCHATTINGER FLUME ABOVE	20	0	50	0	Irr,DivSys
474	2302916_A	2302916 Aug Stn	999	0	0	0	Carrier
475	2302917	JEFFERSON CREEK BELOW SY	12	82	51	0	Irr,DivSys
476	2302917_A	2302917 Aug Stn	999	0	0	0	Carrier
477	2302918	DIXON FLUME ON HOLLTHUSE	10	0	50	0	Irr,DivSys
478	2302918_A	2302918 Aug Stn	999	0	0	0	Carrier
479	2304611	Boreas Pass Ditch	999	0	0	0	Import
480	2304611_C	Boreas Pass Divn	999	0	0	0	Carrier
481	23_ADP001	WD23 Tarryall Agg SW Div	999	544	48	4,065	Irr,Agg
482	23_ADP002	WD23 SPR Agg SW Divn	999	1,269	50	3,910	Irr,Agg
483	23_AMP001_I	WD23 Upper Agg Muni In	999	0	10	58	M/I,Agg
484	23_AMP001_O	WD23 Upper Agg Muni Out	999	0	83	46	M/I,Agg
485	23_AUP001_I	WD23 Upper Agg Uninc In	999	0	10	279	M/I,Agg
486	23_AUP001_O	WD23 Upper Agg Uninc Out	999	0	83	219	M/I,Agg
487	23_AUP002_I	WD23 Lower Agg Uninc In	999	0	10	552	M/I,Agg
488	23_AUP002_O	WD23 Lower Agg Uninc Out	999	0	83	434	M/I,Agg
489	3700	EastGravelLakesDivn	100	0	0	0	Carrier
490	6400501	CARLSON DITCH	14	130	35	243	Irr
491	6400502	LIDDLE DITCH	17	937	46	1,165	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
492	6400503	SOUTH RESERVATION DITCH	21	840	53	3,205	Irr
493	6400504	PETERSON DITCH	72	6,784	43	9,905	Irr
494	6400506	RED LION SUPPLY DITCH	19	277	35	0	Irr
495	6400507	LONG ISLAND DITCH	1	2,138	62	0	Irr
496	6400508	SETTLERS DITCH	60	4,821	46	6,388	Irr
497	6400511_D	Harmony Div System	273	0	0	0	Carrier
498	6400511_I	Harmony Irrigation	354	11,682	47	38,697	Irr
499	6400513	CHAMBERS DITCH	29	397	34	0	Irr
500	6400514	RAMSEY DITCH	18	329	41	838	Irr
501	6400516	POWELL BLAIR DITCH	33	2,054	49	5,196	Irr
502	6400518	LONE TREE DITCH	35	696	38	316	Irr
503	6400519	JUD BRUSH DITCH	7	0	48	0	Irr
504	6400520	ILIFF PLATTE VALLEY D	156	6,386	45	24,509	Irr
505	6400522_D	Bravo Div System	50	1,925	43	6,325	Irr,DivSys
506	6400524	LOWLINE DITCH	40	1,781	46	6,606	Irr
507	6400525	HENDERSON SMITH DITCH	15	330	32	2,004	Irr
508	6400526	STERLING IRR CO DITCH 2	17	0	48	0	Irr
509	6400528	STERLING IRR CO DITCH 1	159	7,685	44	23,465	Irr
510	6400530	SPRINGDALE DITCH	60	3,316	34	7,852	Irr
511	6400531	SCHNEIDER DITCH	51	2,314	42	10,369	Irr
512	6400532	DAVIS BROS DITCH	27	1,965	55	0	Irr
513	6400533	PAWNEE DITCH	167	8,016	49	27,018	Irr
514	6400535	SOUTH PLATTE DITCH	67	4,419	42	13,763	Irr
515	6400542	MCWILLIAMS CANAL	1	92	49	0	Irr
516	6400584	I O JONES DITCH & RESERV	1	166	51	122	Irr
517	6400599	RICE DITCH	35	507	38	0	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
518	6400643	HEYBORNE LIFT STATION	6	0	0	0	Carrier
519	6400801	COTTONWOOD CR RCHRG PUMP	2	0	0	24	Carrier
520	6403551_Ced	Cedar to Sterling	540	0	0	0	Carrier
521	6403551_Paw	Pawnee to Sterling	540	0	0	0	Carrier
522	8000650	WANITA DITCH	1	11	42	98	Irr
523	8000651	HALL VALLEY DITCH	1	4	39	116	Irr
524	8000653	Roberts Tunnel	999	0	0	0	Import
525	8000653_A	RobTun Aug Stn	999	0	0	0	Carrier
526	8000653_C	Roberts Tunnel Divn	999	0	0	0	Carrier
527	8000657_D	Hepburn Ranch	2	69	50	381	Irr,DivSys
528	8000662_D	Fitzsimmons Ranch	9	82	41	830	Irr,DivSys
529	8000667	SOUTH SIDE DITCH	2	33	44	222	Irr
530	8000673_D	Herford Ranch	5	76	43	472	Irr,DivSys
531	8000706	BEAVER CREEK DITCH	7	0	41	394	Irr
532	8000713	KENOSHA DITCH	1	18	41	178	Irr
533	8000732_D	Camp Santa Maria	4	34	38	410	Irr,DivSys
534	8000759	MCARTHUR DITCH	1	26	29	331	Irr
535	8000760	WINKLER DITCH 1	1	12	31	188	Irr
536	8000761	WINKLER DITCH 3	1	20	37	138	Irr
537	8000774_D	Berger Ranch	4	26	43	241	Irr,DivSys
538	8000784	JEFFRIES CRAWFORD DITCH	3	55	38	357	Irr
539	8000785	WONDER DITCH	1	9	45	60	Irr
540	8000792	PARMALEE DITCH 2 & 3	1	65	48	154	Irr
541	8000794	FLUME DITCH	1	34	43	76	Irr
542	8000799_D	Deer Creek Ranch	3	21	44	307	Irr,DivSys
543	8000812	CLIFFORD GULCH DITCH	1	18	43	100	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
544	8000829_D	Magnus Ranch	7	113	48	312	Irr,DivSys
545	8000831_D	State Parks Ranch	4	62	45	247	Irr,DivSys
546	80_ADP001	WD80 NF SPR Agg SW Divn	999	90	48	591	Irr
547	AurThEff	Aur WWTP to Thornton	999	0	0	3,946	M/I
548	BCSC	BOULDER CR SUPPLY CANAL	500	0	0	16,257	Return
549	BerthGold1	GoldSpringBerthoudDivn	2	0	0	0	Carrier
550	BerthGold2	GoldSummerBerthoudDivn	4	0	0	0	Carrier
551	BerthNglenn	NglennBerthoudDivn	51	0	0	0	Carrier
552	Bri_WWTP	Brighton WWTP	999	0	100	0	M/I
553	BypReturn	UnusedBypExchWtrCarrier	999	0	0	0	Return
554	Cond15_PL	Denver Conduit 15 water	999	0	0	0	M/I,Carrier
555	Conduit15	Denver Conduit 15	92	0	0	805	M/I
556	CosmicRel	WGL Nov1 Release	999	0	0	2,500	Return
557	DW_ReusePL	DW Reuse PL to Cherokee	999	0	0	0	Return
558	FoothillsWTP	Foothills WTP	396	0	0	0	M/I,Carrier
559	HOMSPICO	Homestake Pipeline	999	0	0	0	Import
560	HOMSPICO_C	Homestake Pipeline Divn	999	0	0	0	Carrier
561	Manifold	Chatfield Manifold	999	0	0	0	Return
562	MetPump_PL	MetroPumpsPipeline	999	0	0	0	Carrier
563	Metro_Pumps	MetroPumpsHistDivns	999	0	0	11,150	M/I
564	Metro_WWTP	Metro WWTP	999	0	100	0	M/I
565	MoffatWTP	Moffat WTP	255	0	0	38,827	M/I
566	Nglenn_WWTP	Northglenn WWTP	999	0	100	0	M/I
567	PCWA_WWTP	Plum Ck Wtr Auth WWTP	999	0	0	0	M/I
568	SAC_WWTP	SACWSD WWTP	999	0	100	0	M/I
569	SPDMSPSC	C-BT	98	0	0	3,081	Export

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Avg. System Efficiency (%)	Avg. Annual Demand (AF)	Structure Type (See Footnotes)
570	SPLk_Pump	South Platte Lake Pump	999	0	0	0	Carrier
571	SWSP_C	C-BTSWSP Carrier	999	0	0	0	Carrier
572	SandCk_WWTP	Aurora WWTP	999	0	100	0	M/I
573	SandHill_C	SandHillPlanDiv	999	0	0	0	Import
574	WesBrownWTP	Wes Brown WTP	78	0	0	0	M/I,Carrier
575	Westy_WWTP	Westy WWTP	999	0	100	0	M/I

Irr = Irrigation demand

DivSys = Diversion System (multiple headgates that meet a common demand are modeled at a single location)

M/I = Municipal and Industrial Demand

Import = Location were imported water is delivered to the system

Export = Location were exported water is diverted from the system

Agg = Aggregated Structure (non-key diversion structures grouped at a single location)

Return = Location were carried water is returned to the system.

7.2 Diversion Systems

Diversion systems represent multiple diversion points that serve a common demand. The diversion points are generally located on the same river without intervening diversion structures. In the South Platte Model, they are generally designated with *_D. Many of the diversion systems also have off-channel irrigation demands designated with *_I. Inclusion of the off-channel irrigation demand structures in the diversion system list allow information from the primary structure to be transferred to the irrigation demand when input files are created. Note that in District 23, ditches are assigned to administrative gages by decree.

Table 7-2: Diversion Systems

Diversion System ID	Diversion System Name	Associated Structures
0100503_D and 0100503_I	RIVERSIDE CANAL DEMAND	0100503
		0100504
		0100710
0100507_D and 0100507_I	BIJOU CANAL DEMAND	0100506
		0100507
		0100509
0100519_D	TREMONT DITCH DIVSYS	0100519
		0100521
		0100522
		0100523
0100687 and 0100687_I	NORTH STERLING DEMAND	0100687
		6400563
		6403794
0103817_I	JACKSON RESERVOIR DEMAND	0103817
0200805 and 0200805_I	DENVER-HUDSON CNL	0200805
		0200902
0200808_I	FULTON DEMAND	0200808
0200810_I	BRIGHTON DEMAND	0200810
0200812_I	LUPTON BOTTOM DEMAND	0200812
0200813_I	PLATTEVILLE DEMAND	0200813
0200817_I	EVANS NO 2 DEMAND	0200817
0200824_I	FARMERS INDEPENDENT DEMAND	0200824
0200825_I	HEWES COOK DEMAND	0200825
0200828 and 0200828_I	UNION IRRIGATION DEMAND	0200828
		0200886
0200834_I	LOWER LATHAM DEMAND	0200834
0200837_I	HIGHLAND DEMAND	0200837
0203837_I	FRICO-BARR LAKE DEMAND	0203837
0203876_I	FRICO-MILTON LAKE DEMAND	0203876
0400520_I	GEORGE RIST DEMAND	0400520

Diversion System ID	Diversion System Name	Associated Structures
0400521_I	HANDY DITCH DEMAND	0400521
0400524_I	HOME SUPPLY DEMAND	0400524
0400530_I	LOUDEN DITCH DEMAND	0400530
0400532 and 0400532_I	LOVELAND GREELEY DEMAND	0400501
		0400532
0400543_I	SOUTH SIDE DITCH DEMAND	0400543
0400588 and 0400588_I	BOULD LARIM CO IRR MFG DEMAND	0400588
		0404156
0400691_I	HANSEN FEEDER DEMAND	0400691
0400692_I	ST VRAIN SUPPLY DEMAND	0400692
0500526_I	HIGHLAND DITCH DEMAND	0500526
0500547_I	OLIGARCHY DITCH DEMAND	0500547
0500564_I	LAKE DITCH DEMAND	0500564
0600501_I	ANDERSON DITCH DEMAND	0600501
0600515_D	BOULDER WELD CTY DIVSYS	0600515
		0600533
		0600540
0600516_I	BOULDER WHITE ROCK DEMAND	0600516
0600520_D	CARR/TYLER DITCH DIVSYS	0600520
		0600545
0600537_I	LEGGETT DITCH DEMAND	0600537
0600538_D and 0600538_I	LOWER BOULDER DIVSYS	0200552
		0600538
		0600562
0600564_D and 0600564_I	COMMUNITY DITCH DEMAND	0600564
		0600589
0600565_I	LEYNER COTTONWOOD DITCH	0600565
0600569_D	DRY CREEK DAVIDSON DIVSYS	0600569
		0600735
0600608_D	EGGLESTON 1 DITCH DIVSYS	0600605
		0600608
		0600609
0700502_I	AGRICULTURAL DITCH DEMAND	0700502
0700527_D	SLOUGH DIVSYS	0700523
		0700527
		0700528
		0700550
		0700580
		0700581
		0700595
		0700599

Diversion System ID	Diversion System Name	Associated Structures
		0700602
		0700628
		0700649
		0700650
		0700654
		0700655
		0700663
		0700664
		0700677
		0700694
		0700695
		0700705
		0700706
0700540_I	CHURCH DEMAND	0700540
0700547_I	LOWER CLEAR CREEK DEMAND	0700547
0700549_I	COLORADO AG DEMAND	0700549
0700569_I	FHL DEMAND	0700569
0700570_I	FISHER DEMAND	0700570
0700597_I	KERSHAW DEMAND	0700597
0700601_I	LSE DEMAND	0700601
0700652 and 0700652_I	ROCKY MOUNTAIN DEMAND	0700620
		0700652
0700698_I	WANNAMAKER DEMAND	0700698
0801002_D	CONDUIT 20	0801002
		0801005
0801009_D	NEVADA DITCH DIVSYS	0801009
		0801011
		0801462
0900731_D	ARNETT/HARRIMAN DIVSYS	0900522
		0900731
		0900862
		0900880
0900963_D	WARRIOR/HARRIMAN DITCH	0900896
		0900962
		0900963
		0900964
2302900	SFKANTCO DIVSYS	2300507
		2300510
		2300511
		2300513
		2300514
		2300515

Diversion System ID	Diversion System Name	Associated Structures
		2300519
		2300520
		2300523
		2300525
		2300529
		2300530
		2300538
		2300542
		2300546
		2300550
		2300551
		2300552
		2300553
		2300566
		2300574
		2300575
		2300580
		2300634
2302901	FOUHARCO DIVSYS	2300622
		2300623
		2300624
		2300626
		2300627
		2300628
		2300645
2302902	MFKSTMCO DIVSYS	2300686
		2300687
		2300689
		2300691
		2300694
		2300695
		2300698
		2300699
		2300803
		2300807
		2301078
2302903	PLASPICO DIVSYS	2300562
		2300700
		2300702
		2300703
		2300706
		2300707

Diversion System ID	Diversion System Name	Associated Structures
		2300708
		2300709
		2300710
		2300712
		2300714
		2300814
		2300816
		2300827
		2300829
		2300830
2302904	FOUHIGCO DIVSYS	2300541
		2300601
		2300609
		2300610
		2300611
		2300612
		2300616
		2300617
2302906	TARCOMCO DIVSYS	2300879
		2300882
		2300884
		2300885
		2300886
		2300887
		2300888
		2300889
		2300890
		2300892
		2300894
		2300895
		2300903
		2301089
2302907	MCHJEFCO DIVSYS	2300963
		2300966
		2300967
		2300976
		2300977
		2300978
		2300984
		2300986
2302908	JEFJEFCO DIVSYS	2301001
		2301003

Diversion System ID	Diversion System Name	Associated Structures
		2301004
		2301006
		2301008
		2301009
		2301011
		2301013
2302909	TARBORCO DIVSYS	2300909
		2300910
		2300911
		2300920
		2300921
		2300928
		2301087
2302910	OHGJEFCO DIVSYS	2302910
		2301024
2302911	TROGARCO DIVSYS	2300797
2302912	SPRBRNCO DIVSYS	2300667
2302913	MFKPRICO DIVSYS	2300620
		2300654
		2300659
		2300661
		2300663
		2300664
		2300665
		2300672
		2300673
		2300675
		2300676
		2300677
		2300678
		2300680
		2300683
2302914	FRNCRKCO DIVSYS	2300961
2302915	RCKTARCO DIVSYS	2301031
		2301032
		2301036
		2301037
		2301038
		2301039
		2301040
		2301041
		2301042

Diversion System ID	Diversion System Name	Associated Structures
		2301043
		2301044
		2301045
		2301046
		2301047
		2301055
2302916	SCHFLMCO DIVSYS	2300802
		2300962
		2300974
		2300983
2302917	JEFSNYCO DIVSYS	2301014
		2301019
		2301020
		2301029
2302918	DIXCOMCO DIVSYS	2300878
		2300951
		2300952
		2300954
6400511_D and 6400511_I	HARMONY DITCH 1 DEMAND	6400510
		6400511
		6400515
		6403906
6400522_D	BRAVODITCHDIVSYS	6400521
		6400522
8000657_D	HEPBURN DITCH 2 DIVSYS	8000657
		8000739
		8000740
8000662_D	MACK DITCH 1 DIVSYS	8000659
		8000660
		8000661
		8000662
		8000889
		8000893
8000673_D	BOND DITCH 2 DIVSYS	8000673
		8000674
8000732_D	CRAIG PARK GULCH DIVSYS	8000728
		8000729
		8000730
		8000732
8000774_D	BERGER DITCH DIVSYS	8000773
		8000774
		8000776

Diversion System ID	Diversion System Name	Associated Structures
		8000777
8000799_D	ALKIRE DITCH DIVSYS	8000799
		8000800
		8000801
		8000845
8000829_D	ROCKY MTN FUEL 1 DIVSYS	8000825
		8000826
		8000827
		8000828
		8000829
		8000842
		8000843
8000831_D	DAVIS DITCH 1 DIVSYS	8000831
		8000847
		8000848
		8000849
		8000854
		8000858

7.3 Aggregated Irrigation Structures

Irrigation structures were aggregated based on physical location. The figures below show the aggregate boundaries that were developed under Task 3. The map is divided across two figures due to the detailed nature of the aggregate boundaries. The same boundaries are used for both aggregate surface water structures and ground water only aggregate structures. The only modification to these boundaries is in Water District 5; aggregate area 05_ADP001 was divided into 05_ADP001 and 05_ADP002 to better represent the water sources for the aggregated structures.

Where to find more information

- SPDSS Task Memorandum 3, “Aggregate Non-Key Agricultural Diversion Structures,” available on the CDSS website.

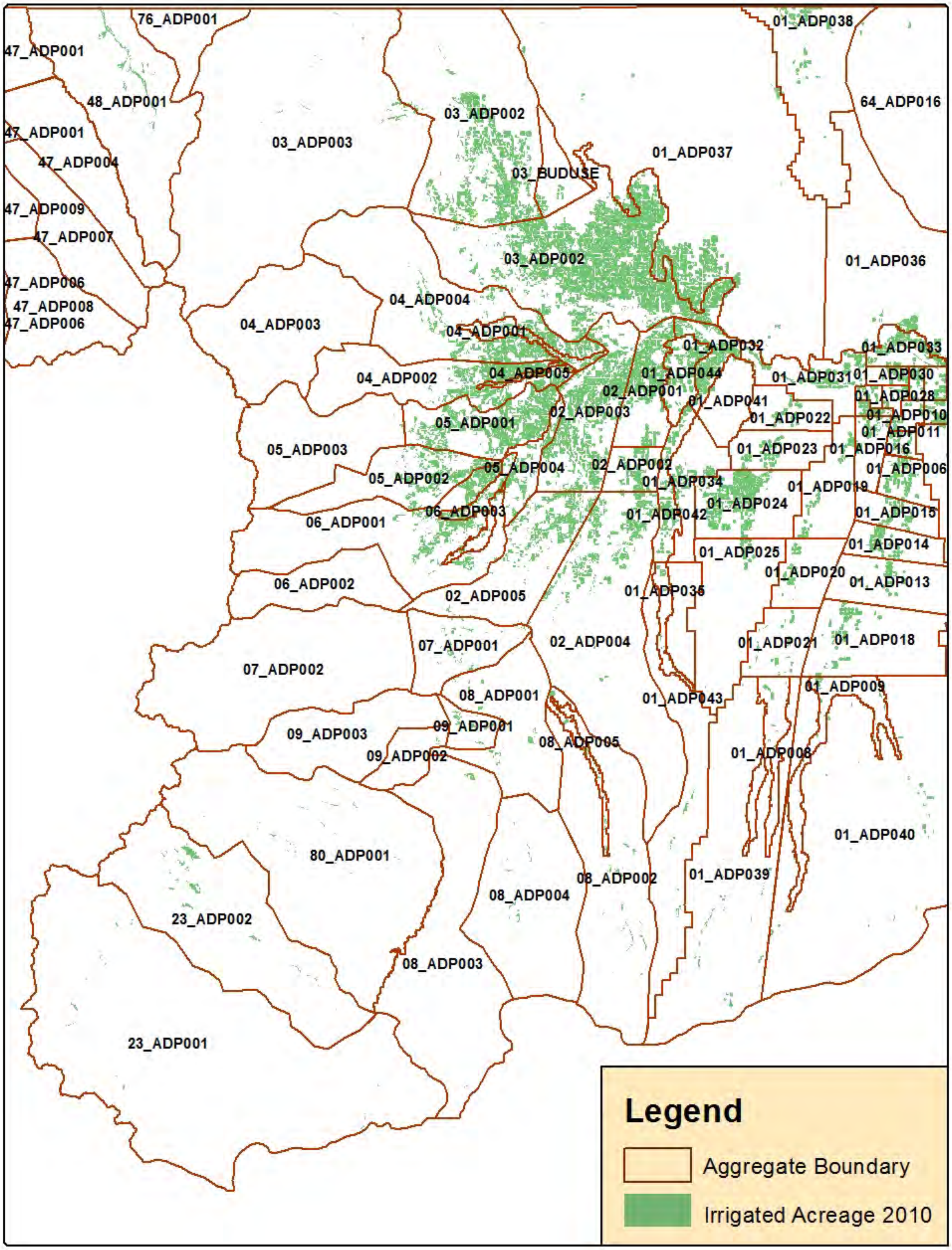


Figure 7-1: Aggregate boundaries (Western portion)

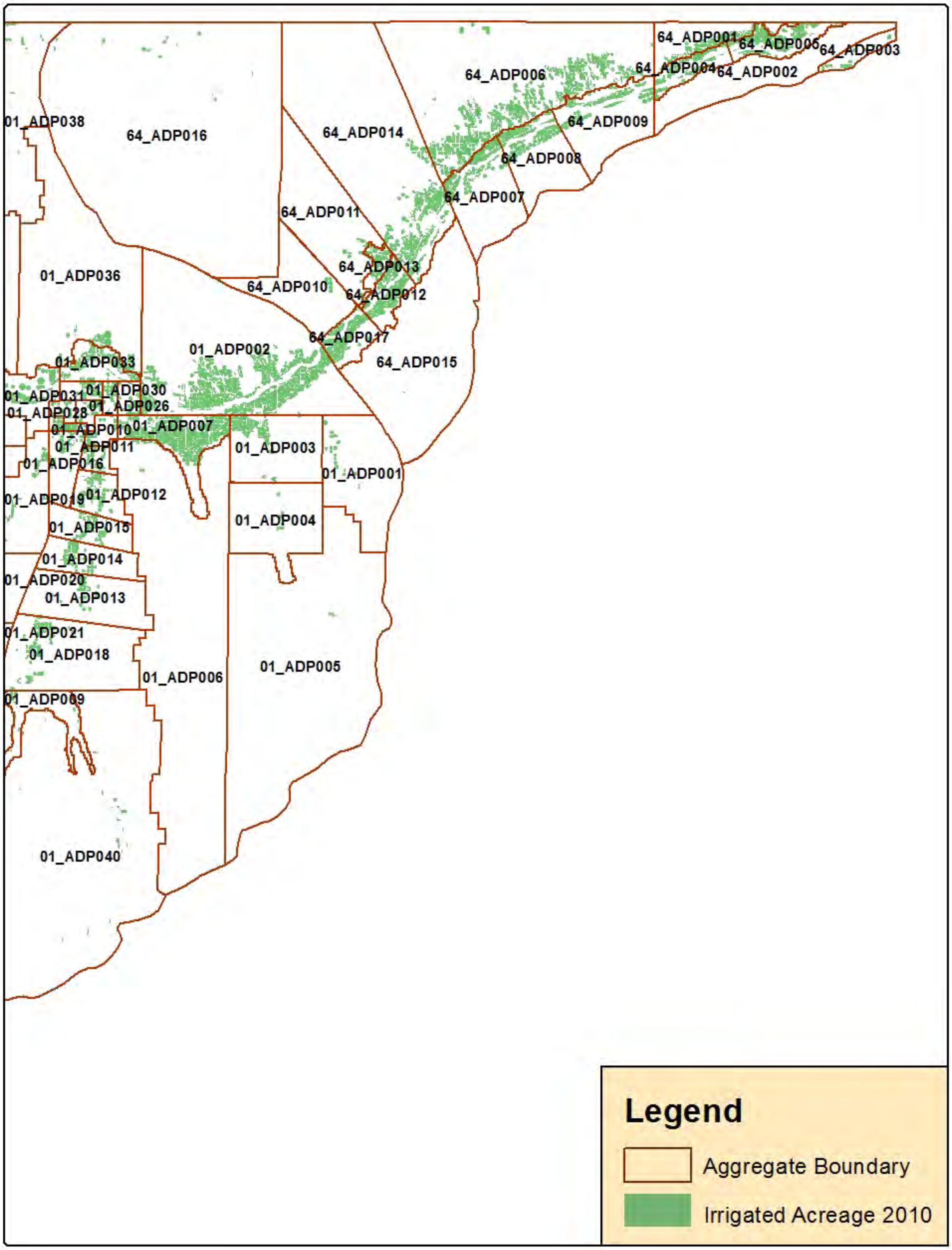


Figure 7-2: Aggregate boundaries (Eastern portion)

Table 7-3: Surface Water Aggregate Structures

Aggregate ID	Aggregate Name	Associated Structures
01_ADP037	South Platte River below Kersey Co North 2	0100643
		0100644
		0100835
		0104486
02_ADP003	South Platte River below Ft Lupton West	0200885
		0200887
		0200888
05_ADP001	Left Hand Creek above Saint Vrain Group 1	0500583
		0500584
		0500587
		0500588
		0500831
		0500938
		0500942
		0600732
05_ADP002	Left Hand Creek above Saint Vrain Group 2	0500555
		0500556
		0500829
07_ADP001	Clear Creek below Golden Co	0700526
		0700711
		0700720
08_ADP003	South Platte River above Chatfield Reservoir	0800909
		0800910
08_ADP004	Plum Creek above South Platte Confluence	0801215
		0801216
		0801217
		0801230
		0801250
		0801252
		0801254
		0801264
		0801266
		0801267
		0801278
		0801279
08_ADP002	Cherry Creek above Franktown Co	0801360
		0801418
		0801421
		0801426
		0801427

Aggregate ID	Aggregate Name	Associated Structures
08_ADP003	South Platte River above Chatfield Reservoir	0801483
09_ADP003	Bear Creek above Morrison Co	0900739
		0900740
		0900741
23_ADP001	SF South Platte River above Tarryall Confluence	2300502
		2300503
		2300504
		2300505
		2300506
		2300516
		2300564
		2300568
		2300569
		2300573
		2300579
		2300583
		2300585
		2300586
		2300587
		2300631
		2300763
		2300774
		2300787
		2300788
		2300789
		2300866
		2300867
		2300868
		2300869
		2301138
		2301140
23_ADP002	Tarryall Creek above SF South Platte Confluence	2300908
		2300931
		2300932
		2300933
		2300936
		2300937
		2300940
		2300948
		2300968

Aggregate ID	Aggregate Name	Associated Structures
		2300975
		2300987
		2301002
		2301005
		2301018
		2301022
		2301025
		2301075
		2301083
		2301094
80_ADP001	Water District 80 NF South Platte River	8000668
		8000708
		8000709
		8000710
		8000763
		8000764
		8000867
		8000895
		8000896
		8000897
		8000921
		8001014

7.4 Plan Structures

Table 7-4 lists the plan structures included in the model organized by plan type. For more details on plan structures, refer to Section 5.8.1.

Table 7-4: Plan Structures

Plan ID	Plan Name	River Location	Plan Type
06538_B_RF	LowBoul Bo RFOblig	06BOU_RFO	1
06538_L_RF	LBLafyt RFOblig	06LAF_RFO	1
06543_B_RF	NoBoFarm Bo RFOblig	06BOU_RFO	1
06565_L_RF	LeynCott LAF RFOblig	06LAF_RFO	1
06565_V_RF	LeynCott LOU RFOblig	06LOU_RFO	1
06567_L_RF	Davidson Lafyt RFOb	06LAF_RFO	1
06567_V_RF	Davidson Louis RFOb	06LOU_RFO	1
06569_L_RF	DCDavd Lafyt RFOblig	06LAF_RFO	1
06576_L_RF	Entprs Lafyt RFOblig	06LAF_RFO	1
06650_L_RF	Goodhue Lafyt RFOblig	06LAF_RFO	1
06650_V_RF	Goodhue Louis RFOblig	06LOU_RFO	1
07_C_AugPln	CoorsC_AugPlan	07_C_AugPln	1
6400525_RF	HendersonSmith TCPlan	6400525_RF	1
6400528_RF	SterlingNo1 TCPlan	6400528_RF	1
AurLastChRF	AuroraLastChanceD_RFs	AurLastChRF	1
BriFulRFs	BrightonFultonRFs	BriFulRFs	1
CenBriRFs	CentralBrightonRFs	CenBriRFs	1
CenFarmRFs	FarmersCentralRFs	CenFarmRFs	1
CenFulRFs	CentalFultonRFs	CenFulRFs	1
CenHighRFs	HighlandCentralRFs	CenHighRFs	1
CenLBRFs	CentralLBRFs	CenLBRFs	1
CenPVRFs	CentralPVRFs	CenPVRFs	1
CenSN3RFs	SectionNo3CentralRFs	CenSN3RFs	1
ConM_AgRFs	ConMutualAgDitchRFs	ConM_AgRFs	1
ConM_WelRFs	ConMutualWelchDitchRFs	ConM_WelRFs	1
ConMClCkRFs	ConMutualClearCkRFs	ConMClCkRFs	1
ConMSPRRFs	ConMutualSPlatteRFs	ConMSPRRFs	1
CoorsAug12	CoorsRenoJuchemAugStn	CoorsAug12	1
CoorsAug3	CoorsAg_RkyMtnAugStn	CoorsAug3	1
CoorsAug7	CoorsWannamakerAugStn	CoorsAug7	1
JeffLkDRF	JeffersonLkWinterRFs	JeffLkDRF	1
KershRFs	WestyKershawRFs	KershRFs	1
Longmont_TC	Longmont_RFOs	05LONG_RFOs	1
NglennLBRFs	NglennLuptonBottomRFs	NglennLBRFs	1

Plan ID	Plan Name	River Location	Plan Type
NglnBDCRFs	NorthglennBDCRFS	NglnBDCRFs	1
NglnFulRFs	NorthglennFultonRFs	NglnFulRFs	1
PSCoClCkRFs	PSCoClearCreekRFs	PSCoClCkRFs	1
PSCoFishApr	PSCoFisherRFs	PSCoFishApr	1
PSCoFishAug	PSCoFisherRFs	PSCoFishAug	1
PSCoFishJul	PSCoFisherRFs	PSCoFishJul	1
PSCoFishJun	PSCoFisherRFs	PSCoFishJun	1
PSCoFishMay	PSCoFisherRFs	PSCoFishMay	1
PSCoFishOct	PSCoFisherRFs	PSCoFishOct	1
PSCoFishSep	PSCoFisherRFs	PSCoFishSep	1
PSCoLBRFs	PSCoLuptonBottomRFs	PSCoLBRFs	1
PSCoMISPRFs	PSCoMeadowIsland2SPRFs	PSCoMISPRFs	1
PSCoSPRFs	PSCoSPRRFsabvFulton	PSCoSPRFs	1
PSCoSPRFs2	PSCoJTandHCRFs	PSCoSPRFs2	1
SABurRFsSum	SASummerBurlRFs	SABurRFsSum	1
SABurRFsYR	SAYearRoundBurlRFs	SABurRFsYR	1
SAC_BriRFs	SACWSDBrightonRFs	SAC_BriRFs	1
SAC_FulRFs	SACWSDFultonRFs	SAC_FulRFs	1
SAC_LBRFs	SACWSDLuptonBottomRFs	SAC_LBRFs	1
SAC_MI1RFs	SACWSDMdwIsland1RFs	SAC_MI1RFs	1
SpinDRF_03	SpinneyWinterRFs_3%	SpinDRF_03	1
SpinDRF_04	SpinneyWinterRFs_4%	SpinDRF_04	1
SpinDRF_07	SpinneyWinterRFs_7%	SpinDRF_07	1
SpinDRF_11	SpinneyWinterRFs_11%	SpinDRF_11	1
SpinDRF_13	SpinneyWinterRFs_13%	SpinDRF_13	1
SpinDRF_16	SpinneyWinterRFs_16%	SpinDRF_16	1
SpinDRF_17	SpinneyWinterRFs_17%	SpinDRF_17	1
SpinDRF_21	SpinneyWinterRFs_21%	SpinDRF_21	1
SpinMtnDRF	SpinneyMtnWinterRFs	SpinMtnDRF	1
ThBDC_RFs	ThorntonBDCReturns	ThBDC_RFs	1
ThBurRFsSum	ThornSummerBurlRFs	ThBurRFsSum	1
ThBurRFsYR	ThornYearRoundBurlRFs	ThBurRFsYR	1
ThChurchRFs	ThorntonChurchReturns	ThChurchRFs	1
ThCoAg02RFs	ThorntonCoAg02CW132RFs	ThCoAg02RFs	1
ThCoAg89RFs	ThorntonCoAg89CW132RFs	ThCoAg89RFs	1
ThFHL_RFs	ThorntonFHLReturns	ThFHL_RFs	1
ThFishRFs1	ThorntonFishApr-AugRFs	ThFishRFs1	1
ThFishRFs2	ThorntonFishSep-OctRFs	ThFishRFs2	1
ThLCC_RFs	ThorntonLowerClearCkRFs	ThLCC_RFs	1
ThLCC02RFs	ThorntonLCC02CW266RFs	ThLCC02RFs	1

Plan ID	Plan Name	River Location	Plan Type
ThLCC89RFs	ThorntonLCC89CW132RFs	ThLCC89RFs	1
ThornSPRFs1	ThorntonSPRFsabvFulton	ThornSPRFs1	1
ThornSPRFs2	ThorntonSPRFsabvBrntnr	ThornSPRFs2	1
WestBDCRFs	WestyBDC_RFs	WestBDCRFs	1
WestyChRFs	WestyChurchRFs	WestyChRFs	1
WestyFHLRFs	WestyFHLRFs	WestyFHLRFs	1
WestyLCCRFs	WestyLCC_RFs	WestyLCCRFs	1
WestySPRFs	WestySPReturns	WestySPRFs	1
0102456	FT MORGAN CITY AUG	0102456	2
0102513	ROTHE AUG PLAN	0102513	2
0102518	PIONEER AUG PLAN	0102518	2
0102522	RIVERSIDE AUG	0102522	2
0102528	FT MORGAN AUG PLAN	0102528	2
0102529	UPPER PB AUG PLAN	0102529	2
0102535	LPB AUG PLAN	0102535	2
0102662	BRUSH AUG	0102662	2
0103339	BIJOU AUG PLAN	0103339	2
0703390	CoorsA_AugPlan	0703390	2
0802593	AuroraWellAugPlan	0802593	2
6402517	SEDGWICK CTY AUG PLAN	6402517	2
6402518	HARMONY AUG PLAN	6402518	2
6402519	DINSDALE AUG	6402519	2
6402525	CONDON AUG	6402525	2
6402526	STERLING AUG	6402526	2
6402536	LOWER LOGAN WELL USERS	6402536	2
6402539	LOGAN WELL USERS AUG	6402539	2
6402540	LOWLINE AUG PLAN	6402540	2
6402542	LSPWCD AUG	6402542	2
6403392	NORTH AUG PLAN	6403392	2
9902502	SACWSDAugPlan	9902502	2
9902541	BrightonAugPlan	9902541	2
9903334_A	GMSReachAAugPln	9903334_A	2
9903334_B	GMSReachBAugPln	9903334_B	2
9903334_C	GMSReachCAugPln	9903334_C	2
9903334_D	GMSReachDAugPln	9903334_D	2
9903334_E	GMSReachEAugPln	9903334_E	2
9903334_F	GMSReachFAugPln	9903334_F	2
9903394_A	WASReachAAugPln	9903394_A	2
9903394_B	WASReachBAugPln	9903394_B	2
9903394_C	WASReachCAugPln	9903394_C	2

Plan ID	Plan Name	River Location	Plan Type
9903394_D	WASReachDAugPln	9903394_D	2
9903394_E	WASReachEAugPln	9903394_E	2
9903394_F	WASReachFAugPln	9903394_F	2
AggWell_01	AggWell_01	AggWell_01	2
AggWell_02	AggWell_02	AggWell_02	2
AggWell_04	AggWell_04	AggWell_04	2
AggWell_05	AggWell_05	AggWell_05	2
AggWell_06	AggWell_06	AggWell_06	2
AggWell_07	AggWell_07	AggWell_07	2
AggWell_08	AggWell_08	AggWell_08	2
AggWell_64	AggWell_64	AggWell_64	2
GwOnly_01	GwOnly_01	GwOnly_01	2
GwOnly_02	GwOnly_02	GwOnly_02	2
GwOnly_04	GwOnly_04	GwOnly_04	2
GwOnly_05	GwOnly_05	GwOnly_05	2
GwOnly_06	GwOnly_06	GwOnly_06	2
GwOnly_07	GwOnly_07	GwOnly_07	2
GwOnly_08	GwOnly_08	GwOnly_08	2
GwOnly_64	GwOnly_64	GwOnly_64	2
AurResPln	AuroraReservoirPlan	AurResPln	3
AurStronPln	StrontiaSpgsResPlan	AurStronPln	3
EGLks_Pln	EastGravelLakesPln	EGLks_Pln	3
JimBakerPln	JimBakerResPlan	JimBakerPln	3
LResReusable	LongResReuse	LONG_RES_Re	3
PhanFRIPln1	FRICO4WayInWestyAcc	PhanFRIPln1	3
PhanFRIPln2	FRICOn4WayInThornAcc	PhanFRIPln2	3
PhanNglPln1	Nglenn4WayInWestyAcc	PhanNglPln1	3
PhanNglPln2	Nglenn4WayInThornAcc	PhanNglPln2	3
PhanWesPln	Westy4WayInThorntAcc	PhanWesPln	3
SPLk_Pln	SouthPlatteLakePlan	SPLk_Pln	3
StanFRIPln1	FRICOWaterInWestyAcc	StanFRIPln1	3
StanFRIPln2	FRICOWaterInThornAcc	StanFRIPln2	3
StanNglPln1	NglennWaterInWestyAc	StanNglPln1	3
StanNglPln2	NglennWaterInThornAc	StanNglPln2	3
StanReuseN	NorthglennStandleyReuse	StanReuseN	3
StanReuseT	ThorntonStandleyReuse	StanReuseT	3
StanReuseW	WestyStandleyReuse	StanReuseW	3
StanWesPln	WestyWaterInThornAcc	StanWesPln	3
USR_ResPln	USR_RightsInSpinney	USR_ResPln	3
WGLks_Pln	WestGravelLakesPln	WGLks_Pln	3

Plan ID	Plan Name	River Location	Plan Type
06LAF_DIVRE	Laf I Non-Res Reuse	06LAF_REUSE	4
0702318	CoorsWWTP	0702318	4
0802300DW	BiCityDWPlan	0802300DW	4
AurSC_Reuse	AuroraSCReuse	AurSC_Reuse	4
AurSC_Reuse	SandCkAuroraPlan	AurSC_Reuse	4
AurTotEffl	AuroraTotalEffluent	AurTotEffl	4
BearCkPln	BearCkDivnPlan	BearCkPln	4
BriReuse	BrightonReuse	BriReuse	4
CoorsGuaPln	CoorsGuaranteeWater	CoorsGuaPln	4
Gold_WWTP	GoldenWWTP	Gold_WWTP	4
LInReusable	LongEffluent	LONG_IN_Re	4
LOutReusable	LongLIRFs	LONG_OUT_Re	4
MetPumpsPln	MetroPumpsPlan	MetPumpsPln	4
MetroArv	MetroArvadaPln	MetroArv	4
MetroAur	MetroAuroraPlan	MetroAur	4
MetroConM	MetroConMutPln	MetroConM	4
MetroDW	MetroDWPlan	MetroDW	4
MetroGold	MetroGoldenPlan	MetroGold	4
MetroTh	MetroThnPlan	MetroTh	4
MetroWesty	MetroWestyPlan	MetroWesty	4
NglennReuse	NorthglennReuse	NglennReuse	4
PCWA_Reuse	PlumCklWtrAuthPlan	PCWA_Reuse	4
SAC_Reuse	SACWSDReusePln	SAC_Reuse	4
WestyReuse	WestyReuse	WestyReuse	4
0404634	AdamsTunnelDiversion	0404634	7
05_BRCBT	BRCBTImpPlan	05_BRCBT	7
05_LHCBT	LHCBTImpPlan	05_LHCBT	7
05_LongCBT	LongCBTImpPlan	05_LongCBT	7
05_SVCBT	SVCBTImpPlan	05_SVCBT	7
06_CBT_IMP	C-BTImports Plan	06_CBT_IMP	7
06_MOF_IMP	Moffat Import Plan	06_MOF_IMP	7
06_SWSP_IMP	SWSP Import Plan	06_SWSP_IMP	7
060800_IMP	Boulder Import Plan	060800_IMP	7
0700903	StraightCkTunnelPlan	0700903	7
0704625	BerthoudPassDPlan	0704625	7
0704626	VidlerTunnelPlan	0704626	7
0704650	GumlickTunnelPlan	0704650	7
2304611	BoreasPassDPlan	2304611	7
8000653	RobertsTunnelPlan	8000653	7
HOMSPICO	HomestakePipelinePlan	HOMSPICO	7

Plan ID	Plan Name	River Location	Plan Type
SandHill_C	SandHillPlan	SandHill_C	7
0102513_PlR	ROTHE RA Plan	0102513	8
0102518_PlC	PIONEER Canal Plan	0102518	8
0102518_PlR	PIONEER RA Plan	0102518	8
0102522_PlC	RIVERSIDE Canal Plan	0102522	8
0102522_PlR	RIVERSIDE RA Plan	0102522	8
0102528_PlC	FT MORGAN Canal Plan	0102528	8
0102528_PlR	FT MORGAN RA Plan	0102528	8
0102529_PlC	UPPER PB Canal Plan	0102529	8
0102529_PlR	UPPER PB RA Plan	0102529	8
0102535_PlC	LPB CANAL PLAN	0102535	8
0102535_PlR	LPB RA PLAN	0102535	8
0103339_PlC	BIJOU Canal Plan	0103339	8
0103339_PlR	BIJOU RA Plan	0103339	8
0103570_PlR	BIJOU RA Plan	0103570	8
0200824_PlC	FarmersCanalRecharge	0200824_PlC	8
0200824_PlR	FarmersPondRecharge	0200824_PlR	8
0200825_PlC	HewesCkCanalRecharge	0200825_PlC	8
0200825_PlR	HewesCkPondRecharge	0200825_PlR	8
0202003_PlR	FordRechargePln	0202003_PlR	8
6402517_PCP	SEDGWICK Peterson Plan	6402517	8
6402517_PCS	SEDGWICK SReserv Plan	6402517	8
6402517_PlR	SEDGWICK CTY RA PLAN	6402517	8
6402518_PlC	HARMONY CANAL PLAN	6402518	8
6402518_PlR	HARMONY RA PLAN	6402518	8
6402519_PlR	DINSDALE AUG	6402519	8
6402525_PlR	CONDON AUG	6402525	8
6402526_PlC	STERLING AUG	6402526	8
6402526_PlR	STERLING AUG	6402526	8
6402536_PCB	LLWUA Bravo D	6402536	8
6402536_PCH	LLWUA Harmony D	6402536	8
6402536_PCI	LLWUA Iliff Platte D	6402536	8
6402536_PCP	LLWUA Powell Blair D	6402536	8
6402536_PlR	LOWER LOGAN WELL USERS	6402536	8
6402539_PCC	LWU Schneider D	6402539	8
6402539_PCF	LWU Farmers Pawnee D	6402539	8
6402539_PCP	LWU South Platte D	6402539	8
6402539_PCS	LWU Springdale D	6402539	8
6402539_PCT	LWU Sterling No 1 D	6402539	8
6402539_PlR	LWU RA PLAN	6402539	8

Plan ID	Plan Name	River Location	Plan Type
6402540_PlC	LOWLINE CANAL PLAN	6402540	8
6402540_PlR	LOWLINE RA PLAN	6402540	8
6402542_PCL	LSPWCD Liddle D	6402542	8
6402542_PCP	LSPWCD Peterson D	6402542	8
6402542_PlR	LSPWCD AUG	6402542	8
6403392_PlC	NORTH CANAL PLAN	6403392	8
6403392_PlR	NORTH RA PLAN	6403392	8
9902502_PlR	SACWSDAugPln	9902502_PlR	8
9902541_PlR	BrightonAugPln	9902541_PlR	8
9903394_PlR	CentralAugPln	9903394_PlR	8
Camp_Creek	Camp_Creek	Camp_Creek	10
Coffin_Well	Coffin_Well	Coffin_Well	10
Kiowa_Bijou	Kiowa_Bijou	Kiowa_Bijou	10
Lost_Creek	Lost_Creek	Lost_Creek	10
Upper_Crow	Upper_Crow	Upper_Crow	10
05_BRCBT_Pln	BRCBTAcctPlan	05_BRCBT_Pln	11
05_LHCBT_Pln	LHCBTAcctPlan	05_LHCBT_Pln	11
05_SVCBT_Pln	SVCBTAcctPlan	05_SVCBT_Pln	11
06_CBT_ACC	C-BTAcct Plan	06_CBT_ACC	11
06_CBT_SP1	C-BTSplit Plan 1 60pct	06_CBT_ACC	11
06_CBT_SP2	C-BTSplit Plan 2 20pct	06_CBT_ACC	11
06_MOF_ACC	Moffat Acct Pln	06_MOF_ACC	11
06_SWSP_PL	SWSP Acct Pln	06_SWSP_PL	11
060800_ACC	Boulder Acct Pln	060800_PL	11
AdamsTunPln	AdamsTunnelPlan	AdamsTunPln	11
BerthoudPln	BerthoudPassDPlan	BerthoudPln	11
BoreasPln	BoreasPassDPlan	BoreasPln	11
CBT_AllPln	HoldAllCBTimports	CBT_AllPln	11
Compact_Pln	Compact_Plan	6499999	11
CosCoExcFR	FRICOCoorsBypExch	CosCoExcFR	11
CosCoExcNg	NorthglennCoorsByp	CosCoExcNg	11
CosCoExcPln	CoorsBypassExchFromW	CosCoExcPln	11
CosCoExcWe	WestyCoorsBypExch	CosCoExcWe	11
CosGoExcNg	NorthglennGoldenBy	CosGoExcNg	11
CosGoExcPln	GoldenBypassExchFrom	CosGoExcPln	11
CosGoExcWe	WestyGoldenBypExc	CosGoExcWe	11
GumlickPln	GumlickTunnelPlan	GumlickPln	11
HomestkPln	HomestakePipelinePlan	HomestkPln	11
LongCBT_Pln	LongCBTAcctPlan	LongCBT_Pln	11
RobTunPln	RobertsTunnelPlan	RobTunPln	11

Plan ID	Plan Name	River Location	Plan Type
SandHillPln	SandHillPlan	SandHillPln	11
StratCkPln	StraightCkTunnelPlan	StratCkPln	11
VidlerPln	VidlerTunnelPlan	VidlerPln	11
0102513_RnL	ROTHE North RA Limit	0102513_RnL	12
0102513_RsL	ROTHE South RA Limit	0102513_RsL	12
0102518_RL	PIONEER RA Limit	0102518_RL	12
0102522_RL	RIVERSIDE RA Limit	0102522_RL	12
0102528_RL	FT MORGAN RA Limit	0102528_RL	12
0102529_RL	UPPER PB RA Limit	0102529_RL	12
0102535_RL	LPB RA LIMIT	0102535_RL	12
0103339_RL	BIJOU RA Limit	0103339_RL	12
0200824_RL	FarmIndepRelLim	USP_RL	12
0200825_RL	HewesCookRelLim	USP_RL	12
0202003_RL	FordRelLim	USP_RL	12
06_BWR_XLIM	BWR Exchange Limits	060516_PL	12
06_CBT_LIM	Boulder C-BTExch Limit	06_CBT_ACC	12
060501_CHL1	Anderson ChgLm Bou 1	060501_PL	12
060501_CHL2	Anderson ChgLm Bou 2	060501_PL	12
060501_CHL3	Anderson ChgLm Bou 3	060501_PL	12
060525_CHL1	Farmers ChgLm Bou 1	060525_PL	12
060525_CHL2	Farmers ChgLm Bou 2	060525_PL	12
060538_CHL1	LowBoul ChgLm LoBo 59	060538_PL	12
060538_CHL2	LowBoul ChgLm DryCkDav	060538_PL	12
060538_CHL3	LowBoul ChgLm Enterpri	060538_PL	12
060538_CHL4	LowBoul ChgLm Central	060538_PL	12
060538_CHL5	LowBoul ChgLm South	060538_PL	12
060538_CHL8	LowBoul ChgLm LoBo 70	060538_PL	12
060538_CXL1	LowBoul BoMunX ChgLm 1	060538_PL	12
060538_CXL2	LowBoul BoMunX ChgLm 2	060538_PL	12
060538_CXL3	LowBoul BoMunX ChgLm 3	060538_PL	12
060538_CXL4	LowBoul BoMunX ChgLm 4	060538_PL	12
060554_CHL1	SmithGoss ChgLm Bou 1	060554_PL	12
060564_CHL1	SoBoCoal ChgLm Louis 1	060564_PL	12
060565_CHL1	LeynCott ChgLm Lafyt	060902_PL	12
060565_CHL2	LeynCott ChgLm Louis	060902_PL	12
060566_CHL1	Cotton2 ChgLm Louis 1	060902_PL	12
060566_CHL2	Cotton2 ChgLm Louis 2	060902_PL	12
060567_CHL1	Davidsn ChgLm Lafyt 1	060567_PL	12
060567_CHL2	Davidsn ChgLm Lafyt 2	060567_PL	12
060567_CHL3	Davidsn ChgLm Louis 3	060567_PL	12

Plan ID	Plan Name	River Location	Plan Type
060569_CHL1	DCDavd ChgLm Lafyt 1	060902_PL	12
060569_CHL2	DCDavd ChgLm Louis 2	060902_PL	12
060569_CHL3	DCDavd ChgLm CoRid 3	060902_PL	12
060570_CHL1	DryCk2 ChgLm Lafyt 1	060570_PL	12
060570_CHL2	DryCk2 ChgLm Lafyt 2	060570_PL	12
060570_CHL3	DryCk2 ChgLm Lafyt 3	060570_PL	12
060570_CHL4	DryCk2 ChgLm Louis 4	060570_PL	12
060570_CHL5	DryCk2 ChgLm Louis 5	060570_PL	12
060570_CHL6	DryCk2 ChgLm Louis 6	060570_PL	12
060575_CHL1	East Bould ChgLm Louis	060575_PL	12
060575_CHL2	East Bould ChgLm Xcel	060575_PL	12
060576_CHL1	Entprs ChgLm Lafyt 1	060902_PL	12
060576_CHL2	Entprs ChgLm Lafyt 2	060902_PL	12
060576_CHL3	Entprs ChgLm Louis 3	060902_PL	12
060576_CHL4	Entprs ChgLm Louis 4	060902_PL	12
060576_CHL5	Entprs ChgLm CoRid 5	060902_PL	12
060580_CHL1	Howard ChgLm Lafyt 1	060580_PL	12
060580_CHL2	Howard ChgLm Lafyt 2	060580_PL	12
060580_CHL3	Howard ChgLm Louis 3	060580_PL	12
060580_CHL4	Howard ChgLm Louis 4	060580_PL	12
060580_CHL5	Howard ChgLm Louis 5	060580_PL	12
060580_CHL6	Howard ChgLm Louis 6	060580_PL	12
060580_CHL7	Howard ChgLm Eldora 7	060580_PL	12
060599_CHL1	Boulder PL MSF Alt Pt	060599_PL	12
060650_CHL1	Goodhue ChgLm Lafyt 1	060650_PL	12
060650_CHL2	Goodhue ChgLm Lafyt 2	060650_PL	12
060650_CHL3	Goodhue ChgLm Lafyt 3	060650_PL	12
060650_CHL4	Goodhue ChgLm Louis 4	060650_PL	12
064173_CH	Base Rels Limit	064173_CH	12
06LAF_RELIM	Laf I Reuse Limits	06LAF_REUSE	12
527_Pln81DF	527DirectFlow81Limit	0500527_P	12
527_Pln87DF	527DirectFlow87Limit	0500527_P	12
528_Pln81DF	528DirectFlow81Limit	0500528_P	12
529_Pln81DF	529DirectFlow81Limit	0500529_P	12
530_Pln81DF	530DirectFlow81Limit	0500530_P	12
545_Pln81DF	545DirectFlow81Limit	0500545_P	12
545_Pln87DF	545DirectFlow87Limit	0500545_P	12
547_Pln81DF	547DirectFlow81Limit	0500547_P	12
547_Pln87DF	547DirectFlow87Limit	0500547_P	12
551_Pln87DF	551DirectFlow87Limit	0500551_P	12

Plan ID	Plan Name	River Location	Plan Type
552_Pln87DF	552DirectFlow87Limit	0500552_P	12
554_Pln87DF	554DirectFlow87Limit	0500554_P	12
558_Pln87DF	558DirectFlow87Limit	0500558_P	12
560_Pln87DF	560DirectFlow87Limit	0500560_P	12
601_Pln87DF	601DirectFlow87Limit	0500601_P	12
6402517_R1	SEDGWICK Peterson Limit	6402517	12
6402517_R2	SEDGWICK SReserv Limit	6402517	12
6402518_RL	HARMONY RA LIMIT	6402518	12
6402526_RL	STERLING RA LIMIT	6402526	12
6402536_R1	LLWUA IPV PLAN LIMIT	6402536	12
6402536_R2	LLWUA HARMONY LIMIT	6402536	12
6402536_R3	LLWUA BRAVO PLAN LIMIT	6402536	12
6402539_R1	LWU SCHNEIDER LIMIT	6402539	12
6402539_R2	LWU SOUTH PLATTE LIMIT	6402539	12
6402539_R3	LWU SPRINGDALE LIMIT	6402539	12
6402539_R4	LWU STERLING NO1 LIMIT	6402539	12
6402539_R5	LWU FARMERS LIMIT	6402539	12
6402540_RL	LOWLINE RA LIMIT	6402540	12
6402542_R1	LSPWCD LIDDLE LIMIT	6402542	12
6402542_R2	LSPWCD PETERSON LIMIT	6402542	12
6402542_R3	LSPWCD HEYBORNE LIMIT	6402542	12
6403392_RL	NORTH RA LIMIT	6403392	12
Ag_ConM_RL	ConMutualAgDitchLim	USP_RL	12
AgCoors_RL	CoorsAgDitchLimLim	USP_RL	12
AurInt_RL1	AuroraW2083_Limit	USP_RL	12
AurInt_RL2	AuroraW91CW117_Limit	USP_RL	12
BriFul_RL	BriFultonRelLim	USP_RL	12
CenBri_RL	CenFultonRelLim	USP_RL	12
CenFI_RL	CenFIRelLim	USP_RL	12
CenFul_RL	CenFultonRelLim	USP_RL	12
CenHigh_RL	CenHighlandRelLim	USP_RL	12
CenLB_RL	CenLBRelLim	USP_RL	12
CenLM_RL	CenLMRelLim	USP_RL	12
CenPV_RL	CenPVRelLim	USP_RL	12
CenSN3_RL	CenSN3RelLim	USP_RL	12
ChrchCo_RL	CoorsChurchDitchLim	USP_RL	12
ChrchGo_RL	GoldenChurchDitchLim	USP_RL	12
ChrchNg_RL	NglennChurchDitchLim	USP_RL	12
ChrchTh_RL	ThorntonChurchDitchLim	USP_RL	12
ChrchWe_RL	WestyChurchDitchLim	USP_RL	12

Plan ID	Plan Name	River Location	Plan Type
CoorsRJ_RL	CoorsRenoJ_Lim	USP_RL	12
CoorsRM_RL	CoorsRkyMtnLim	USP_RL	12
Cosmic_RL1	CoorsBypassLimit	USP_RL	12
Cosmic_RL2	GoldenBypassLimit	USP_RL	12
Cosmic_RL3	LCCLimitPlanCosmic	USP_RL	12
DWB_PSCo_RL	DWB_ReuseRelLim	USP_RL	12
FHL_Coo_RL	CoorsFHLLim	USP_RL	12
FHL_Thn_RL	ThornFHLLim	USP_RL	12
FHL_Wes_RL	WestyFHLLim	USP_RL	12
FishPSC_RL	PSCoFisherLim	USP_RL	12
FishTh_RL	ThorntonFisherLim	USP_RL	12
LSEConM_RL	ConM_LSE_Lim	USP_RL	12
LSEGol1_RL	Golden_LSE_Pri12_Lim	USP_RL	12
LSEGol2_RL	Golden_LSE_Lim	USP_RL	12
MetroAurRL	MetroAuroraReuseLim	USP_RL	12
NglennLB_RL	NglennLBRelLim	USP_RL	12
NglnFul_RL	NglnFultonRelLim	USP_RL	12
PSCoHC_RL	PSCoHCRelLim	USP_RL	12
PSCoJT_RL	PSCoJTRelLim	USP_RL	12
PSCoLB_RL	PSCoLBRelLim	USP_RL	12
PSCoLM_RL	PSCoLMRelLim	USP_RL	12
PSCoMI21_RL	PSCoMI2SenRelLim	USP_RL	12
PSCoMI22_RL	PSCoMI2JunRelLim	USP_RL	12
SACBri_RL	SACFultonRelLim	USP_RL	12
SACBurl_RL	SACBurlRelLim	USP_RL	12
SACFul_RL	SACFultonRelLim	USP_RL	12
SACLB_RL	SACLBRelLim	USP_RL	12
SACLM_RL	SACLMRelLim	USP_RL	12
SACMI1_RL	SACMI1RelLim	USP_RL	12
Standley_RL	Stan1FillPlnSourceTo	Standley_RL	12
ThBurl_RL	ThBurlRelLim	USP_RL	12
ThCoAg02_RL	Thorn02caseCoAgRelLim	USP_RL	12
ThCoAg89_RL	Thorn89caseCoAgRelLim	USP_RL	12
ThLCC_02_RL	Thorn02caseLCC_RelLim	USP_RL	12
ThLCC_89_RL	Thorn89caseLCC_RelLim	USP_RL	12
WannCoo_RL	CoorsWannLim	USP_RL	12
Welch_RL	ConMutualWelchLim	USP_RL	12
WesKer86_RL	Westy_86CW398_ExchLim	USP_RL	12
WesKer93_RL	Westy_93CW176_KerExcLim	USP_RL	12
WesMan93_RL	Westy_93CW176_ManExcLim	USP_RL	12

Plan ID	Plan Name	River Location	Plan Type
060501_CH1	Anderson D Chg Bou 1	060501_PL	13
060501_CH2	Anderson D Chg Bou 2	060501_PL	13
060501_CH3	Anderson D Chg Bou 3	060501_PL	13
060501_CHI1	Anderson D Irr	060501_PL	13
060501_CHT1	Anderson D Chg	060501_PL	13
060525_CH1	Farmers D Chg Bou 1	060525_PL	13
060525_CH2	Farmers D Chg Bou 2	060525_PL	13
060525_CHT1	Farmers D Chg	060525_PL	13
060525_CS1	Farmers D 10pct on D	060525_PL	13
060525_CS2	Farmers D 5pct on D	060525_PL	13
060530_CH1	Harden D Chg Bou 1	060599_PL	13
060538_CH1	LBLafyt Chg LoBo 1859	060538_PL	13
060538_CH2	LBLafyt Chg DryCkDavid	060538_PL	13
060538_CH5	LBLafyt Chg South	060538_PL	13
060538_CH6	LBLafyt Chg LoBo 1870	060538_PL	13
060538_CH7	LBLafyt Chg CentSou	060538_PL	13
060538_CH8	LBLafyt Chg CentSou	060538_PL	13
060538_CHI1	LowBoul Irrig Chg 1	060538_PL	13
060538_CHI2	LowBoul Irrig Chg 2	060538_PL	13
060538_CHI5	LowBoul Irrig Chg 5	060538_PL	13
060538_CHI6	LowBoul Irrig Chg 6	060538_PL	13
060538_CHI8	LowBoul Irrig Chg 8	060538_PL	13
060538_CHT1	LowBoul Chg LoBo 1859	060538_PL	13
060538_CHT2	LowBoul Chg LoBo 1863	060538_PL	13
060538_CHT5	LowBoul Chg LoBo 1870	060538_PL	13
060538_CHT6	LowBoul Chg LoBo 1882	060538_PL	13
060538_CHT8	LowBoul Chg LoBo 1882	060538_PL	13
060538_CX1	LowBoul Bo MunEx Chg 1	060538_PL	13
060538_CX2	LowBoul Bo MunEx Chg 2	060538_PL	13
060538_CX3	LowBoul Bo MunEx Chg 3	060538_PL	13
060538_CX4	LowBoul Bo MunEx Chg 4	060538_PL	13
060538_CX5	CentSou Bo MunEx Chg 1	060538_PL	13
060538_CX6	CentSou Bo MunEx Chg 2	060538_PL	13
060542_CH1	McCarty D Chg	060542_PL	13
060543_CH1	NoBoFarm Chg 1	060543_PL	13
060543_CH2	NoBoFarm Chg 2	060543_PL	13
060543_CH3	NoBoFarm Chg 3	060543_PL	13
060543_CH4	NoBoFarm Chg 4	060543_PL	13
060554_CH1	SmithGoss Chg Bou 1	060554_PL	13
060554_CH2	SmithGoss Chg Bou 2	060554_PL	13

Plan ID	Plan Name	River Location	Plan Type
060554_CHT1	SmithGoss Chg	060554_PL	13
060554_CS1	SmithGoss 10pct on D	060554_PL	13
060554_CS2	SmithGoss 5pct on D	060554_PL	13
060564_CH1	SoBo Cl Ck Chg Louis 1	060564_PL	13
060564_CHI1	SoBo Cl Ck Irr	060564_PL	13
060564_CHT1	SoBo Cl Ck Chg	060564_PL	13
060564_CS1	SoBo Cl Ck 16.6pct	060564_PL	13
060565_CH1	LeynCott Chg Lafyt	060902_PL	13
060565_CH2	LeynCott Chg Louis	060902_PL	13
060565_CHI1	LeynCott Irr	060902_PL	13
060565_CHT1	LeynCott Chg	060902_PL	13
060565_CS1	LeynCott 10pct in D	060902_PL	13
060565_CS2	LeynCott 20pct in D	060902_PL	13
060566_CH1	Cotton No2 Chg Louis 1	060902_PL	13
060566_CH2	Cotton No2 Chg Louis 2	060902_PL	13
060566_CHI1	Cotton No2 Irr	060902_PL	13
060566_CHT1	Cotton No2 Chg	060902_PL	13
060566_CS1	Cotton No2 19pct on D	060902_PL	13
060566_CS2	Cotton No2 19pct on D	060902_PL	13
060567_CH1	Davidson Chg Lafyt 1	060567_PL	13
060567_CH2	Davidson Chg Lafyt 2	060567_PL	13
060567_CH3	Davidson Chg Louis 3	060567_PL	13
060567_CHT1	Davidson Chg	060567_PL	13
060567_CS2	Davidson 10pct in D	060567_PL	13
060567_CS3	Davidson 10pct in D	060567_PL	13
060569_CH1	DCDavd Chg Lafytt 1	060902_PL	13
060569_CH2	DCDavd Chg Louis 2	060902_PL	13
060569_CH3	DCDavd Chg CoalRidge 3	060902_PL	13
060569_CHI1	DCDavd Irr	060902_PL	13
060569_CHT1	DCDavd Chg	060902_PL	13
060569_CS1	DCDavd 12pct in D	060902_PL	13
060569_CS2	DCDavd 17.7pct in D	060902_PL	13
060570_CH1	DryCk2 Chg Lafyt 1	060570_PL	13
060570_CH2	DryCk2 Chg Lafyt 2	060570_PL	13
060570_CH3	DryCk2 Chg Lafyt 3	060570_PL	13
060570_CH4	DryCk2 Chg Louis 1	060570_PL	13
060570_CH5	DryCk2 Chg Louis 2	060570_PL	13
060570_CH6	DryCk2 Chg Louis 3	060570_PL	13
060570_CHT1	DryCk2 Chg	060570_PL	13
060570_CS4	DryCk2 10pct in D	060570_PL	13

Plan ID	Plan Name	River Location	Plan Type
060570_CS5	DryCk2 17pct in D	060570_PL	13
060570_CS6	DryCk2 50pct in D	060570_PL	13
060575_CH1	East Bould Chg Louis	060575_PL	13
060575_CH2	East Bould Chg Xcel	060575_PL	13
060575_CHT1	East Bould Chg	060575_PL	13
060575_CS1	East Bould 17pct on D	060575_PL	13
060576_CH1	Entprs Chg Lafytt 1	060902_PL	13
060576_CH2	Entprs Chg Lafytt 2	060902_PL	13
060576_CH3	Entprs Chg Louis 3	060902_PL	13
060576_CH4	Entprs Chg Louis 4	060902_PL	13
060576_CH5	Entprs Chg CoalRidge 5	060902_PL	13
060576_CHI1	Entprs Irr	060902_PL	13
060576_CHT1	Entprs Chg	060902_PL	13
060576_CS3	Entprs 16.6pct on D	060902_PL	13
060576_CS4	Entprs 16.6pct on D	060902_PL	13
060580_CH1	Howard Chg Lafyt 1	060580_PL	13
060580_CH2	Howard Chg Lafyt 2	060580_PL	13
060580_CH3	Howard Chg Louis 3	060580_PL	13
060580_CH4	Howard Chg Louis 4	060580_PL	13
060580_CH5	Howard Chg Louis 5	060580_PL	13
060580_CH6	Howard Chg Louis 6	060580_PL	13
060580_CH7	Howard Chg Eldora 7	060580_PL	13
060580_CHT1	Howard Chg	060580_PL	13
060580_CS1	Howard 20pct in D	060580_PL	13
060580_CS2	Howard 20pct in D	060580_PL	13
060580_CS3	Howard 10pct in D	060580_PL	13
060580_CS4	Howard 10pct in D	060580_PL	13
060580_CS5	Howard 20pct in D	060580_PL	13
060580_CS6	Howard 15pct in D	060580_PL	13
060580_CS7	Howard 5pct in D	060580_PL	13
060585_CH1	Mrshvl Chg Louis 1	060585_PL	13
060586_CH1	McGinn Chg Louis 1	060586_PL	13
060588_CH1	SouBouBC Chg Lafyt 1	060588_PL	13
060599_CH1	Boulder PL MSF Pln 1	060599_PL	13
060599_CH2	Boulder PL MSF Pln 2	060599_PL	13
060599_CHT1	Boulder PL MSF Alt Pt	060599_PL	13
060650_CH1	Goodhue Chg Lafyt 1	060650_PL	13
060650_CH2	Goodhue Chg Lafyt 2	060650_PL	13
060650_CH3	Goodhue Chg Lafyt 3	060650_PL	13
060650_CH4	Goodhue Chg Lafyt 4	060650_PL	13

Plan ID	Plan Name	River Location	Plan Type
060650_CHT1	Goodhue Chg	060650_PL	13
060650_CS4	Goodhue 10pct in d	060650_PL	13
150_85Split	Burlington1885Divn	150_85Split	13
200_85Split	Barr1885divn	200_85Split	13
2302201	BeeryDTransferPlan	2302201	13
2302900_Pln	SFkSPRAbvAnteroPln	2302900_Pln	13
2302901_Pln	4MileNrHarstelPln	2302901_Pln	13
2302902_Pln	SPR_SantaMariaPln	2302902_Pln	13
2302902_Pln	SPR_SantaMariaPln	2302902_Pln	13
2302903_Pln	SFkSPRAbvSpinneyPln	2302903_Pln	13
2302903_Pln	SFkSPRAbvSpinneyPln	2302903_Pln	13
2302904_Pln	4MileAtHighCkPln	2302904_Pln	13
2302904_Pln	4MileAtHighCkPln	2302904_Pln	13
2302906_Pln	TroutGaroPln	2302906_Pln	13
2302907_Pln	MichCkAbvJeffersonPln	2302907_Pln	13
2302907_Pln	SprBranchAbMidFkPln	2302907_Pln	13
2302908_Pln	JeffCkNrJeffersonPlan	2302908_Pln	13
2302908_Pln	MidSPR_PrincePln	2302908_Pln	13
2302909_Pln	TroutGaroPln	2302909_Pln	13
2302910_Pln	OhlerGulchGagePlan	2302910_Pln	13
2302910_Pln	SprBranchAbMidFkPln	2302910_Pln	13
2302911_Pln	MidSPR_PrincePln	2302911_Pln	13
2302912_Pln	SPR_SantaMariaPln	2302912_Pln	13
2302913_Pln	SFkSPRAbvSpinneyPln	2302913_Pln	13
2302914_Pln	FrenchCkGagePlan	2302914_Pln	13
2302914_Pln	4MileAtHighCkPln	2302914_Pln	13
2302915_Pln	TroutGaroPln	2302915_Pln	13
2302916_Pln	SchattingerGagePlan	2302916_Pln	13
2302916_Pln	SprBranchAbMidFkPln	2302916_Pln	13
2302917_Pln	MidSPR_PrincePln	2302917_Pln	13
2302918_Pln	MidSPR_PrincePln	2302918_Pln	13
527_Pln	527ChangePlan	0500527_P	13
527_Pln81	527ChangeSplit81	0500527_P	13
527_Pln87	527ChangeSplit87	0500527_P	13
528_Pln81	528ChangePlan	0500528_P	13
529_Pln81	529ChangePlan	0500529_P	13
530_Pln81	530ChangePlan	0500530_P	13
545_Pln	545ChangePlan	0500545_P	13
545_Pln81	545ChangeSplit81	0500545_P	13
545_Pln87	545ChangeSplit87	0500545_P	13

Plan ID	Plan Name	River Location	Plan Type
547_Pln	547ChangePlan	0500547_P	13
547_Pln81	547ChangeSplit81	0500547_P	13
547_Pln87	547ChangeSplit87	0500547_P	13
547_PlnI	547IrrPlan	0500547_P	13
551_Pln87	551ChangePlan	0500551_P	13
552_Pln87	552ChangePlan	0500552_P	13
554_Pln87	554ChangePlan	0500554_P	13
558_Pln87	558ChangePlan	0500558_P	13
560_Pln87	560ChangePlan	0500560_P	13
601_Pln87	601ChangePlan	0500601_P	13
6400525_PL	HendersonSmith Plan	6400525_PL	13
6400528_PL	SterlingNo1 Plan	6400528_PL	13
AgIrrPln	AgDIrrigPlan	AgIrrPln	13
AgSplPln	AgDitchSplitPlan	AgSplPln	13
ArvChPln	ArvadaChurchDPlan	ArvChPln	13
ArvFHLPln	ArvadaFHLPlan	ArvFHLPln	13
ArvRJPln	ArvadaRenoJuchemDPlan	ArvRJPln	13
ArvSluPln	ArvadaSloughDPlan	ArvSluPln	13
AurIntPln1	AuroraIntakePlanW2083	AurIntPln1	13
AurIntPln2	AuroraIntakePln91CW117	AurIntPln2	13
AurIntPln3	AuroraIntakePln1964	AurIntPln3	13
BarnDL_Pln	PL_BarnesDitchLoss	BarnDL_Pln	13
Barnes_Pln	PL_BarnesPlan	Barnes_Pln	13
BarnLV_Pln	PL_BarnesLvlndPlan	BarnLV_Pln	13
Berthoud_C	BerthoudPassCarrier	Berthoud_C	13
BigTDL_Pln	PL_BigTDitchLoss	BigTDL_Pln	13
BigTLV_Pln	PL_BigTLvlndPlan	BigTLV_Pln	13
BigTMfg_Pln	PL_BigTMfgPlan	BigTMfg_Pln	13
Boreas_C	BoreasPassCarrier	Boreas_C	13
BriFulPln	FultonBrightonChange	BriFulPln	13
BriIrrPln	BrightonIrrigPlan	BriIrrPln	13
BriSplPln	BrightonSplitPlan	BriSplPln	13
Bur10Split	Burlington10.28Divn	Bur10Split	13
CenBriPln	BrightonCentralChangE	CenBriPln	13
CenFarmPln	CentralFarmersChange	CenFarmPln	13
CenFulPln	FultonCentralChange	CenFulPln	13
CenHighPln	CentralHighlandChange	CenHighPln	13
CenLBPln	LBCentralChange	CenLBPln	13
CenLMPln	CentralLB10cfsChange	CenLMPln	13
CenPVPln	CentralPVChange	CenPVPln	13

Plan ID	Plan Name	River Location	Plan Type
CenSN3Pln	CentralSN3Change	CenSN3Pln	13
ChrchIrrPln	ChurchDIrrigPlan	ChrchIrrPln	13
ChrchSplPl1	ChurchDSplitPlan2	ChrchSplPl1	13
ChrchSplPln	ChurchDSplitPlan1	ChrchSplPln	13
ChubbuckPln	PL_ChubbuckPlan	ChubbuckPln	13
ChubDL_Pln	PL_ChubDitchLoss	ChubDL_Pln	13
ChubLV_Pln	PL_ChubLvlndPlan	ChubLV_Pln	13
Cnd20DirPln	Cond20DirectFlowPln	Cnd20DirPln	13
CoAgIrrPln	ColoAgIrrigPlan	CoAgIrrPln	13
CoAgSplPln	ColoAgDSplitPlan	CoAgSplPln	13
Cond20Pln	Cond20ChangedRightsPln	Cond20Pln	13
ConM_Ag_Pln	ConMutualAgDPlan	ConM_Ag_Pln	13
ConM_LS2Pln	ConMutualLSE1988Plan	ConM_LS2Pln	13
ConM_LSEPln	ConMutualLSEPlan	ConM_LSEPln	13
ConM_RM_Pln	ConMutualRkyMtnDPlan	ConM_RM_Pln	13
CoorsAgPln	CoorsAgDPlan	CoorsAgPln	13
CoorsChPln	CoorsChurchDPlan	CoorsChPln	13
CoorsFHLPln	CoorsFHLPlan	CoorsFHLPln	13
CoorsRJPln	CoorsRenoJuchemDPlan	CoorsRJPln	13
CoorsRM_Pln	CoorsRkyMtnDPlan	CoorsRM_Pln	13
CoorsSluPln	CoorsSloughDPlan	CoorsSluPln	13
CoorsWanPln	CoorsWannamakerDPlan	CoorsWanPln	13
CosmcPln1	GoldenBypassWtrSource	CosmcPln1	13
CosmcPln2	CoorsBypassWtrSource	CosmcPln2	13
DenLastDPln	DenverLastChanceDPln	DenLastDPln	13
EngIntPln	EnglewoodNevadaDPlan	EngIntPln	13
EngLastDPln	EnglwdLastChanceDPln	EngLastDPln	13
FandGIndPln	FarmGardIndusPlan	FandGIndPln	13
FandGIrrPln	FarmGardIrrigPlan	FandGIrrPln	13
FandGSplPln	FarmGardSplitPlan	FandGSplPln	13
FarmIrrPln	FarmersIndIrrigPln	FarmIrrPln	13
FarmSplPln	FarmersIndSplitPlan	FarmSplPln	13
FB150_85Pln	FricoBarr150_1885Divn	FB150_85Pln	13
FB200_85Pln	FricoBarr200_1885Divn	FB200_85Pln	13
FHL_IrrPln	FHLIrrigPlan	FHL_IrrPln	13
FHL_SplPln	FHLSplitPlan	FHL_SplPln	13
FishIrrPln	FisherIrrigPlan	FishIrrPln	13
FishSplPln	FisherDSpliPlan	FishSplPln	13
FulIrrPln	FultonIrrigPlan	FulIrrPln	13
FulSplPln	FultonSplitPlan	FulSplPln	13

Plan ID	Plan Name	River Location	Plan Type
GeoRDL_Pln	PL_GeorgeRDitchLoss	GeoRDL_Pln	13
GeoRist_Pln	PL_GeorgeRistPlan	GeoRist_Pln	13
GeoRLV_Pln	PL_GeorgeRLvlndPlan	GeoRLV_Pln	13
GldnCtyDPln	GoldenCityDitchPlan	GldnCtyDPln	13
GldPri12Pln	GoldenLSEPriority12Pln	GldPri12Pln	13
Gold_LSEPln	GoldenLSEPlan	Gold_LSEPln	13
GoldChPln	GoldenChurchDPlan	GoldChPln	13
GoldLSE2Pln	GoldenLSEPlanAfterLoss	GoldLSE2Pln	13
GoldSluPln	GoldenSloughDPlan	GoldSluPln	13
Gumlick_C	JonePassCarrier	Gumlick_C	13
HewesIrrPln	HewesCookIrrigPln	HewesIrrPln	13
HewesSplPln	HewsCookSplitPlan	HewesSplPln	13
HID15085Pln	Henrylyn150_1885Divn	HID15085Pln	13
HID20085Pln	Henrylyn200_1885Divn	HID20085Pln	13
HighIrrPln	HighlandIrrigPln	HighIrrPln	13
HighSplPln	HighlandSplitPlan	HighSplPln	13
Homestk_C	HomestakePL_Carrier	Homestk_C	13
KerIrrPln	KershawIrrigPlan	KerIrrPln	13
KerSplPln	KershawDSplitPlan	KerSplPln	13
LastDSplPln	LastChanceDSplPlan	LastDSplPln	13
LB_IrrPln	LuptonBottomIrrigPlan	LB_IrrPln	13
LB_SplPln	LuptonBottomSplitPlan	LB_SplPln	13
LB200_85Pln	LittleBurl200_1885Divn	LB200_85Pln	13
LBBur10Pln	LittBurlBurlington10.28	LBBur10Pln	13
LBSanstPln	LittleBurlSanstad6	LBSanstPln	13
LBWell7Pln	LittleBurlWellington7	LBWell7Pln	13
LCC_IrrPln	LCCDIrrigPlan	LCC_IrrPln	13
LCC_SplPln	LCCDSplitPlan	LCC_SplPln	13
LM_SplPln	LuptonMeadowsSplitPlan	LM_SplPln	13
LoudDL_Pln	PL_LoudenDitchLoss	LoudDL_Pln	13
Louden_Pln	PL_LoudenPlan	Louden_Pln	13
LoudLV_Pln	PL_LoudenLvlndPlan	LoudLV_Pln	13
LSE_IrrPln	LSEIrrigPlan	LSE_IrrPln	13
LSE_SplPln	LSEDitchSplitPlan	LSE_SplPln	13
M2JunSplPln	MeadowIsland2JunSplPlan	M2JunSplPln	13
M2SenSplPln	MeadowIsland2SenSplPlan	M2SenSplPln	13
MI1IrrPln	MeadowIsland1IrrigPln	MI1IrrPln	13
MI1SplPln	MeadowIsland1SplitPlan	MI1SplPln	13
MI2IrrPln	MeadowIsland1IrrigPln	MI2IrrPln	13
Ngl_LCCPln	NorthglennLCCDPlan	Ngl_LCCPln	13

Plan ID	Plan Name	River Location	Plan Type
NglennChPln	NglennChurchDPlan	NglennChPln	13
NglennLBPln	LBNorthglennChange	NglennLBPln	13
NglnFulPln	FultonNorthglennChange	NglnFulPln	13
OrigXferPln	PL_OrigXferPlan	OrigXferPln	13
PSCoFishPln	PSCoFisherDPlan	PSCoFishPln	13
PSCoHewsPln	PSCHewesCookChange	PSCoHewsPln	13
PSCoLBPln	PSCoLuptonBottomChange	PSCoLBPln	13
PSCoLMPln	PSCoLB10cfsChange	PSCoLMPln	13
PSCoMI2Pln1	PSCoMI2SenChange	PSCoMI2Pln1	13
PSCoMI2Pln2	PSCoMI2JunChange	PSCoMI2Pln2	13
PV_IrrPln	PlattevilleIrrigPln	PV_IrrPln	13
PVSplPln	PlattevilleSplPln	PVSplPln	13
RJ_IrrPln	RenoJuchemDIrrigPln	RJ_IrrPln	13
RJ_SplPln	RenoJuchemDSplitPln	RJ_SplPln	13
RM_IrrPln	RkyMtnDIrrigPlan	RM_IrrPln	13
RM_SplPln	RkyMtnDSplitPlan	RM_SplPln	13
RobTun_C	RobertsTunnelCarrier	RobTun_C	13
SA200_85Pln	SA200_1885Divn	SA200_85Pln	13
SABur10Pln	SABurlington10.28	SABur10Pln	13
SAC_BriPln	SACWSDBrightonChange	SAC_BriPln	13
SAC_FulPln	FultonSACWSDChange	SAC_FulPln	13
SAC_LBPln	SACWSDLuptonBtmChange	SAC_LBPln	13
SAC_LMPln	SACWSDLB10cfsChange	SAC_LMPln	13
SAC_MI1Pln	SACWSDMI1Change	SAC_MI1Pln	13
SanstSplit	Sanstad6Divn	SanstSplit	13
SASanstPln	SASanstad6	SASanstPln	13
SAWell7Pln	SAWellington7	SAWell7Pln	13
SluSplit1	SloughDNo1SplPlan	SluSplit1	13
SluSplit2	SloughDNo2SplPlan	SluSplit2	13
SluSplit3	SloughDNo3SplPlan	SluSplit3	13
SluSplit4	SloughDNo4SplPlan	SluSplit4	13
SluSplit5	SloughDNo5SplPlan	SluSplit5	13
SN3IrrPln	SectionNo3IrrigPln	SN3IrrPln	13
SN3SplPln	SectionNo3SplPln	SN3SplPln	13
SouSdDL_Pln	PL_SSideDitchLoss	SouSdDL_Pln	13
SouSdLV_Pln	PL_SSideLvlndPlan	SouSdLV_Pln	13
SouSide_Pln	PL_SSidePlan	SouSide_Pln	13
SouthSidPln	CoorsSouthSideCredits	SouthSidPln	13
Stan1902Pln	CrokeOneFillStoRight	Stan1902Pln	13
StanLimPln	Croke1FillPlnRightSt	StanLimPln	13

Plan ID	Plan Name	River Location	Plan Type
StanPlnF	FRICO1902Croke	StanPlnF	13
StanPlnN	Northglenn1902Croke	StanPlnN	13
StanPlnT	Thornton1902Croke	StanPlnT	13
StanPlnW	Westy1902Croke	StanPlnW	13
StratCk_C	StraightCkTunnelCarrier	StratCk_C	13
TaryTempPln	ChangedRightsForRel	TaryTempPln	13
Th200_85Pln	Thornton200_1885Divn	Th200_85Pln	13
ThBur10Pln	ThorntonBurlington10.28	ThBur10Pln	13
ThChurchPln	ThorntonChurchDPlan	ThChurchPln	13
ThCoAg02Pln	ThorntonCoAg02CW266Pln	ThCoAg02Pln	13
ThCoAg89Pln	ThorntonCoAg89CW132Pln	ThCoAg89Pln	13
ThFHLPln	ThorntonFHLPlan	ThFHLPln	13
ThFishPln	ThorntonFisherDPlan	ThFishPln	13
ThKerPln	ThorntonKershawDPlan	ThKerPln	13
ThLCC02Pln	ThorntonLCC02CW132Plan	ThLCC02Pln	13
ThLCC89Pln	ThorntonLCC89CW132Plan	ThLCC89Pln	13
ThSanstPln	ThorntonSanstad6	ThSanstPln	13
ThWell7Pln	ThorntonWellington7	ThWell7Pln	13
Vidler_C	VidlerTunnelCarrier	Vidler_C	13
WannIrrPln	WannamakerDIrrigPlan	WannIrrPln	13
WannSplPln	WannamakerDSplPlan	WannSplPln	13
WelcConMPln	WelchConMutPlan	WelcConMPln	13
WelchIrrPln	WelchIrrigPlan	WelchIrrPln	13
WelchPln	WelchPlan	WelchPln	13
Well7Split	Wellington7Divn	Well7Split	13
WestKer1Pln	Westy68CW398KershPln	WestKer1Pln	13
WestKer2Pln	Westy68CW398KershPln	WestKer2Pln	13
WestyChPln	WestyChurchDPlan	WestyChPln	13
WestyFHLPln	WestyFHLPlan	WestyFHLPln	13
WestyKerPln	WestyKershawDPlan	WestyKerPln	13

7.5 Aggregate Well Structures

The table below summarizes the structures in the well station file (*.wes). The same aggregate boundaries are used for surface water and ground water structures; see Figure 7-1 and Figure 7-2 for the aggregate boundaries.

Table 7-5: Well Station File Summary

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
1	01_ADP037	South Platte River below Kersey Co North 2	3	806	60	28	Irr
2	01_AMP001_I	WD 1 Muni Ind	92	N/A	10	3,809	M/I
3	01_AMP001_O	WD 1 Muni Out	92	N/A	83	2,992	M/I
4	01_AUP001_I	WD 1 Unincorp Ind	999	N/A	10	13,669	M/I
5	01_AUP001_O	WD 1 Unincorp Out	999	N/A	83	10,740	M/I
6	01_AUP002_I	WD 1 Unincorp Ind	999	N/A	10	1,831	M/I
7	01_AUP002_O	WD 1 Unincorp Out	999	N/A	83	1,439	M/I
8	01_AWP001	Camp Creek Designated Basin	31	2,025	60	4,131	Irr
9	01_AWP002	South Platte River below Weldona CO North	269	1,590	60	4,429	Irr
10	01_AWP003	WD 1 Upper Beaver Creek	133	2,147	60	7,954	Irr
11	01_AWP004	WD 1 Main Stem Beaver Creek	108	757	60	4,663	Irr
12	01_AWP005	WD 1 Washington County	62	193	60	1,881	Irr
13	01_AWP006	South Platte River below Weldona CO South 1	28	197	60	1,624	Irr
14	01_AWP007	South Platte River below Weldona CO South 2	188	1,484	60	5,301	Irr
15	01_AWP008	Upper Kiowa Bijou Designated Basin	21	916	60	1,704	Irr
16	01_AWP009	Upper Kiowa Bijou Designated Basin	46	1,638	60	3,066	Irr
17	01_AWP010	Lower Kiowa Bijou Designated Basin East 1	37	1,375	60	2,311	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
18	01_AWP011	Lower Kiowa Bijou Designated Basin East 2	78	2,830	60	5,948	Irr
19	01_AWP012	Lower Kiowa Bijou Designated Basin East 4	223	5,519	60	8,642	Irr
20	01_AWP013	Lower Kiowa Bijou Designated Basin East 5	61	2,950	60	5,102	Irr
21	01_AWP014	Lower Kiowa Bijou Designated Basin East 6	175	4,726	60	7,497	Irr
22	01_AWP015	Lower Kiowa Bijou Designated Basin East 7	126	3,921	60	5,745	Irr
23	01_AWP016	Lower Kiowa Bijou Designated Basin East 8	111	3,176	60	6,492	Irr
24	01_AWP017	Lower Kiowa Bijou Designated Basin East 9	79	2,646	60	5,069	Irr
25	01_AWP018	Lower Kiowa Bijou Designated Basin East 10	123	6,042	60	9,747	Irr
26	01_AWP019	Lower Kiowa Bijou Designated Basin West 1	147	4,301	60	7,085	Irr
27	01_AWP020	Lower Kiowa Bijou Designated Basin West 2	50	2,562	60	4,644	Irr
28	01_AWP021	Lower Kiowa Bijou Designated Basin West 3	60	1,935	60	3,838	Irr
29	01_AWP022	Lower Lost Creek Designated Basin 1	46	2,875	60	4,776	Irr
30	01_AWP023	Lower Lost Creek Designated Basin 2	107	4,605	60	10,363	Irr
31	01_AWP024	Lower Lost Creek Designated Basin 3	111	2,909	60	4,177	Irr
32	01_AWP025	Upper Lost Creek Designated Basin	30	2,013	60	3,668	Irr
33	01_AWP026	South Platte River Above Weldona Co South 1	70	786	60	2,951	Irr
34	01_AWP027	South Platte River Above Weldona Co South 2	88	2,266	60	4,566	Irr
35	01_AWP028	South Platte River Above Weldona Co South 3	114	2,000	60	6,528	Irr
36	01_AWP029	South Platte River Above Weldona Co South 4	65	1,407	60	4,205	Irr
37	01_AWP030	South Platte River Above Weldona Co South 5	118	1,803	60	4,851	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
38	01_AWP031	South Platte River below Riverside Canal South	123	3,516	60	7,145	Irr
39	01_AWP032	WD 1 Lower Boxelder Creek	150	3,976	60	5,405	Irr
40	01_AWP033	South Platte River Above Weldona Co North	71	1,197	60	4,534	Irr
41	01_AWP035	WD 1 Upper Boxelder Creek	57	875	60	2,551	Irr
42	01_AWP037	South Platte River below Kersey Co North 2	28	600	60	533	Irr
43	01_AWP038	Upper Crow Creek Designated Basin	119	4,997	60	7,798	Irr
44	01_AWP039	Upper Kiowa Bijou Designated Basin	42	1,860	60	3,895	Irr
45	01_AWP040	Upper Kiowa Bijou Designated Basin	27	1,661	60	2,175	Irr
46	01_AWP042	South Platte River below Kersey Co South	159	3,914	60	8,068	Irr
47	01_AWP043	WD 1 Upper Boxelder Creek	30	843	60	1,601	Irr
48	01_AWP044	WD 1 Lower Boxelder Creek	1	53	60	3	Irr
49	0100503_I	RIVERSIDE CANAL DEMAND	248	27,943	60	4,636	Irr
50	0100507_I	BIJOU CANAL DEMAND	1,072	27,877	60	4,512	Irr
51	0100511	Weldon Valley Ditch	77	7,844	60	0	Irr
52	0100514	Ft Morgan Div System	253	10,318	60	476	Irr
53	0100515	Upper Platte Beaver Cana	299	10,134	60	1,173	Irr
54	0100517	Deuel Snyder Canal	152	1,439	60	262	Irr
55	0100518	Lower Platte Beaver Ditc	393	12,362	60	8,086	Irr
56	0100519_D	TREMONT DITCH DIVSYS	298	3,847	60	2,012	Irr
57	0100520	Gill Stevens Ditch	28	559	60	1,527	Irr
58	0100524	Trowell Ditch	17	514	60	582	Irr
59	0100526	Johnson Edwards Ditch	162	2,175	60	2,343	Irr
60	0100570	East Gulch Ditch	2	174	60	351	Irr
61	0100620	Consolidated Larson D	1	284	60	184	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
62	0100687_I	NORTH STERLING DEMAND	50	39,009	60	3,209	Irr
63	0100688	Union Ditch	71	1,105	60	648	Irr
64	0100711	PSCo Well Field	15	N/A	100	3,008	M/I
65	0102513_ReW	Rothe Recharge Well	11	N/A	0	466	Recharge/Aug Well
66	0102535_ReW	LPB Recharge Well	9	N/A	0	365	Recharge/Aug Well
67	0103817_I	JACKSON RESERVOIR DEMAND	9	342	60	90	Irr
68	02_ADP003	South Platte River below	21	373	60	4	Irr
69	02_AUP001_I	WD 2 Agg Uninc In	999	N/A	10	2,860	M/I
70	02_AUP001_O	WD 2 Agg Uninc Out	999	N/A	83	2,247	M/I
71	02_AWP001	WD2 Agg Wells1 blw Barr	221	3,388	60	7,216	Irr
72	02_AWP002	WD2 Agg Wellsw abv Barr	129	3,647	60	8,846	Irr
73	02_AWP003	WD2 Agg Wells 3	291	3,419	60	2,431	Irr
74	02_AWP004	WD2 Agg Wells 4	197	4,824	60	7,900	Irr
75	02_AWP005	WD2 Agg Wells 5	22	261	60	628	Irr
76	02_Bright_I	Brighton Indoor	999	N/A	10	6,327	M/I
77	02_Bright_O	Brighton Outdoor	999	N/A	83	4,971	M/I
78	02_SACWSD_I	SACWSD Indoor	999	N/A	10	3,462	M/I
79	02_SACWSD_O	SACWSD Outdoor	999	N/A	83	2,720	M/I
80	0200805_I	DENVER-HUDSON CNL	484	25,909	60	23,486	Irr
81	0200808_I	FULTON DEMAND	190	6,736	60	535	Irr
82	0200809	Brantner Ditch	9	3,850	60	2	Irr
83	0200810_I	BRIGHTON DEMAND	27	1,592	60	0	Irr
84	0200812_I	LUPTON BOTTOM DEMAND	79	3,172	60	71	Irr
85	0200813_I	PLATTEVILLE DEMAND	82	3,586	60	0	Irr
86	0200817_I	EVANS NO 2 DEMAND	335	13,568	60	7,027	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
87	0200821	Meadow Island No. 1	58	1,151	60	0	Irr
88	0200822	Meadow Island No. 2	87	2,422	60	75	Irr
89	0200824_I	FARMERS INDEPENDENT DEMA	381	4,709	60	3,504	Irr
90	0200825_I	HEWES COOK DEMAND	370	5,879	60	1,488	Irr
91	0200826	Jay Thomas Ditch	0	207	60	0	Irr
92	0200828_I	UNION IRRIGATION DEMAND	188	4,578	60	0	Irr
93	0200830	Section No. 3 Ditch	8	1,184	60	3	Irr
94	0200834_I	LOWER LATHAM DEMAND	239	9,470	60	236	Irr
95	0200836	Patterson Ditch	1	660	60	0	Irr
96	0200837_I	HIGHLAND DEMAND	3	502	60	1	Irr
97	0200871	Whipple D (Bull Canal)	1	5,447	60	36	Irr
98	0200915	Little Burlington Ditch	66	4,408	60	1,012	Irr
99	0203837_I	FRICO-BARR LAKE DEMAND	211	19,795	60	3,359	Irr
100	0203876_I	FRICO-MILTON LAKE DEMAND	145	11,350	60	4,298	Irr
101	04_AWP001	Big Thompson below Loveland, CO	5	162	60	82	Irr
102	04_AWP002	Little Thompson above Berthoud, CO	2	0	60	105	Irr
103	04_AWP004	Big Thompson above Loveland, CO	0	0	60	52	Irr
104	04_AWP005	Little Thompson above Big Thompson confl	2	0	60	204	Irr
105	0400502	Big T & Platte R Ditch	76	1,351	60	29	Irr
106	0400517	Evanstown Ditch	5	245	60	0	Irr
107	0400519	Farmers Irrigation Canal	4	1,741	60	88	Irr
108	0400521_I	HANDY DITCH DEMAND	5	8,659	60	131	Irr
109	0400522	Hill Brush Ditch	3	447	60	30	Irr
110	0400523	Hillsborough Ditch	32	5,897	60	573	Irr
111	0400524_I	HOME SUPPLY DEMAND	9	16,013	60	547	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
112	0400530_I	LOUDEN DITCH DEMAND	1	2,247	60	10	Irr
113	0400532_I	LOVELAND GREELEY DEMAND	2	16,275	60	48	Irr
114	0400583	Victory Irrig Cnl	0	145	60	5	Irr
115	0400588_I	BOULD LARIM CO IRR MFG D	8	2,632	60	247	Irr
116	0400601	Rockwell Ditch	4	177	60	5	Irr
117	0400691_I	HANSEN FEEDER DEMAND	0	1,834	60	14	Irr
118	05_ADP001	Left Hand Creek above St Vrain Group 1	0	416	60	0	Irr
119	05_AWP001	Left Hand Creek above St Vrain Group 1	0	23	60	0	Irr
120	05_AWP004	St Vrain below Lyons North	1	11	60	0	Irr
121	0500523	SUPPLY DITCH	3	4,594	60	51	Irr
122	0500526_I	HIGHLAND DITCH DEMAND	4	28,843	60	215	Irr
123	0500527	ROUGH READY DITCH	0	1,682	60	0	Irr
124	0500529	SWEDE DITCH	0	1,565	60	5	Irr
125	0500547_I	OLIGARCHY DITCH DEMAND	0	1,408	60	0	Irr
126	0500548	DENIO TAYLOR DITCH	0	83	60	0	Irr
127	0500569	TABLE MOUNTAIN DITCH	0	760	60	17	Irr
128	0500571	JOHNSON DITCH	18	162	60	65	Irr
129	0500572	STAR DITCH	18	707	60	113	Irr
130	0500573	HINMAN DITCH	18	537	60	2	Irr
131	0500575	WILLIAMSON DITCH	0	877	60	0	Irr
132	0500589	LAST CHANCE DITCH	12	1,440	60	0	Irr
133	0500601	ZWECK TURNER DITCH	1	260	60	0	Irr
134	0500648	TOLL GATE DITCH	0	294	60	4	Irr
135	06_AWP001	Boulder Creek to South Platte Confluence	1	0	60	1	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
136	0600513	BOULDER LEFT HAND DITCH	0	1,262	60	0	Irr
137	0600515_D	BOULDERWELDCTYDIVSYS	4	2,079	60	107	Irr
138	0600527	Godding Dailey Plumb Dit	0	508	60	0	Irr
139	0600528	GREEN DITCH	0	370	60	0	Irr
140	0600532	Highland Southside Ditch	2	554	60	10	Irr
141	0600537_I	LEGGETT DITCH DEMAND	0	3,225	60	4	Irr
142	0600538_I	LOWERBOULDERDIVSYS	2	5,280	60	61	Irr
143	0600553	SMITH EMMONS DITCH	0	300	60	0	Irr
144	0600564_I	COMMUNITY DITCH DEMAND	1	2,845	60	63	Irr
145	0600565_I	LEYNER COTTONWOOD DITCH	0	1,342	60	0	Irr
146	0600566	COTTONWOOD DITCH 2	0	571	60	4	Irr
147	0600569_D	DRYCREEKDAVIDSONDIVSYS	0	677	60	0	Irr
148	0600580	HOWARD DITCH	0	190	60	0	Irr
149	0600586	MCGINN DITCH	0	1,195	60	0	Irr
150	0600613	KERR DITCH NO 2	0	5	60	5	Irr
151	0600650	GOODHUE DITCH	3	1,550	60	11	Irr
152	07_AWP001	Clear Creek below Golden Co	1	0	60	55	Irr
153	07_CoorsA	Coors Springs	4	N/A	10	2,719	M/I
154	0700527_D	SLOUGH DIVSYS	0	117	60	0	Irr
155	0700547_I	LOWER CLEAR CREEK DEMAND	2	858	60	6	Irr
156	0700549_I	COLORADO AG DEMAND	1	66	60	0	Irr
157	0700569_I	FHL DEMAND	8	2,262	60	211	Irr
158	0700597_I	KERSHAW DEMAND	0	13	60	0	Irr
159	0700647	Reno Juchem Ditch	0	57	60	0	Irr
160	08_ADP002	Cherry Creek above Frank	14	496	60	539	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
161	08_ADP004	Plum Creek above South P	4	298	60	33	Irr
162	08_AMP001_I	Plum Ck Agg Muni In	999	N/A	10	3,463	M/I
163	08_AMP001_O	Plum Ck Agg Muni Out	999	N/A	83	2,721	M/I
164	08_AMP002_I	Cherry Ck Agg Muni Out	999	N/A	10	5,792	M/I
165	08_AMP002_O	Cherry Ck Agg Muni Out	999	N/A	83	4,551	M/I
166	08_AUP001_I	Plum Ck Agg Uninc In	999	N/A	10	6,528	M/I
167	08_AUP001_O	Plum Ck Agg Uninc Out	999	N/A	83	5,129	M/I
168	08_AUP002_I	Cherry Ck Agg Uninc In	999	N/A	10	6,962	M/I
169	08_AUP002_O	Cherry Ck Agg Uninc Out	999	N/A	83	5,470	M/I
170	08_AWP001	WD8 Agg Well 1	29	316	60	350	Irr
171	08_AWP002	WD8 Cherry Ck Agg GW Div	39	494	60	1,206	Irr
172	08_AWP003	WD8 SPR Agg GW Divn	1	137	60	72	Irr
173	08_AWP004	WD8 Plum Ck Agg GW Divn	9	106	60	262	Irr
174	08_AWP005	WD8 Agg Well 5	490	1,379	60	2,352	Irr
175	0801004	Highline Canal	3	501	60	54	Irr
176	0801009_D	NEVADADITCHDIVSYS	1	92	60	0	Irr
177	0801124	Hayland Ditch	1	15	60	2	Irr
178	0801125	Fairview Ditch	1	191	60	80	Irr
179	0801237	Spring Creek Ditch	0	52	60	1	Irr
180	0801240	Ratcliff Ditch	0	52	60	4	Irr
181	0801241	Dakan Ditch	0	52	60	5	Irr
182	0801403	Heiser Ditch	0	77	60	0	Irr
183	0801404	McCracken Ditch	5	103	60	49	Irr
184	0801405	Smith Ditch	5	33	60	46	Irr
185	0801412	Sixty Seven Ditch	2	94	60	15	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
186	0805065	Aurora Cherry Ck Wells	999	N/A	0	2,305	M/I
187	64_AMP001_I	WD 64 Muni Ind	35	N/A	10	3,114	M/I
188	64_AMP001_O	WD 64 Muni Out	35	N/A	83	2,446	M/I
189	64_AUP001_I	WD 64 Unincorp Ind	999	N/A	10	2,073	M/I
190	64_AUP001_O	WD 64 Unincorp Out	999	N/A	83	1,629	M/I
191	64_AWP001	Water District 64 Sedgwick County North	7	132	60	313	Irr
192	64_AWP002	Water District 64 Sedgwick County South	1	122	60	322	Irr
193	64_AWP003	Water District 64 Sedgwick County South	27	1,744	60	3,550	Irr
194	64_AWP004	Water District 64 Sedgwick County GW 1	213	3,041	60	7,962	Irr
195	64_AWP005	Water District 64 Sedgwick County GW 2	96	2,421	60	6,463	Irr
196	64_AWP006	Water District 64 Lower Logan County North	27	1,131	60	1,408	Irr
197	64_AWP007	Water District 64 Lower Logan County South 1	95	1,996	60	4,917	Irr
198	64_AWP008	Water District 64 Lower Logan County South 2	324	5,119	60	11,552	Irr
199	64_AWP009	Water District 64 Lower Logan County South 3	167	3,947	60	10,213	Irr
200	64_AWP010	WD 64 Logan County North Blw Tetsel	14	846	60	2,186	Irr
201	64_AWP011	Water District 64 Logan County North Central	45	1,840	60	4,085	Irr
202	64_AWP012	WD 64 Logan County S of Pawnee Canal	189	2,165	60	6,709	Irr
203	64_AWP013	WD 64 Logan County N of Pawnee Canal	100	4,387	60	10,356	Irr
204	64_AWP014	WD 64 Logan County North Blw Sterling No 1	161	4,694	60	9,642	Irr
205	64_AWP015	Water District 64 Logan County South	2	44	60	352	Irr
206	64_AWP016	Water District 64 Weld County	31	1,180	60	1,539	Irr

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
207	64_AWP017	WD 64 Logan County North Blw Tetsel	66	1,037	60	2,485	Irr
208	6400502	Liddle Ditch	13	937	60	1,097	Irr
209	6400503	South Reservation Ditch	16	840	60	26	Irr
210	6400504	Peterson Ditch	149	6,784	60	8,741	Irr
211	6400506	Red Lion Supply Ditch	9	277	60	384	Irr
212	6400507	Long Island Ditch	103	2,138	60	3,365	Irr
213	6400508	Settlers Ditch	75	4,821	60	4,238	Irr
214	6400511_I	HARMONY DITCH 1 DEMAND	138	11,682	60	842	Irr
215	6400513	Chambers Ditch	6	397	60	702	Irr
216	6400514	Ramsey Ditch	7	329	60	385	Irr
217	6400516	Powell Blair Ditch	26	2,054	60	707	Irr
218	6400518	Lone Tree Ditch	215	696	60	1,488	Irr
219	6400520	Iliff Platte Valley Ditc	190	6,386	60	931	Irr
220	6400522_D	BRAVODITCHDIVSYS	121	1,925	60	996	Irr
221	6400524	Lowline Ditch	54	1,781	60	300	Irr
222	6400528	Sterling No. 1 Irrigation	78	7,685	60	1,203	Irr
223	6400530	Springdale Ditch	166	3,316	60	4,416	Irr
224	6400531	Schneider Ditch	63	2,314	60	426	Irr
225	6400532	DAVIS BROS DITCH	218	1,965	60	4,778	Irr
226	6400533	Pawnee Ditch	318	8,016	60	1,265	Irr
227	6400535	South Platte Ditch	165	4,419	60	2,273	Irr
228	6400599	Rice Ditch	28	507	60	1,118	Irr
229	6402517_AuW	Sedgwick Cty Aug Well	999	N/A	0	792	Recharge/Aug Well
230	6402517_ReW	Sedgwick Cty Recharge We	7	N/A	0	414	Recharge/Aug Well
231	6402519_AuW	Dinsdale Aug Well	999	N/A	0	319	Recharge/Aug Well

#	Model ID	Name	Capacity (cfs)	2010 Irrigated Acreage	Average System Efficiency (%)	Average Annual Demand (AF)	Structure Type (See Footnotes)
232	6402519_ReW	Dinsdale Recharge Well	23	N/A	0	1,485	Recharge/Aug Well
233	6402525_AuW	Condon Aug Well	999	N/A	0	38	Recharge/Aug Well
234	6402525_ReW	Condon Recharge Well	64	N/A	0	1,276	Recharge/Aug Well
235	6402526_AuW	Sterling Aug Well	999	N/A	0	9	Recharge/Aug Well
236	6402536_AuW	Lower Logan Aug Well	999	N/A	0	444	Recharge/Aug Well
237	6402536_ReW	Lower Logan Recharge Wel	80	N/A	0	4,212	Recharge/Aug Well
238	6402539_AuW	Logan Aug Well	999	N/A	0	360	Recharge/Aug Well
239	6402539_ReW	Logan Recharge Well	58	N/A	0	2,115	Recharge/Aug Well
240	6402540_AuW	Low Line Aug Well	999	N/A	0	32	Recharge/Aug Well
241	6402542_ReW	LSPWCD Recharge Well	13	N/A	0	541	Recharge/Aug Well

7.6 Calibration Structure Summary

As discussed in Section 6.2, the following table provides a summary of the average annual (1993 – 2012) surface and ground water demand, the percent of demand met during simulation, and the total irrigation and M&I consumptive use for each structure in the model. Carrier structures are excluded from the table because they do not have set demands, rather they carry water to meet other structures' demands.

Table 7-6: Calibration Structure Summary

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
1	0100503_I	Riverside Irrigation	87,383	4,636	92,019	100	40,755	-	40,755
2	0100507_I	Bijou Irrigation	81,800	4,512	86,311	100	43,758	-	43,758

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
3	0100511	WELDON VALLEY DITCH	42,583	-	42,583	100	12,692	-	12,692
4	0100514	Ft Morgan Canal	58,357	476	58,834	100	16,308	-	16,308
5	0100515	UPPER PLATTE BEAVER CNL	32,789	1,173	33,962	100	16,774	-	16,774
6	0100517	DEUEL SNYDER CANAL	6,784	262	7,045	100	2,536	-	2,536
7	0100518	LOWER PLATTE BEAVER D	27,464	8,086	35,549	100	20,174	-	20,174
8	0100519_D	Tremont Div System	8,874	2,012	10,886	100	5,768	-	5,768
9	0100520	GILL STEVENS DITCH	-	1,527	1,527	100	956	-	956
10	0100524	TROWELL DITCH	-	582	582	100	392	-	392
11	0100525	TETSEL DITCH	5,972	-	5,972	100	2,149	-	2,149
12	0100526	JOHNSON EDWARDS DITCH	2,866	2,343	5,209	100	3,025	-	3,025
13	0100565	MAGUIRE DITCH	142	-	142	-	-	-	-
14	0100570	EAST GULCH DITCH	-	351	351	100	211	-	211
15	0100620	CONSOLIDATED LARSON D	67	184	251	73	129	-	129
16	0100687_I	N Sterling Irrigation	89,062	3,209	92,271	100	44,479	-	44,479
17	0100688	UNION DITCH	3,113	648	3,761	100	1,265	-	1,265
18	0103817_I	Jackson Irrigation	293	90	383	100	207	-	207
19	01_ADP037	South Platte River below	-	28	28	100	17	-	17
20	0200800	Farmers Gardeners Ditch	275	-	275	76	69	-	69
21	0200805_I	Henrylyn Irrigators	26,135	23,486	49,621	100	35,453	-	35,453
22	0200808_I	Fulton Irrig Div	28,147	535	28,682	99	13,783	-	13,783
23	0200809	BRANTNER DITCH	19,816	2	19,818	100	7,874	-	7,874
24	0200810_I	Brighton Irrig Div	9,008	0	9,009	100	3,081	-	3,081
25	0200812_I	Lupton Bottom Irrig Div	16,375	71	16,447	100	6,596	-	6,596
26	0200813_I	Platteville Irrig Div	21,705	-	21,705	100	7,158	-	7,158
27	0200817_I	Evans No 2 Irrigators	24,263	7,027	31,291	100	21,972	-	21,972
28	0200821	MEADOW ISLAND 1 DITCH	6,905	-	6,905	98	1,913	-	1,913

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
29	0200822	MEADOW ISLAND DITCH	11,114	75	11,189	98	4,919	-	4,919
30	0200824_I	Farmers Indep Irrig Div	16,355	3,504	19,859	99	10,302	-	10,302
31	0200825_I	Hewes Cook Irrig Div	19,860	1,488	21,348	100	12,110	-	12,110
32	0200826	JAY THOMAS DITCH	1,025	-	1,025	100	211	-	211
33	0200828_I	Union Ditch Irrigators	23,472	-	23,472	100	8,183	-	8,183
34	0200830	SECTION NO 3 DITCH	8,613	3	8,617	99	2,281	-	2,281
35	0200834_I	Lower Latham Irrigators	35,613	236	35,849	100	16,831	-	16,831
36	0200836	PATTERSON DITCH	5,359	-	5,359	100	1,257	-	1,257
37	0200837_I	Highland Irrig Div	3,686	1	3,687	100	868	-	868
38	0200871	WHIPPLE DITCH	16,145	36	16,181	52	3,842	-	3,842
39	0200872	GERMAN DITCH	1,870	-	1,870	100	829	-	829
40	0200873	BIG DRY CREEK DITCH	944	-	944	100	469	-	469
41	0200874	YOXALL DITCH	498	-	498	99	243	-	243
42	0200915	Little Burlington	12,418	1,012	13,430	84	5,777	-	5,777
43	0203837_I	Barr Irrigators	41,125	3,359	44,484	100	30,831	-	30,831
44	0203876_I	Milton Irrigators	19,832	4,298	24,131	100	17,038	-	17,038
45	02_ADP003	WD2 Agg SW Divn	4,303	4	4,307	100	907	-	907
46	02_ChrkPP	Cherokee Power Plant	9,250	-	9,250	97	-	6,719	6,719
47	02_Nglenn_I	Northglenn Indoor Dem	3,060	-	3,060	99	-	302	302
48	02_Nglenn_O	Northglenn Outdoor Dem	2,067	-	2,067	99	-	1,701	1,701
49	02_Thorn_I	Thornton Indoor Dem	11,091	-	11,091	100	-	1,109	1,109
50	02_Thorn_O	Thornton Outdoor Dem	8,513	-	8,513	100	-	7,066	7,066
51	02_VRNPP	Ft St Vrain Power Plant	2,940	-	2,940	100	-	2,352	2,352
52	02_Westy_I	Westy Indoor Dem	8,887	-	8,887	100	-	889	889
53	02_Westy_O	Westy Outdoor Dem	8,605	-	8,605	100	-	7,142	7,142
54	0400502	BIG T PLATTE R DITCH	10,070	29	10,099	100	2,892	-	2,892

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
55	0400503	BIG THOMPSON DITCH & MAN	4,329	-	4,329	100	1,329	-	1,329
56	0400517	EVANSTOWN DITCH	8,778	-	8,778	99	489	-	489
57	0400518_I	Estes Park Indoor Dem	1,022	-	1,022	100	-	102	102
58	0400518_O	Estes Park Outdoor Dem	568	-	568	100	-	472	472
59	0400519	FARMERS IRRIGATION CANAL	5,411	88	5,499	99	2,637	-	2,637
60	0400520_I	George Rist Irrigation	790	-	790	100	342	-	342
61	0400521_I	Handy Irrigation	11,113	131	11,244	100	6,899	-	6,899
62	0400522	HILL BRUSH DITCH	2,038	30	2,069	100	715	-	715
63	0400523	HILLSBOROUGH DITCH	15,782	573	16,355	100	8,367	-	8,367
64	0400524_I	Home Supply Irrigation	18,748	547	19,296	100	11,946	-	11,946
65	0400530_I	Louden Irrigation	8,568	10	8,578	100	4,682	-	4,682
66	0400532_I	Loveland Greeley Irrigat	31,539	48	31,587	100	21,078	-	21,078
67	0400534	MARIANA DITCH	239	-	239	100	30	-	30
68	0400541	RIST GOSS DITCH	206	-	206	99	25	-	25
69	0400543_I	South Side Irrigation	2,159	-	2,159	100	1,274	-	1,274
70	0400561	BLACK CANNON DITCH	149	-	149	100	69	-	69
71	0400574	BUCKHORN HIGHLINE DITCH	163	-	163	99	20	-	20
72	0400578	KIRCHNER DITCH	197	-	197	99	36	-	36
73	0400580	PERKINS DITCH	171	-	171	100	89	-	89
74	0400582	UNION DITCH	145	-	145	100	10	-	10
75	0400583	VICTORY IRR CNL	136	5	141	97	65	-	65
76	0400587	BEELINE DITCH	1,791	-	1,791	98	-	-	-
77	0400588_I	Boulder Larimer Irrigati	5,462	247	5,709	100	2,998	-	2,998
78	0400592	EAGLE DITCH	191	-	191	98	57	-	57
79	0400596	JIM EGLIN DITCH	153	-	153	99	76	-	76
80	0400599	MINER LONGAN DITCH	563	-	563	100	234	-	234

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
81	0400600	OSBORNE CAYWOOD DITCH	737	-	737	100	172	-	172
82	0400601	ROCKWELL D ROCKWELL P P	968	5	974	100	306	-	306
83	0400602	SUPPLY LATERAL DITCH	1,171	-	1,171	99	579	-	579
84	0400603	W R BLOWER DITCH 1	477	-	477	99	222	-	222
85	0400691_I	Hansen Feeder Irrigation	1,608	14	1,622	98	1,012	-	1,012
86	0400692_I	St. Vrain Irrigation	1,408	-	1,408	100	847	-	847
87	0401001	Big T Power Plant	63,238	-	63,238	89	-	-	-
88	0401002	Hansen Feeder Wasteway	9,867	-	9,867	71	-	-	-
89	04_AUP002_I	Little T Wtr Dist In	2,091	-	2,091	61	-	127	127
90	04_AUP002_O	Little T Wtr Dist Out	1,648	-	1,648	76	-	1,035	1,035
91	04_Lovelnd_I	Loveland Indoor Dem	6,359	-	6,359	100	-	633	633
92	04_Lovelnd_O	Loveland Outdoor Dem	7,085	-	7,085	100	-	5,872	5,872
93	0500513	DAVE MILLER DITCH	102	-	102	71	23	-	23
94	0500519	REESE STILES DITCH	194	-	194	96	21	-	21
95	0500520	SOUTH LEDGE DITCH	687	-	687	97	132	-	132
96	0500523	SUPPLY DITCH	9,686	51	9,736	81	3,693	-	3,693
97	0500526_I	Highland Ditch Irrigation	35,043	215	35,258	100	21,917	-	21,917
98	0500527	ROUGH READY DITCH	5,655	-	5,655	99	2,570	-	2,570
99	0500528	ST VRAIN PALMERTON DITCH	5,178	-	5,178	100	1,747	-	1,747
100	0500529	SWEDE DITCH	3,463	5	3,467	94	1,660	-	1,660
101	0500530	SMEAD DITCH	852	-	852	100	356	-	356
102	0500531	MONTGOMERY PRIVATE DITCH	14	-	14	100	4	-	4
103	0500534	GOSS PRIVATE DITCH 1	340	-	340	100	172	-	172
104	0500535	CLOUGH/TRUE DITCH	268	-	268	100	45	-	45
105	0500536	CLOUGH PRIVATE DITCH	560	-	560	100	102	-	102
106	0500537	WEBSTER MCCASLIN DITCH	539	-	539	100	230	-	230

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
107	0500538	TRUE WEBSTER DITCH	549	-	549	100	138	-	138
108	0500539	JAMES DITCH	2,011	-	2,011	100	942	-	942
109	0500542	DAVIS DOWNING DITCH	1,847	-	1,847	100	740	-	740
110	0500545	LONGMONT SUPPLY DITCH	2,395	-	2,395	100	389	-	389
111	0500546	CHAPMAN MCCASLIN DITCH	761	-	761	100	286	-	286
112	0500547_I	Oligarchy Irrigation	4,584	-	4,584	100	2,459	-	2,459
113	0500548	DENIO TAYLOR DITCH	764	-	764	100	179	-	179
114	0500549	RUNYAN DITCH	438	-	438	100	74	-	74
115	0500550	PECK DITCH	762	-	762	100	299	-	299
116	0500551	PELLA DITCH	404	-	404	99	171	-	171
117	0500552	CLOVER BASIN DITCH	245	-	245	100	88	-	88
118	0500553	HAGERS MEADOW DITCH	832	-	832	99	90	-	90
119	0500554	NIWOT DITCH	975	-	975	100	383	-	383
120	0500557	NORTHWEST MUT INS CO D	480	-	480	100	105	-	105
121	0500558	SOUTH FLAT DITCH	1,007	-	1,007	100	332	-	332
122	0500559	CUSHMAN DITCH	169	-	169	100	52	-	52
123	0500560	BECKWITH DITCH	655	-	655	100	135	-	135
124	0500561	ISLAND DITCH	254	-	254	100	30	-	30
125	0500563	BONUS DITCH	1,765	-	1,765	100	664	-	664
126	0500564_I	Lake Ditch Irrigation	1,500	-	1,500	90	809	-	809
127	0500565	HALDI DITCH	3,749	-	3,749	100	701	-	701
128	0500568	CROCKER DITCH	304	-	304	100	127	-	127
129	0500569	TABLE MOUNTAIN DITCH	1,777	17	1,794	100	781	-	781
130	0500570	BADER DITCH 1 & 2	285	-	285	100	120	-	120
131	0500571	JOHNSON DITCH	393	65	458	100	202	-	202
132	0500572	STAR DITCH	1,599	113	1,712	100	739	-	739

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
133	0500573	HINMAN DITCH	1,092	2	1,094	100	458	-	458
134	0500574	HOLLAND DITCH	2,289	-	2,289	100	961	-	961
135	0500575	WILLIAMSON DITCH	2,298	-	2,298	99	932	-	932
136	0500589	LAST CHANCE DITCH	11,609	-	11,609	100	3,047	-	3,047
137	0500601	ZWECK TURNER DITCH	2,251	-	2,251	100	488	-	488
138	0500602	JAMES MASON DITCH	178	-	178	100	23	-	23
139	0500603	LEFT HAND DITCH DIVERSION	15,272	-	15,272	99	-	-	-
140	0500619_a	SPURGEON TREATMENT PLANT	2,194	-	2,194	92	-	1,772	1,772
141	0500619_b	DODD TREATMENT PLANT DEM	1,965	-	1,965	99	-	1,617	1,617
142	0500648	TOLL GATE DITCH	968	4	972	100	395	-	395
143	05LONG_IN	LONGMONT INDOOR DEMAND	8,886	-	8,886	100	-	889	889
144	05LONG_OUT	LONGMONT OUTDOOR DEMAND	5,868	-	5,868	100	-	4,871	4,871
145	05_ADP001	Aggregated Diversion Str	3,188	-	3,188	100	915	-	915
146	05_ADP002	Aggregated Diversion Str	1,068	-	1,068	100	512	-	512
147	0600501_I	Anderson Irrigation	1,660	-	1,660	91	87	-	87
148	0600513	BOULDER LEFT HAND DITCH	1,723	-	1,723	98	802	-	802
149	0600515_D	Boulder and Weld Co Ditch	3,197	107	3,304	100	1,464	-	1,464
150	0600516_I	Boulder White Rock Irrig	14,379	-	14,379	98	8,491	-	8,491
151	0600518	BUTTE MILL DITCH	992	-	992	100	411	-	411
152	0600520_D	CARR TYLER DITCH	213	-	213	100	102	-	102
153	0600523	DELEHANT DITCH	262	-	262	100	97	-	97
154	0600525	FARMERS DITCH	5,037	-	5,037	94	2,089	-	2,089
155	0600527	GODDING DAILEY PLUMB D	2,810	-	2,810	100	995	-	995
156	0600528	GREEN DITCH	2,297	-	2,297	100	655	-	655
157	0600532	HIGHLAND SOUTH SIDE DITC	4,490	10	4,500	100	1,573	-	1,573
158	0600534	HOUCK 2 DITCH	337	-	337	100	83	-	83

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
159	0600536	HOWELL DITCH	642	-	642	100	204	-	204
160	0600537_I	Leggett Irrigation	6,030	4	6,034	100	3,827	-	3,827
161	0600538_I	Lower Boulder Irrigation	13,273	61	13,334	89	7,360	-	7,360
162	0600542	MC CARTY DITCH	118	-	118	87	4	-	4
163	0600543	N BOULD FARMER DITCH	5,158	-	5,158	86	854	-	854
164	0600551	RURAL DITCH	7,002	-	7,002	100	1,301	-	1,301
165	0600553	SMITH EMMONS DITCH	1,048	-	1,048	100	428	-	428
166	0600554	SMITH GOSS DITCH	723	-	723	99	359	-	359
167	0600560	ANDREWS FARWELL DITCH	203	-	203	99	85	-	85
168	0600564_I	Community Ditch	4,740	63	4,802	100	2,909	-	2,909
169	0600565_I	Leyner Cottonwood Irriga	1,903	-	1,903	98	1,130	-	1,130
170	0600566	COTTONWOOD DITCH 2	2,054	4	2,058	94	798	-	798
171	0600567	DAVIDSON DITCH	2,278	-	2,278	98	658	-	658
172	0600569_D	DRY CREEK DAVIDSON DITCH	1,575	-	1,575	95	656	-	656
173	0600570	DRY CREEK NO 2 DITCH	796	-	796	95	364	-	364
174	0600575	EAST BOULDER DITCH	275	-	275	96	106	-	106
175	0600576	ENTERPRISE DITCH	942	-	942	93	178	-	178
176	0600580	HOWARD DITCH	1,491	-	1,491	96	399	-	399
177	0600582	JONES DONNELLY DITCH	1,080	-	1,080	100	464	-	464
178	0600585	MARSHALVILLE DITCH	1,316	-	1,316	95	555	-	555
179	0600586	MCGINN DITCH	1,191	-	1,191	98	523	-	523
180	0600588	S BOULDER BEAR CR DITCH	800	-	800	99	344	-	344
181	0600592	SCHEARER DITCH	1,231	-	1,231	99	551	-	551
182	0600593	S BOULDER CANON DITCH	1,975	-	1,975	99	870	-	870
183	0600603	SILVER LAKE DITCH	770	-	770	100	462	-	462
184	0600606	CHURCH DITCH(UPPER)	58	-	58	98	27	-	27

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
185	0600608_D	EGGLESTON NO 1 DITCH	255	-	255	97	83	-	83
186	0600610	ERIE COAL CR DITCH	483	-	483	100	208	-	208
187	0600611	HARRIS DITCH	225	-	225	96	65	-	65
188	0600612	KERR DITCH NO 1	389	-	389	97	115	-	115
189	0600613	KERR DITCH NO 2	122	5	127	95	12	-	12
190	0600615	LAST CHANCE DITCH	1,273	-	1,273	97	595	-	595
191	0600621	WILLIAM C HAKE DITCH	366	-	366	99	59	-	59
192	0600622	T N WILLIS DITCH	272	-	272	95	69	-	69
193	0600650	GOODHUE DITCH	1,847	11	1,858	93	751	-	751
194	06BOULDER_I	Boulder Indoor	12,451	-	12,451	100	-	891	891
195	06BOULDER_O	Boulder Outdoor	8,405	-	8,405	100	-	6,977	6,977
196	06BOULD_RTN	Boulder Return	6,515	-	6,515	100	-	-	-
197	06LAFFYT_I	Lafayette Indoor	1,927	-	1,927	99	-	132	132
198	06LAFFYT_O	Lafayette Outdoor	2,082	-	2,082	100	-	1,726	1,726
199	06LOUIS_I	Louisville Indoor	2,249	-	2,249	100	-	155	155
200	06LOUIS_O	Louisville Outdoor	2,071	-	2,071	100	-	1,719	1,719
201	06_AMP001_I	WD 6 Agg Muni Indoor	3,183	-	3,183	100	-	319	319
202	06_AMP001_O	WD 6 Agg Muni Outdoor	2,501	-	2,501	100	-	2,076	2,076
203	06_AUP001_I	WD 6 Unincorp Indoor	4,417	-	4,417	100	-	441	441
204	06_AUP001_O	WD 6 Unincorp Outdoor	3,470	-	3,470	100	-	2,880	2,880
205	06_BOU_RF	Constant Winter RF	216	-	216	100	-	-	-
206	06_ELDORA	Eldora Ski Resort	180	-	180	2	1	-	1
207	06_VALMPP	PSCO	3,000	-	3,000	100	-	3,000	3,000
208	0700502_I	Ag Ditch Irrigators	5,401	-	5,401	79	1,823	-	1,823
209	0700527_D	Slough Ditches	7,515	-	7,515	100	2,826	-	2,826
210	0700540_I	Church Ditch Irrigators	5,774	-	5,774	81	1,879	-	1,879

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
211	0700547_I	Lower Clear Ck D Irrigat	5,298	6	5,305	89	1,710	-	1,710
212	0700549_I	Colorado Ag Ditch Irriga	4,125	0	4,125	82	1,298	-	1,298
213	0700551	CORT GRAVES HUGHES DITCH	146	-	146	54	41	-	41
214	0700569_I	FHL Canal Irrigators	9,683	211	9,894	82	3,637	-	3,637
215	0700570_I	Fisher Ditch Irrigators	3,233	-	3,233	83	1,083	-	1,083
216	0700597_I	Kershaw Ditch Irrigators	622	0	622	100	235	-	235
217	0700601_I	Lee Stewart Eskins Irrig	773	-	773	96	294	-	294
218	0700614	MANHART DITCH	905	-	905	90	324	-	324
219	0700632	OUELETTE DITCH	133	-	133	94	48	-	48
220	0700647	RENO JUCHEM DITCH	734	-	734	100	222	-	222
221	0700652_I	Rocky Mtn Ditch Irrigato	5,463	-	5,463	96	1,977	-	1,977
222	0700669	SOUTH SIDE DITCH	80	-	80	76	29	-	29
223	0700681	Georgetown D	201	-	201	100	201	-	201
224	0700698_I	Wannamaker Irrigators	1,673	-	1,673	85	504	-	504
225	0700699	WELCH DITCH	1,046	-	1,046	78	122	-	122
226	07_ADP001	WD7 Agg SW Irrig	1,062	-	1,062	100	279	-	279
227	07_AMP001_I	WD7 Upper Agg Muni In	514	-	514	100	-	49	49
228	07_AMP001_O	WD7 Upper Agg Muni Out	404	-	404	100	-	336	336
229	07_AUP001_I	WD7 Upper Agg Uninc In	5,683	-	5,683	100	-	569	569
230	07_AUP001_O	WD7 Upper Agg Uninc Out	4,465	-	4,465	100	-	3,706	3,706
231	07_Arvada_I	Arvada Indoor Dem	9,919	-	9,919	100	-	992	992
232	07_Arvada_O	Arvada Outdoor Dem	9,051	-	9,051	100	-	7,513	7,513
233	07_ConMut_I	ConMutual Indoor Dem	2,126	-	2,126	100	-	212	212
234	07_ConMut_O	ConMutual Outdoor Dem	1,671	-	1,671	100	-	1,387	1,387
235	07_CoorsB	Coors Malting Potable Demand	5,975	-	5,975	100	-	1,789	1,789
236	07_CoorsC	Coors Cooling Demand	765	-	765	100	-	765	765

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
237	07_Golden_I	Golden Indoor Dem	1,634	-	1,634	99	-	162	162
238	07_Golden_O	Golden Outdoor Dem	1,283	-	1,283	99	-	1,082	1,082
239	07_LSA	Loveland Ski Area	113	-	113	100	-	23	23
240	0801004	HIGHLINE CNL	17,826	54	17,880	100	7,131	-	7,131
241	0801007	LAST CHANCE DITCH 2	1,468	-	1,468	98	592	-	592
242	0801008	CITY DITCH PL	5,173	-	5,173	100	2,006	-	2,006
243	0801009_D	Nevada Ditch	3,351	-	3,351	97	1,475	-	1,475
244	0801014	Arapahoe Power Plant	2,047	-	2,047	98	-	1,610	1,610
245	0801015	EPPERSON DITCH/PUMP	258	-	258	85	-	105	105
246	0801100	Chatfield Pumps	613	-	613	82	-	-	-
247	0801124	HAYLAND DITCH	156	2	159	92	25	-	25
248	0801125	FAIRVIEW DITCH	357	80	437	91	144	-	144
249	0801127	OLD TIME DITCH	101	-	101	92	5	-	5
250	0801128	GARDEN DITCH	49	-	49	95	4	-	4
251	0801235	RED ROCK DITCH	239	-	239	90	38	-	38
252	0801237	SPRING CREEK DITCH	263	1	263	100	72	-	72
253	0801240	RATCLIFF DILLON DITCH	77	4	81	100	28	-	28
254	0801241	DAKAN DITCH	76	5	80	100	34	-	34
255	0801362	JOHN JONES DITCH	376	-	376	90	95	-	95
256	0801400	ALDERMAN DITCH	155	-	155	91	25	-	25
257	0801403	HEISER DITCH	25	-	25	88	11	-	11
258	0801404	MCCRACKEN DITCH	23	49	72	100	33	-	33
259	0801405	SMITH DITCH	40	46	86	92	40	-	40
260	0801406	SCHREIBER DITCH	8	-	8	84	1	-	1
261	0801412	SIXTY SEVEN DITCH	640	15	656	90	96	-	96
262	0801413	CRAWFORD DITCH	290	-	290	70	18	-	18

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
263	0801414	BIRMINGHAM DITCH	51	-	51	85	8	-	8
264	0801416	GOODRICH DITCH	212	-	212	75	38	-	38
265	0801417	ROCKY RIDGE DITCH	22	-	22	53	6	-	6
266	0801492	IZZARD DITCH	93	-	93	28	2	-	2
267	08_ADP002	WD8 CherryCk Agg SW Divn	418	539	957	89	488	-	488
268	08_ADP003	WD8 SPR Agg SW Divn	225	-	225	85	34	-	34
269	08_ADP004	WD8 Plum Ck Agg SW Divn	2,205	33	2,238	100	397	-	397
270	08_Aurora_I	Aurora Indoor Dem	28,402	-	28,402	100	-	2,840	2,840
271	08_Aurora_O	Aurora Outdoor Dem	20,949	-	20,949	100	-	17,388	17,388
272	08_Denver_I	Denver Indoor Dem	129,727	-	129,727	100	-	16,866	16,866
273	08_Denver_O	Denver Outdoor Dem	91,198	-	91,198	100	-	82,078	82,078
274	08_Englwd_I	Englewood Indoor Dem	3,687	-	3,687	100	-	368	368
275	08_Englwd_O	Englewood Outdoor Dem	2,897	-	2,897	100	-	2,404	2,404
276	0900535	BERGEN DITCH	720	-	720	88	21	-	21
277	0900731_D	Arnett/Harriman Ditch	2,367	-	2,367	100	1,115	-	1,115
278	0900752	HODGSON DITCH	455	-	455	98	45	-	45
279	0900767	INDEPENDENT HIGHLINE DIT	306	-	306	93	116	-	116
280	0900816	MCBROOM DITCH	730	-	730	97	341	-	341
281	0900903	WARRIOR/HARRIMAN D TK CR	121	-	121	98	56	-	56
282	0900958	WARD DITCH	1,951	-	1,951	100	912	-	912
283	0900963_D	Warrior/Harriman Ditch	3,466	-	3,466	100	-	-	-
284	09_ADP003	WD9 Agg SW Divn	5	-	5	100	3	-	3
285	09_AMP001_I	WD9 Lower Agg Muni In	3,418	-	3,418	100	-	343	343
286	09_AMP001_O	WD9 Lower Agg Muni Out	2,685	-	2,685	100	-	2,229	2,229
287	09_AUP001_I	WD9 Lower Agg Uninc In	5,608	-	5,608	100	-	560	560
288	09_AUP001_O	WD9 Lower Agg Uninc Out	4,406	-	4,406	100	-	3,657	3,657

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
289	2300500	PLATTE STATION DITCH	612	-	612	99	107	-	107
290	2300760	SACRAMENTO DITCH	910	-	910	97	189	-	189
291	2300902	PETRIE DITCH	684	-	684	98	247	-	247
292	2300904	LINK DITCH	323	-	323	86	118	-	118
293	2300922	HOLST DITCH 2	540	-	540	100	70	-	70
294	2300923	HOLST PACKER D	611	-	611	100	94	-	94
295	2300924	HOLST DITCH 1	495	-	495	100	63	-	63
296	2300926	PACKER BONIS DITCH	371	-	371	98	41	-	41
297	2300991	TAYLOR DITCH	978	-	978	54	130	-	130
298	2300993	GIBSON DITCH	243	-	243	28	28	-	28
299	2300994	CROSIER TAYLOR DITCH	485	-	485	96	232	-	232
300	23_ADP001	WD23 Tarryall Agg SW Div	4,065	-	4,065	100	1,211	-	1,211
301	23_ADP002	WD23 SPR Agg SW Divn	3,910	-	3,910	100	1,649	-	1,649
302	23_AMP001_I	WD23 Upper Agg Muni In	58	-	58	99	-	6	6
303	23_AMP001_O	WD23 Upper Agg Muni Out	46	-	46	97	-	36	36
304	23_AUP001_I	WD23 Upper Agg Uninc In	279	-	279	99	-	29	29
305	23_AUP001_O	WD23 Upper Agg Uninc Out	219	-	219	97	-	177	177
306	23_AUP002_I	WD23 Lower Agg Uninc In	552	-	552	99	-	54	54
307	23_AUP002_O	WD23 Lower Agg Uninc Out	434	-	434	97	-	351	351
308	6400501	CARLSON DITCH	243	-	243	100	88	-	88
309	6400502	LIDDLE DITCH	1,165	1,097	2,262	100	1,287	-	1,287
310	6400503	SOUTH RESERVATION DITCH	3,205	26	3,231	100	1,685	-	1,685
311	6400504	PETERSON DITCH	9,905	8,741	18,646	100	10,579	-	10,579
312	6400506	RED LION SUPPLY DITCH	-	384	384	100	293	-	293
313	6400507	LONG ISLAND DITCH	-	3,365	3,365	100	2,233	-	2,233
314	6400508	SETTLERS DITCH	6,388	4,238	10,626	100	5,818	-	5,818

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
315	6400511_I	Harmony Irrigation	38,697	842	39,539	100	18,939	-	18,939
316	6400513	CHAMBERS DITCH	-	702	702	100	558	-	558
317	6400514	RAMSEY DITCH	838	385	1,223	99	588	-	588
318	6400516	POWELL BLAIR DITCH	5,196	707	5,903	100	3,032	-	3,032
319	6400518	LONE TREE DITCH	316	1,488	1,804	100	1,084	-	1,084
320	6400520	ILIFF PLATTE VALLEY D	24,509	931	25,439	100	11,594	-	11,594
321	6400522_D	Bravo Div System	6,325	996	7,321	100	3,544	-	3,544
322	6400524	LOWLINE DITCH	6,606	300	6,907	100	3,221	-	3,221
323	6400525	HENDERSON SMITH DITCH	2,004	-	2,004	90	616	-	616
324	6400528	STERLING IRR CO DITCH 1	23,465	1,203	24,669	99	11,596	-	11,596
325	6400530	SPRINGDALE DITCH	7,852	4,416	12,268	100	5,737	-	5,737
326	6400531	SCHNEIDER DITCH	10,369	426	10,795	100	4,521	-	4,521
327	6400532	DAVIS BROS DITCH	-	4,778	4,778	100	3,457	-	3,457
328	6400533	PAWNEE DITCH	27,018	1,265	28,283	100	14,160	-	14,160
329	6400535	SOUTH PLATTE DITCH	13,763	2,273	16,036	100	7,640	-	7,640
330	6400584	I O JONES DITCH & RESERV	122	-	122	-	-	-	-
331	6400599	RICE DITCH	-	1,118	1,118	100	783	-	783
332	6400643	HEYBORNE LIFT STATION	0	-	0	-	-	-	-
333	6400801	COTTONWOOD CR RCHRG PUMP	24	-	24	-	-	-	-
334	8000650	WANITA DITCH	98	-	98	100	9	-	9
335	8000651	HALL VALLEY DITCH	116	-	116	100	5	-	5
336	8000657_D	Hepburn Ranch	381	-	381	91	92	-	92
337	8000662_D	Fitzsimmons Ranch	830	-	830	97	127	-	127
338	8000667	SOUTH SIDE DITCH	222	-	222	99	38	-	38
339	8000673_D	Herford Ranch	472	-	472	100	61	-	61
340	8000706	BEAVER CREEK DITCH	394	-	394	94	56	-	56

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
341	8000713	KENOSHA DITCH	178	-	178	99	22	-	22
342	8000732_D	Camp Santa Maria	410	-	410	100	35	-	35
343	8000759	MCARTHUR DITCH	331	-	331	100	38	-	38
344	8000760	WINKLER DITCH 1	188	-	188	100	14	-	14
345	8000761	WINKLER DITCH 3	138	-	138	99	17	-	17
346	8000774_D	Berger Ranch	241	-	241	99	25	-	25
347	8000784	JEFFRIES CRAWFORD DITCH	357	-	357	96	53	-	53
348	8000785	WONDER DITCH	60	-	60	95	9	-	9
349	8000792	PARMALEE DITCH 2 & 3	154	-	154	36	21	-	21
350	8000794	FLUME DITCH	76	-	76	58	21	-	21
351	8000799_D	Deer Creek Ranch	307	-	307	89	24	-	24
352	8000812	CLIFFORD GULCH DITCH	100	-	100	94	12	-	12
353	8000829_D	Magnus Ranch	312	-	312	98	71	-	71
354	8000831_D	State Parks Ranch	247	-	247	93	48	-	48
355	80_ADP001	WD80 NF SPR Agg SW Divn	591	-	591	99	131	-	131
356	AurThEff	Aur WWTP to Thornton	3,946	-	3,946	97	-	-	-
357	Conduit15	Denver Conduit 15	805	-	805	100	-	-	-
358	Metro_Pumps	MetroPumpsHistDivns	11,150	-	11,150	100	-	-	-
359	0100711	PSCo Well Field	-	3,008	3,008	99	-	2,979	2,979
360	0102513_ReW	Rothe Recharge Well	-	466	466	100	-	-	-
361	0102535_ReW	LPB Recharge Well	-	365	365	100	-	-	-
362	01_AMP001_I	WD 1 Muni Ind	-	3,809	3,809	100	-	382	382
363	01_AMP001_O	WD 1 Muni Out	-	2,992	2,992	100	-	2,484	2,484
364	01_AUP001_I	WD 1 Unincorp Ind	-	13,669	13,669	100	-	1,366	1,366
365	01_AUP001_O	WD 1 Unincorp Out	-	10,740	10,740	100	-	8,914	8,914
366	01_AUP002_I	WD 1 Unincorp Ind	-	1,831	1,831	100	-	182	182

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
367	01_AUP002_O	WD 1 Unincorp Out	-	1,439	1,439	100	-	1,194	1,194
368	01_AWP001	Camp Creek Designated Basin	-	4,131	4,131	100	3,280	-	3,280
369	01_AWP002	South Platte River below Weldona CO North	-	4,429	4,429	100	3,249	-	3,249
370	01_AWP003	WD 1 Upper Beaver Creek	-	7,954	7,954	100	5,470	-	5,470
371	01_AWP004	WD 1 Main Stem Beaver Creek	-	4,663	4,663	100	3,136	-	3,136
372	01_AWP005	WD 1 Washington County	-	1,881	1,881	100	1,360	-	1,360
373	01_AWP006	South Platte River below Weldona CO South 1	-	1,624	1,624	100	1,225	-	1,225
374	01_AWP007	South Platte River below Weldona CO South 2	-	5,301	5,301	100	3,976	-	3,976
375	01_AWP008	Upper Kiowa Bijou Designated Basin	-	1,704	1,704	100	1,300	-	1,300
376	01_AWP009	Upper Kiowa Bijou Designated Basin	-	3,066	3,066	100	2,336	-	2,336
377	01_AWP010	Lower Kiowa Bijou Designated Basin East 1	-	2,311	2,311	100	1,837	-	1,837
378	01_AWP011	Lower Kiowa Bijou Designated Basin East 2	-	5,948	5,948	100	4,624	-	4,624
379	01_AWP012	Lower Kiowa Bijou Designated Basin East 4	-	8,642	8,642	100	6,638	-	6,638
380	01_AWP013	Lower Kiowa Bijou Designated Basin East 5	-	5,102	5,102	100	3,898	-	3,898
381	01_AWP014	Lower Kiowa Bijou Designated Basin East 6	-	7,497	7,497	100	5,692	-	5,692
382	01_AWP015	Lower Kiowa Bijou Designated Basin East 7	-	5,745	5,745	100	4,373	-	4,373
383	01_AWP016	Lower Kiowa Bijou Designated Basin East 8	-	6,492	6,492	100	4,921	-	4,921
384	01_AWP017	Lower Kiowa Bijou Designated Basin East 9	-	5,069	5,069	100	3,914	-	3,914
385	01_AWP018	Lower Kiowa Bijou Designated Basin East 10	-	9,747	9,747	100	7,209	-	7,209

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
386	01_AWP019	Lower Kiowa Bijou Designated Basin West 1	-	7,085	7,085	100	5,280	-	5,280
387	01_AWP020	Lower Kiowa Bijou Designated Basin West 2	-	4,644	4,644	100	3,491	-	3,491
388	01_AWP021	Lower Kiowa Bijou Designated Basin West 3	-	3,838	3,838	100	2,485	-	2,485
389	01_AWP022	Lower Lost Creek Designated Basin 1	-	4,776	4,776	100	3,820	-	3,820
390	01_AWP023	Lower Lost Creek Designated Basin 2	-	10,363	10,363	100	8,050	-	8,050
391	01_AWP024	Lower Lost Creek Designated Basin 3	-	4,177	4,177	100	2,967	-	2,967
392	01_AWP025	Upper Lost Creek Designated Basin	-	3,668	3,668	100	2,921	-	2,921
393	01_AWP026	South Platte River Above Weldona Co South 1	-	2,951	2,951	100	2,360	-	2,360
394	01_AWP027	South Platte River Above Weldona Co South 2	-	4,566	4,566	100	3,630	-	3,630
395	01_AWP028	South Platte River Above Weldona Co South 3	-	6,528	6,528	100	5,045	-	5,045
396	01_AWP029	South Platte River Above Weldona Co South 4	-	4,205	4,205	100	3,273	-	3,273
397	01_AWP030	South Platte River Above Weldona Co South 5	-	4,851	4,851	100	3,758	-	3,758
398	01_AWP031	South Platte River below Riverside Canal South	-	7,145	7,145	100	5,651	-	5,651
399	01_AWP032	WD 1 Lower Boxelder Creek	-	5,405	5,405	100	3,864	-	3,864
400	01_AWP033	South Platte River Above Weldona Co North	-	4,534	4,534	100	3,458	-	3,458
401	01_AWP035	WD 1 Upper Boxelder Creek	-	2,551	2,551	100	1,767	-	1,767
402	01_AWP037	South Platte River below Kersey Co North 2	-	533	533	100	384	-	384
403	01_AWP038	Upper Crow Creek Designated Basin	-	7,798	7,798	100	6,031	-	6,031
404	01_AWP039	Upper Kiowa Bijou Designated Basin	-	3,895	3,895	100	2,569	-	2,569
405	01_AWP040	Upper Kiowa Bijou Designated Basin	-	2,175	2,175	100	1,509	-	1,509

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
406	01_AWP042	South Platte River below Kersey Co South	-	8,068	8,068	100	6,103	-	6,103
407	01_AWP043	WD 1 Upper Boxelder Creek	-	1,601	1,601	100	1,025	-	1,025
408	01_AWP044	WD 1 Lower Boxelder Creek	-	3	3	100	2	-	2
409	02_AUP001_I	WD 2 Agg Uninc In	-	2,860	2,860	100	-	286	286
410	02_AUP001_O	WD 2 Agg Uninc Out	-	2,247	2,247	100	-	1,865	1,865
411	02_AWP001	WD2 Agg Wells1 blw Barr	-	7,216	7,216	100	5,492	-	5,492
412	02_AWP002	WD2 Agg Wellsw abv Barr	-	8,846	8,846	100	7,031	-	7,031
413	02_AWP003	WD2 Agg Wells 3	-	2,431	2,431	100	1,676	-	1,676
414	02_AWP004	WD2 Agg Wells 4	-	7,900	7,900	100	5,840	-	5,840
415	02_AWP005	WD2 Agg Wells 5	-	628	628	100	381	-	381
416	02_Bright_I	Brighton Indoor	-	6,327	6,327	100	-	634	634
417	02_Bright_O	Brighton Outdoor	-	4,971	4,971	100	-	4,126	4,126
418	02_SACWSD_I	SACWSD Indoor	-	3,462	3,462	100	-	346	346
419	02_SACWSD_O	SACWSD Outdoor	-	2,720	2,720	100	-	2,258	2,258
420	04_AWP001	Big Thompson below Loveland, CO	-	82	82	100	61	-	61
421	04_AWP002	Little Thompson above Berthoud, CO	-	105	105	100	62	-	62
422	04_AWP004	Big Thompson above Loveland, CO	-	52	52	99	31	-	31
423	04_AWP005	Little Thompson above Big Thompson confl	-	204	204	100	122	-	122
424	05_AWP001	Left Hand Creek above St Vrain Group 1	-	-	-	100	-	-	-
425	05_AWP004	St Vrain below Lyons North	-	-	-	100	-	-	-
426	06_AWP001	Boulder Creek to South Platte Confluence	-	1	1	100	1	-	1
427	07_AWP001	Clear Creek below Golden Co	-	55	55	100	33	-	33
428	07_CoorsA	Coors Springs	-	2,719	2,719	100	-	270	270
429	0805065	Aurora Cherry Ck Wells	-	2,305	2,305	100	-	-	-

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
430	08_AMP001_I	Plum Ck Agg Muni In	-	3,463	3,463	100	-	349	349
431	08_AMP001_O	Plum Ck Agg Muni Out	-	2,721	2,721	100	-	2,258	2,258
432	08_AMP002_I	Cherry Ck Agg Muni Out	-	5,792	5,792	100	-	579	579
433	08_AMP002_O	Cherry Ck Agg Muni Out	-	4,551	4,551	100	-	3,777	3,777
434	08_AUP001_I	Plum Ck Agg Uninc In	-	6,528	6,528	100	-	652	652
435	08_AUP001_O	Plum Ck Agg Uninc Out	-	5,129	5,129	100	-	4,257	4,257
436	08_AUP002_I	Cherry Ck Agg Uninc In	-	6,962	6,962	100	-	697	697
437	08_AUP002_O	Cherry Ck Agg Uninc Out	-	5,470	5,470	100	-	4,540	4,540
438	08_AWP001	WD8 Agg Well 1	-	350	350	100	229	-	229
439	08_AWP002	WD8 Cherry Ck Agg GW Div	-	1,206	1,206	100	723	-	723
440	08_AWP003	WD8 SPR Agg GW Divn	-	72	72	99	43	-	43
441	08_AWP004	WD8 Plum Ck Agg GW Divn	-	262	262	100	157	-	157
442	08_AWP005	WD8 Agg Well 5	-	2,352	2,352	100	1,520	-	1,520
443	6402517_AuW	Sedgwick Cty Aug Well	-	792	792	100	-	-	-
444	6402517_ReW	Sedgwick Cty Recharge We	-	414	414	98	-	-	-
445	6402519_AuW	Dinsdale Aug Well	-	319	319	100	-	-	-
446	6402519_ReW	Dinsdale Recharge Well	-	1,485	1,485	100	-	-	-
447	6402525_AuW	Condon Aug Well	-	38	38	100	-	-	-
448	6402525_ReW	Condon Recharge Well	-	1,276	1,276	100	-	-	-
449	6402526_AuW	Sterling Aug Well	-	9	9	100	-	-	-
450	6402536_AuW	Lower Logan Aug Well	-	444	444	100	-	-	-
451	6402536_ReW	Lower Logan Recharge Wel	-	4,212	4,212	99	-	-	-
452	6402539_AuW	Logan Aug Well	-	360	360	100	-	-	-
453	6402539_ReW	Logan Recharge Well	-	2,115	2,115	100	-	-	-
454	6402540_AuW	Low Line Aug Well	-	32	32	100	-	-	-
455	6402542_ReW	LSPWCD Recharge Well	-	541	541	100	-	-	-

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
456	64_AMP001_I	WD 64 Muni Ind	-	3,114	3,114	100	-	312	312
457	64_AMP001_O	WD 64 Muni Out	-	2,446	2,446	100	-	2,031	2,031
458	64_AUP001_I	WD 64 Unincorp Ind	-	2,073	2,073	100	-	207	207
459	64_AUP001_O	WD 64 Unincorp Out	-	1,629	1,629	100	-	1,351	1,351
460	64_AWP001	Water District 64 Sedgwick County North	-	313	313	100	233	-	233
461	64_AWP002	Water District 64 Sedgwick County South	-	322	322	100	232	-	232
462	64_AWP003	Water District 64 Sedgwick County South	-	3,550	3,550	100	2,719	-	2,719
463	64_AWP004	Water District 64 Sedgwick County GW 1	-	7,962	7,962	100	5,358	-	5,358
464	64_AWP005	Water District 64 Sedgwick County GW 2	-	6,463	6,463	100	4,503	-	4,503
465	64_AWP006	Water District 64 Lower Logan County North	-	1,408	1,408	100	1,058	-	1,058
466	64_AWP007	Water District 64 Lower Logan County South 1	-	4,917	4,917	100	3,818	-	3,818
467	64_AWP008	Water District 64 Lower Logan County South 2	-	11,552	11,552	100	9,131	-	9,131
468	64_AWP009	Water District 64 Lower Logan County South 3	-	10,213	10,213	100	7,545	-	7,545
469	64_AWP010	WD 64 Logan County North Blw Tetsel	-	2,186	2,186	100	1,748	-	1,748
470	64_AWP011	Water District 64 Logan County North Central	-	4,085	4,085	100	2,952	-	2,952
471	64_AWP012	WD 64 Logan County S of Pawnee Canal	-	6,709	6,709	100	4,828	-	4,828
472	64_AWP013	WD 64 Logan County N of Pawnee Canal	-	10,356	10,356	100	7,766	-	7,766
473	64_AWP014	WD 64 Logan County North Blw Sterling No 1	-	9,642	9,642	100	7,170	-	7,170
474	64_AWP015	Water District 64 Logan County South	-	352	352	100	259	-	259

#	Model ID	Name	Avg. Annual SW Demand (AF)	Avg. Annual GW Demand (AF)	Avg. Annual Total Demand (AF)	Percent Demand Simulated	Avg. Annual Irrig. CU (AF)	Avg. Annual M & I CU (AF)	Avg. Annual Total CU (AF)
475	64_AWP016	Water District 64 Weld County	-	1,539	1,539	100	1,202	-	1,202
476	64_AWP017	WD 64 Logan County North Blw Tetsel	-	2,485	2,485	100	1,791	-	1,791

7.7 SPDSS Task Memorandum Links

The table below contains hyperlinks to the CDSS website with all of the previously completed task memos.

Link	Title	Description
SPDSS_Task 69_EstimateReservoirStockPondEvaporation	SPDSS Task 69 - Estimate Reservoir and Stock Evaporation	The purpose of Task 69 is to estimate the capacity of smaller, non-key reservoirs and stock ponds, combine them by Water District into "aggregated" reservoirs, and estimate their evaporative losses.
SPDSS_Task 7-1_IdentifyReviewCallRecords	SPDSS Task 7.1 - Identify and Review Call Records	The Task 7.1 objectives are to: Collect, review and characterize historical call regime over time. Determine an appropriate methodology with Division 1 personnel to develop consistent coding standards for the 1950 to present study period.
SPDSS_Task1_Research-ID-StudyPeriod	SPDSS Task 1 - Research and Identify Appropriate Study Period	The objective of this task was to verify or refine the recommended study period as follows: 1. Review the availability and reliability of digitized data required for the development of DSS components; 2. Determine that the period includes wet, dry, and average periods; represents the long-term average hydrology of the basin; and allows for cost-effective modeling efforts; 3. Document study periods used in other modeling efforts in the South Platte Basin.
SPDSS_Task104_MappingIrrigatedLands1997	Tasks 104 & 105 - SPDSS Spatial Systems Integration: Mapping Historic Land Use for 1997	This memorandum provides details on the methods used to map the SPDSS irrigated lands that existed in 1997.

Link	Title	Description
SPDSS_Task2_IDKeyStreamflowGages	SPDSS Task 2 - Identify Key Streamflow Gages and Estimate Streamflows for Missing Records	The objective of this task is to identify key streamflow gages to use in the SPDSS modeling efforts and to develop a method for filling missing data. Revised memo to account for new information regarding the Balzac Gage. Revised February 2007.
SPDSS_Task3_AggregateNonKeyAgDiversionStructures	Task 3 - Aggregate Non-Key Agricultural Diversion Structures	This memo describes the approach and results for grouping (aggregating) non-key surface water and ground water only structures for the SPDSS Historical Consumptive Use analysis and for future modeling efforts.
SPDSS_Task3_IDKeyDiversionStructures_DistMeetingNotes	SPDSS Task 3 - Identify Key Diversion Structures	Notes from Water District Meetings: Includes Water Districts 1-9, 23, 47, 48, 64, 76 and 80
SPDSS_Task3_KeyDiversionSTructures_Summary	SPDSS Task 3 - Summary of Key Diversion Structures	This memo provides the key surface water structures for the SPDSS Historical Consumptive Use analysis and for future modeling efforts.
SPDSS_Task33_2_Phase2_FieldStudyWorkPlan	Task 33.2 Phase 2 Field Study Work Plan for Alluvial and Bedrock Well Installation, Testing, and Water Level Monitoring	This document presents the Field Study Work Plan for Alluvial and Bedrock Well Installation, Testing, and Water Level Monitoring. This document includes the memo and figures. Appendices are included in a separate document.
SPDSS_Task33_2_Phase2_FieldStudyWorkPlanAppendices	33.2 - Phase 2 Field Study Work Plan for Streambed Conductance Testing and Water Level Measurement - Appendices Only	Appendices only.
SPDSS_Task33-2_Phase3_StreambedConductanceTestingWorkPlan	33.2 - Phase 3 Field Study Work Plan for Streambed Conductance Testing and Water Level Measurment	This document presents the Field Study Work Plan design, Task 33.2 of Phase 3 of the South Platte Decision Support System (SPDSS).
SPDSS_Task34-3_Phase 3_StreambedConductanceTesting	34.3 - Streambed Conductance Testing - Phase 3	The objective of this Task 34 is to collect data needed to quantify the ground water flux across the streambed in the South Platte River and significant tributaries.
SPDSS_Task35_Phase2_AlluvialWellConstru	35 - Phase 2 - Alluvial Well Construction & Testing	This Task Memo documents field data collection activities in Phase 2.

Link	Title	Description
ctionTesting		
SPDSS_Task35-3_LowerSPlatteRegionAlluvialWellTesting	35.3 Lower S. Platte Region - Alluvial Well Construction and Testing	This self-extracting zip file contains pdfs of the memo, figures and all appendices, which document field data collection activities.
SPDSS_Task36-2_BedrockWellConstTesting	36.2 - Bedrock Well Construction and Testing	The purpose of this task is to construct, test, and instrument with a water level data logger one bedrock monitoring well. This self-extracting zip file contains pdfs of all related documents.
SPDSS_Task37-2_Phase2_AquiferPumpingTests	37.2 - Aquifer Pumping Tests - Phase 2	The overall goal of SPDSS Task 37 is to collect aquifer test data to better define the hydraulic properties of the Denver Basin aquifers.
SPDSS_Task39_Phase4_FinalWaterLevelMeasurement	39 - Final Water Measurement - Phase 4	This technical memorandum documents the methods and results of Task 39, and focuses on field data collection with limited analysis provided.
SPDSS_Task39-2_Phase2_DenverBasinRegionWaterLvlMeasurement	39.2 - Denver Basin Region Water Level Measurement - Phase 2	The objective of this task memo is to provide hydrogeologic data for the bedrock ground water system in the Denver Basin Region to supplement existing information that is collected by the State Engineer's Office (SEO) in the spring of each year.
SPDSS_Task39-4_Phase3_FinalWaterLvlMeasurement	39.4 - Final Water Level Measurement - Phase 3	This technical memorandum documents the methods and results of Tasks 39.1-39.3, and focuses on field data collection with limited analysis provided.
SPDSS_Task4_IDKeyTransmountainDiversions	SPDSS Task 4 - Identify and Fill/Resolve Conflicting Records for Key Transmountain Diversion Structures	The objective of this task is to select the most reliable transmountain diversion data.
SPDSS_Task40-2_Phase2_ConversionofAbandonedWells	40.2 - Conversion Abandonded Wells - Phase 2	This task memo summarizes the process used to identify wells scheduled for abandonment and evaluate identified wells for conversion to monitoring wells in the Denver Basin Region.
SPDSS_Task41-3_EstMunicpalIndustrialPumpingSPAlluviumRegion	41.3 - Estimation of Municipal and Industrial Pumping in the South Platte Alluvium Region	This Technical Memorandum was undertaken under 41.3 of Phase 3 of the SPDSS, and summarizes the methodology and analysis used to estimate pumping values for periods in which no data were available.

Link	Title	Description
SPDSS_Task42-2_Phase2_DenverBasinAquiferConfiguration	42.2 - Denver Basin Region Aquifer Configuratioin - Phase 2	This Technical Memorandum was undertaken under Task 42.2, and summarizes the compilation, analysis and mapping of existing published aquifer configuration data for the Denver Basin Region.
SPDSS_Task42-3_Phase3_LowerSPlatteAlluviumRegionAquiferConfiguration	42.3 - Lower South Platte Alluvium Region Aquifer Configuration - Phase 3	This Technical Memorandum was undertaken under Task 42.3, and summarizes the compilation, analysis and mapping of existing published aquifer configuration data for the Lower South Platte Alluvium Region.
SPDSS_Task43-2_Phase2_DenverBasinRegionAquiferProperty	43.2 - Denver Basin Region Aquifer Property - Phase 2	This Technical Memorandum was undertaken under Task 43.2, and summarizes the compilation, analysis and mapping of existing published aquifer property data for the Denver Basin Region.
SPDSS_Task43-3_Phase3_LowerSPlatteAlluviumRegionAquiferProperty	43.3 - Lower South Platte Alluvium Region Aquifer Property - Phase 3	This Technical Memorandum was undertaken under Task 43.3, and summarizes the compilation, analysis and mapping of existing published aquifer property data for the Lower South Platte Alluvium Region.
SPDSS_Task44-2_Phase3_DenverBasinBedrockWaterLevel	44.2 - Denver Basin Bedrock Water Level - Phase 3	This Technical Memorandum (TM) was undertaken under Task 44.2 of Phase 2 of the SPDSS, and summarizes the compilation, analysis, and mapping of water level data of the Denver Basin bedrock aquifers.
SPDSS_Task44-3_LowerSPlatteAlluviumRegionAquiferWaterLevels	44.3 - Lower South Platte Alluvium Region Aquifer Levels - Phase 3	This Technical Memorandum was undertaken under Task 44.3 of Phase 2 of the SPDSS, and summarizes the compilation, analysis and mapping of water level data of the South Platte Alluvial Aquifer.
SPDSS_Task46-2_StreamGainLossEstimates	46.2 - Stream Gain/Loss Estimates - Phase 4	This Technical Memorandum summarizes the compilation and analysis of data for the computation of monthly gains and losses for the main stem of the South Platte River and selected tributaries for the study period of 1950-2005.
SPDSS_Task48-2_AlluvialGroundwaterModelingCalibration	48.2 - Development of Calibration Targets and Criteria - Phase 4	This Technical Memorandum was undertaken under Task 48.2 of Phase 4 of the SPDSS, to develop calibration criteria, including selection of field data (targets) to be used during the model calibration. This TM summarizes the methodology and data that are anticipated to be used in the model calibration process.

Link	Title	Description
SPDSS_Task5_KeyMuniUser_Aurora	SPDSS Task 5 - Key Municipal User, City of Aurora	The City of Aurora has been identified as a key municipal user for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyMuniUser_DenverWater	SPDSS Task 5 - Key Municipal User, Denver Water Board	Denver Water has been identified as a key municipal user for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyMuniUser_FtCollins	SPDSS Task 5 - Key Municipal User, City of Fort Collins	The City of Fort Collins has been identified as a key municipal user for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyMuniUser_Greeley	SPDSS Task 5 - Key Municipal User, City of Greeley	The City of Greeley has been identified as a key municipal user for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyMuniUser_Longmont	SPDSS Task 5 - Key Structure, City of Longmont	The City of Longmont has been identified as a key municipal user for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyMuniUser_Loveland	SPDSS Task 5 - Key Structure, City of Loveland	The City of Loveland has been identified as a key municipal user for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyReservoirs_Summary	SPDSS Task 5 - Summary - Key Reservoirs	This memo summarizes the work done to identify key reservoirs for consumptive use modeling.

Link	Title	Description
SPDSS_Task5_KeyStructure_AlvaBAdamsTunnel	SPDSS Task 5 - Key Structure, Alva B. Adams Tunnel	The Alva B. Adams Tunnel has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_BerthoudPassDitch	SPDSS Task 5 - Key Structure, Berthoud Pass Ditch	The Berthoud Pass Ditch has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_BijouIrrigationSystem	SPDSS Task 5 - Key Structure, Bijou Irrigation System	The Bijou Irrigation System has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_BobCreekDitch	SPDSS Task 5 - Key Structure, Bob Creek Ditch	The Bob Creek Ditch has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_BoreasPassDitch	SPDSS Task 5 - Key Structure, Boreas Pass Ditch	The Boreas Pass Ditch has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_BoulderLarimerDitch	SPDSS Task 5 - Key Structures, Boulder Larimer Ditch System	The Boulder Larimer Ditch System has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.

Link	Title	Description
SPDSS_Task5_KeyStructure_BurlingtonFRICOHenrylyn	SPDSS Task 5 - Key Structure, Burlington, FRICO-Barr and Henrylyn Systems	The Burlington, FRICO–Barr, and Henrylyn Systems have been identified as key structures for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified. This memo was revised to expand on information regarding conveyance efficiencies and municipal ownership. Revised January 17, 2007.
SPDSS_Task5_KeyStructure_CameronPassDitch	SPDSS Task 5 - Key Structure, Cameron Pass Ditch	The Cameron Pass Ditch has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_FRICO-Marshall	SPDSS Task 5 - Key Structure, FRICO-Marshall Lake Division	The FRICO–Marshall Lake Division has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_FRICO-Milton	SPDSS Task 5 - Key Structure, FRICO-Milton Lake Division	The FRICO–Milton Lake Division has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_FRICO-Standley	SPDSS Task 5 - Key Structure, FRICO-Standley Lake Cities	FRICO–Standley Lake Cities has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_GrandRiverDitch	SPDSS Task 5 - Key Structure, Grand River Ditch	The Grand River Ditch has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.

Link	Title	Description
SPDSS_Task5_KeyStructure_GreeleyLovelandIrrigCo	SPDSS Task 5 - Key Structure, Greeley Loveland Irrigation Company	The Greeley Loveland Irrigation Company has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_HighlandDitch	SPDSS Task 5 - Key Structure, Highland Ditch Company	The Highland Ditch Company has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_HomestakePipeline	SPDSS Task 5 - Key Structure, Homestake Pipeline	The Homestake Pipeline has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_HomeSupplyDitchReservoirCo	SPDSS Task 5 - Key Structure, Concolidated Home Supply Ditch and Reservoir Company	The Consolidated Home Supply Ditch and Reservoir Company has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_JacksonLake	SPDSS Task 5 - Key Structure, Jackson Lake & Fort Morgan Canal System	The Jackson Lake & Fort Morgan Canal System has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified. This memo was revised to incorporate additional storage information. Revised March 15, 2007
SPDSS_Task5_KeyStructure_Julesburg	SPDSS Task 5 - Key Structure, Julesburg Irrigation District	The Julesburg Irrigation District has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.

Link	Title	Description
SPDSS_Task5_KeyStructure_LaramiePoudreTunnel	SPDSS Task 5 - Key Structure, Laramie Poudre Tunnel	The Laramie Poudre Tunnel has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_LarimerWeldIrrigCo	SPDSS Task 5 - Key Structure, Larimer and Weld Irrigation Company	The Larimer and Weld Irrigation Company has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_LeftHandDitch	SPDSS Task 5 - Key Structure, Left Hand Ditch System	The Left Hand Ditch System has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_LowerLathamDitch	SPDSS Task 5 - Key Structure, Lower Latham Ditch and Reservoir System	The Lower Latham Ditch and Reservoir System has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_MichiganDitch	SPDSS Task 5 - Key Structure, Michigan Ditch	The Michigan Ditch has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_MoffatTunnel	SPDSS Task 5 - Key Structure, Moffat Water Tunnel	The Moffat Water Tunnel has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.

Link	Title	Description
SPDSS_Task5_KeyStructure_NCWCD_CBT	SPDSS Task 5 - Key Structure, Northern Colorado Water Conservancy District and Colorado-Big Thompson Project	The Northern Colorado Water Conservancy District and Colorado-Big Thompson Project has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_NewCacheLaPoudre	SPDSS Task 5 - Key Structure, New Cache la Poudre Irrigating Company and Cache la Poudre Reservoir Company	The New Cache la Poudre Irrigating Company and Cache la Poudre Reservoir Company has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_NorthPoudre	SPDSS Task 5 - Key Structure, North Poudre Irrigation Company	The North Poudre Irrigation Company has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_NorthSterling	SPDSS Task 5 - Key Structure, North Sterling Irrigation District	The North Sterling Irrigation District has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_PrewittReservoir	SPDSS Task 5 - Key Structure, Prewitt Reservoir	The Prewitt Reservoir has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_RiversideIrrigation	SPDSS Task 5 - Key Structure, Riverside Irrigation System	The Riverside Irrigation System has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.

Link	Title	Description
SPDSS_Task5_KeyStructure_RobertsTunnel	SPDSS Task 5 - Key Structure, Harold D. Roberts Tunnel	The Harold D. Roberts Tunnel has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_SkylineDitch	SPDSS Task 5 - Key Structure, Skyline Ditch	The Skyline Ditch has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_StraightCreekTunnel	SPDSS Task 5 - Key Structure, Straight Creek Tunnel	The Straight Creek Tunnel Tunnel has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_VidlerTunnel	SPDSS Task 5 - Key Structure, Vidler Tunnel	The Vidler Tunnel has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_WaterSupplyStorageCo	SPDSS Task 5 - Key Structure, Water Supply and Storage Company	The Water Supply and Storage Company has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.
SPDSS_Task5_KeyStructure_WilsonSupplyDitch	SPDSS Task 5 - Key Structure, Wilson Supply Ditch	The Wilson Supply Ditch has been identified as a key structure for the South Platte Decision Support System (SPDSS) consumptive use and surface water modeling efforts. The purpose of this Task 5 memorandum is to document physical, legal, and operational aspects of those key structures identified.

Link	Title	Description
SPDSS_Task50-1_Phase2_ReviewExistingDataCenteredApproachforGW	50.1 - Review of Existing Approaches to Development of a Data Centered Approach for the SPDSS Groundwater Component - Phase 2	This Technical Memorandum summarizes the existing data centered modeling process that has been implemented by the State for the Rio Grande Decision Support System (RGDSS) and identifies candidate graphical user interface (GUI) tools for screening and selection in subsequent tasks.
SPDSS_Task50-2_Phase2_DefinitionsofRequirementsDataCenteredModeling	50.3 - Definition of Requirements for an Enhanced Data Centered Modeling Process for the SPDSS Groundwater Component - Phase 2	This Task Memo defines and prioritizes potential ground water modeling enhancements.
SPDSS_Task50-3_ScopeofWorkDataModelingProcess	50.3 - Implementation Scope of Work for an Enhanced Data Centered Modeling Process for the SPDSS Groundwater Component - Phase 2	This memorandum provides a scope of work for implementing high priority enhancements to the model during Phase 3.
SPDSS_Task50-4_20070330	SPDSS Phase 3 Task 50.4 Technical Memorandum Data Centered Groundwater Modeling Enhancements	Data Centered Groundwater Modeling Enhancements
SPDSS_Task52_ReviewIrrigatedAcreageDiv1Dist47	Task 52 - Review of Irrigation Acreage in Division 1 and Water District 47	The purpose of this memorandum is to document the review of irrigated acreage assigned to surface water diversion structures located in the SPDSS study area.
SPDSS_Task53-1_Daily Climate Data Collection for HydroBase	Task 53.1 - Daily Climate Data Collection for HydroBase	This memorandum presents the general approach and results for the following Task 53 subtask: Collect/digitize daily data for temperature, precipitation, wind speed, solar radiation, and vapor pressure from approximately 20 existing data sources including CoAgMet and NCWCD climate stations. This memo was revised to correct the equation provided to convert NCWCD dew point data to vapor pressure for use in StateCU with the ASCE Standardized Evapotranspiration Equation.

Link	Title	Description
SPDSS Task53-2 Collect and Fill Missing Monthly Climate Data	Task 53.2 - Collect and Fill Missing Monthly Climate Data	SPDSS Task 53.2 –Collect and Fill Missing Monthly Climate Data memo discusses the identification of and filling techniques for the key climate stations selected to represent climatic conditions throughout the South Platte, North Platte and Laramie River basins (SPDSS study area).
SPDSS Task53-3 Assign Key Climate Information to Irrigated Acreage and Reservoirs	Task 53.3 - Assign Key Climate Information to Irrifated Acreage and Reservoirs	This memorandum presents the general approach for the following Task 53 subtasks: 1. Assign key climate stations to geographic areas for the SPDSS modeling efforts. 2. Estimate average monthly reservoir evaporation rates for geographic areas.
SPDSS Task54-2 Agricultural Statistics Data Summary	Task 54.2 - Agricultural Statistics Data Summary	This memo provides a summary of information obtained through the data collection process and recommendations to combine crops based on growing season and irrigation water requirements.
SPDSS Task56 ConveyanceandApplication Efficiencies	Task 56 - Conveyance and Application Efficiencies	This memorandum describes the approach and results obtained under Task 56 - Conveyance and Application Efficiencies. This task includes an estimation of both ditch system conveyance and maximum application (on-farm) efficiencies likely to be experienced in the South Platte Basin, plus a recommendation on efficiencies to use for the historic consumptive use analyses.
SPDSS Task58 Review Previous Estimates of Potential CU	Task 58 - Review Previous Estimates of Potential CU	This memo reviews the methods used in the past to determine potential consumptive use.
SPDSS Task59-1 Develop Locally Calibrated Blaney-Criddle Crop Coefficients	Task 59.1 - Develop Locally Calibrated Blaney-Criddle Crop Coefficients	This memorandum presents the recommended regional Blaney-Criddle crop coefficients for use in the SPDSS CU analysis. Revised January 11, 2008
SPDSS Task59-2 Irrigation Water Requirements at Climate Stations	Task 59.2 - Irrigation Water Requirements at Climate Stations	SPDSS Task 59.2 – This memorandum presents the approach and results from the completion of the following Task 59 subtask: Using calibrated crop coefficients, estimate the irrigation water requirement for common crops grown at the key climate stations identified in Task 53.
SPDSS Task61 Effective Precipitation Estimates for Determining Crop Irrigation	Task 61 - Effective Precipitation Estimates for Determining Crop Irrigation Water Requirements	SPDSS Task 61 was designed to investigate the consumptive use methodology for potential application in SPDSS. The purpose of this memorandum is to convey results of these investigations and provide recommendations for effective precipitation determination in estimating the consumptive use of irrigation water in the SPDSS study area.

Link	Title	Description
SPDSS_Task61_Effective Precipitation Estimates for Determining Crop Irrigation Water Requirements	Task 61 – Effective Precipitation Estimates for Determining Crop Irrigation Water Requirements	SPDSS Task 61 was designed to investigate the consumptive use methodology for potential application in SPDSS. The purpose of this memorandum is to convey results of these investigations and provide recommendations for effective precipitation determination in estimating the consumptive use of irrigation water in the SPDSS study area.
SPDSS_Task62_Review IDSCU	Task 62 - Review IDSCU (formerly SPMAP)	This memorandum provides a review of the IDSCU documentation and functionality.
SPDSS_Task64_ReviewDevelopPrecipitationRechargeEstimates	64 - Review and Develop Precipitation Recharge Estimates	This memorandum presents the general approach used to develop monthly precipitation recharge estimates for both the Denver Basin and South Platte alluvial ground water models.
SPDSS_Task65_EstimateSouthPlattePhreatophyteGroundwaterEvapotranspiration	Task 65 - Estimate South Platte Phreatophyte Groundwater Evapotranspiration	Estimate South Platte Phreatophyte Groundwater Evapotranspiration
SPDSS_Task66-2_CollectDevelopMunicipalIndustrialConsumptiveUseEstimates	Task 66.2 - Collect and Develop Municipal and Industrial Consumptive Use Estimates	This memorandum presents the general approach used to develop municipal and industrial consumptive use for the CU and Losses Summary Report and estimate indoor and outdoor water demands, consumptive use, and return flows for SPDSS modeling efforts.
SPDSS_Task70_Collect Data and Estimate Wildlife Area Use	Task 70 - Collect Data and Estimate Wildlife Area Use	The objective of Task 70 is to: Collect and review published reports and estimates of water use associated with the creation and maintenance of wildlife and wetland areas in the South Platte and North Platte River Basins. Quantify consumptive use of created and maintained wildlife and wetland areas for the Consumptive Use and Losses Summary Report and Water Budget Model.
SPDSS_Task71_EstimateHistoricalAcreage	Task 71 - Estimate Historical Acreage	This memorandum presents the general approach and results from the completion of the following: Determine an appropriate method for using agricultural statistics, water rights, water availability, and other data to estimate historic irrigated acreage and crop types by ditch or other water source for the entire SPDSS study period (e.g. time periods before and between GIS irrigated acreage coverages).

Link	Title	Description
SPDSS_Task7-2_WellUseWellAugmentationPlans	7.2 - Well Use and Well Augmentation Plans	This memorandum and associated appendices characterizes the 20 largest well augmentation plans and develops recommendations for representing well use and augmentation in SPDSS modeling efforts.
SPDSS_Task74_EstimateGroundwaterSprinklerIrrigatedAcreage	South Platte Historic Consumption Use - Annual Irrigation Parameter Time Series (Ground Water Acreage and Sprinkler Acreage)	This memorandum presents the general approach to fill missing irrigated acreage data for the SPDSS.
SPDSS_Task76-8-1_Create Unfilled Blaney-Criddle Statewide Climate Scenario	Taask 76.8-1 - Create Unfilled Blaney-Criddle Statewide Climate Scenario	This memorandum presents the general approach and results for the following portion of this Task 76.8 subtask: Create Statewide monthly unfilled Blaney-Criddle climate scenarios for the period 1950 through 2004.
SPDSS_Task76-8-2_Create Filled Climate Station Scenario for the Arkansas and Republican River Basins	Task 76.8-2 - Create Filled Climate Station Scenario for the Arkansas and Republican River Basins	This memorandum presents the general approach and results for the following portion of this Task 76.8 subtask: Create Statewide monthly filled Blaney-Criddle climate scenarios for the period 1950 through 2004.
SPDSS_Task77_PerformAnalysisofDeficitIrrigation	Task 77 - Perform Analysis of Deficit Irrigation	This memorandum presents the general approach for Task 77: Perform an analysis to determine whether estimating the use of supplemental supplies (i. e. ground water and reservoir releases) to meet full or partial potential use is appropriate for regions within the South Platte.
SPDSS_Task81-2_Consumptive Use and Water Budget Technical Peer Review Meeting Follow-Up	SPDSS Task 81.2 - Consumptive Use and Water Budget Technical Peer Review Meeting Follow-Up	The purpose of this memorandum is to document results from further investigations conducted in response to questions and suggestions provided during the reviews, and to keep others informed of subsequent findings.
SPDSS_Task82_ReviewPublishedReports_WaterBudgets	SPDSS Task 82 - Review Published Reports on Water Budgets	This memorandum summarizes the results of Task 82 of the Consumptive Use and Water Budget portion of the South Platte Decision Support System (SPDSS) effort.
SPDSS_Task83_PrepareInitialWaterBudgets	SPDSS Task 83 - Prepare Initial Water Budgets	This memorandum summarizes the results of Task 83 of the Consumptive Use and Water Budget portion of the South Platte Decision Support System (SPDSS) effort.

Link	Title	Description
SPDSS_Task84_LaramieRiverBasinWaterBudget	SPDSS Task 84 - Laramie River Basin Water Budget - Procedures and Results	This memorandum summarizes the results of Task 84 of the Consumptive Use and Water Budget portion of the South Platte Decision Support System (SPDSS) effort. The objective of this task is as follows: Update the initial average annual basin-wide water budget reports with information developed during Phase 3. Develop annual and monthly water budgets for the two basins in the SPDSS Study Area – South Platte and Laramie – and the areas represented by the South Platte Alluvial ground water model.
SPDSS_Task84_SouthPlatteRiverBasinWaterBudget	SPDSS Task 84 - South Platte Alluvial Ground Water Budget	This memorandum summarizes the results of Task 84 of the Consumptive Use and Water Budget portion of the South Platte Decision Support System (SPDSS) effort. The objective of this task is as follows: Update the initial average annual basin-wide water budget reports with information developed during Phase 3. Develop annual and monthly water budgets for the two basins in the SPDSS Study Area – South Platte and Laramie – and the areas represented by the South Platte Alluvial ground water model.
SPDSS_Task84_SPAlluvialGroundWaterBudget	SPDSS Task 84 - South Platte Alluvial Ground Water Budget	This memorandum summarizes the results of Task 84 of the Consumptive Use and Water Budget portion of the South Platte Decision Support System (SPDSS) effort. The objective of this task is as follows: Update the initial average annual basin-wide water budget reports with information developed during Phase 3. Develop annual and monthly water budgets for the two basins in the SPDSS Study Area – South Platte and Laramie – and the areas represented by the South Platte Alluvial ground water model.
SPDSSTask5_CBoulder_20050309	SPDSS Task 5 - Key Structure, City of Boulder	
SPDSSTask89_Exec_Sum20071201	Task 89 - SPDSS Spatial Systems Integration: Irrigated Lands Assesment, Executive Summary	
SPDSSTask89_Exec_Sum20100927	Task 89 - SPDSS Spatial Systems Integration: Irrigated Lands Assessment, Executive Summary	Executive Summary describing the South Platte Irrigated Lands Assessment, Task 89

Link	Title	Description
SPDSSTask89-1_20030708	Task 89.1 - Finalize Methods and Order Imagery	The purpose of this memo is to review relevant literature, including reports of researchers and previous State contractors engaged in mapping land use and crop types for water resources applications, and consequently describe the recommended technical approach for mapping current land use.
SPDSSTask89-10_20051005	Task 89.10 - Mapping of Water Features	This memorandum summarizes activities performed under Task 89 – Mapping of Current Land Use and Irrigated Field Boundaries, Subtask 89.10 – Mapping of Water Features.
SPDSSTask89-2_20060929	Task 89.2 - Crop and Land Use Classification Procedures for Year 2001	This memorandum describes the activities conducted under Task 89: 'Mapping of Irrigated Land Use and Irrigated Parcel Boundaries' for year 2001 and complements the SPDSS Memoranda for Task 89.1 and Task 90.2. This memorandum also provides details on the methods used to conduct a number of Task 89 activities, including Task 89.3: Determine Irrigated Vs. Non-irrigated Lands, Task 89.4: Identify Crop Types In Each Polygon, Task 89.5: Review, Revision and Final Classification, and Task 89.6: Conduct Accuracy Assessment, as well as the results obtained from these activities for year 2001.
SPDSSTask90-1_20040209	Task 90.1 - Obtain and Process Data (Image Base Map)	This memorandum summarizes the procedures and results of the Image Base Map prepared under Task 90--Image Base Map and Irrigated Field Boundaries, Subtask 90.1—Obtain and Process Data.
SPDSSTask90-2_20040209	Task 90.2 - Determine Field Polygon Boundries	This memorandum summarizes the first draft delivery of the irrigated parcel mapping prepared under Task 90 -- Image Base Map and Irrigated Field Boundaries, Subtask 90.2 – Determine Field Polygon Boundaries.
SPDSSTask91_20070109	Task 91 - Map Wells, Irrigations Systems and Irrigation Service Areas	This memorandum summarizes the procedures for the 2001 irrigated parcel mapping prepared under Task 91 – Map Wells, Irrigation Systems, and Irrigation Service Areas.
SPDSSTask93_20070109	Task 93.2, 93.3, 93.4, 93.5 - Mapping Historic Land Use	This memorandum provides details on the methods used to conduct a number of activities conducted under Task 93: Mapping Historic Land Use, including: Task 93.2: Mapping of Historic Land Use for the 1980s; Task 93.3: Mapping of Historic Land Use for the 1970s; Task 93.4: Mapping of Historic Land Use for the 1950s; and, Task 93.5: Assignment of Water Supply for Three Dates Historic Land Use.

Link	Title	Description
SPDSSTask93-1_20060711	Task 93.1 - Historic Aerial Photography and Satellite Imagery Search	This memorandum summarizes Task 93 – Mapping of Historic Land Use, Subtask 93.1 Historic Aerial Photography and Satellite Imagery Search.
SPDSSTask94_20040209	Task 94 - GIS Database Development	This memo accompanies the GIS database prepared under Task 94 of the SPDSS.
SPDSSTask95-1_20050105	Task 95.1 - Evaluate Spatial Data	This memo discusses the evaluation of spatial data that could be created from HydroBase, considering their potential use in StateView, TSTool, and other CDSS applications, including: climate stations, precipitation stations, etc.
SPDSSTask96-1_20051028	Task 96.1 - Approach for Linking NHD and HydroBase Spatial Data	This memorandum recommends procedures for the use of the National Hydrography Dataset (NHD) with key structures in HydroBase and is a deliverable for the SPDSS Spatial System Integration Task 96.
SPDSSTask96-2-3_20050310	Task 96.2 & 96.3 - River Network and Key Structures Location Products	This subtask includes the following: Create a linked river network layer using the procedure proposed in Deliverable 96.1. Locate and integrate into the network SPDSS key diversion structures. Deliverable 96.2 is the river network and deliverable 96.3 is the location of the key structures along the network reaches.
SPDSSTask98-1_20060711	Task 98 - Mapping, Visualization, and Presentation Tools	This memorandum summarizes activities performed under Task 98 – Mapping, Visualization, and Presentation Tools
SPDSSTask99-2_20060928	Task 99.2 - CDSS Map Viewer Requirements	This memorandum addresses Task 99 – GIS Support and Data Maintenance, Subtask 99.2 - Modify and Maintain GIS Tools. Specifically, this memo defines a list of possible upgrades and enhancements for the CDSS Map Viewer.

7.8 Representation of Central WAS and GMS Quotas

The historical pumping file was developed using a two-step process to represent historical and more recent pumping estimates limited by Central Colorado Water Conservancy District (CCWCD) quota restrictions. To represent historical pumping estimates, StateCU estimates ground water pumping required to satisfy crop consumptive demands on ground water supplied lands not already met by surface water. These pumping estimates include water pumped to offset the inefficiencies associated with ground water application (i.e. flood or sprinkler application). Also, the amount of ground water pumped is limited by the acres served by ground water supplies and the well pumping capacity.

To represent the full extent of CCWCD wells with associated irrigated acreage, a review of original applications and amendments as part of Case 03CW99 was performed and procurement of a complete list of original CCWCD wells was produced. The result mimics the 2005 list of decreed wells as part of the Central GMS and WAS augmentation plans. Once identified, the Central well lists were compared to the wells assigned to each co-mingled and ground water only structure in order to identify the percent of acreage that is served by WAS, GMS, and non-CCWCD wells for each structure.

To represent post-2004 pumping estimates associated with the two CCWCD augmentation plans, quotas (i.e. restricted pumping) were applied to the StateCU estimated historical pumping from 2005 to 2012. A total of 54 well structures have at least a portion of their irrigated acreage served by wells covered under CCWCD augmentation plans. Using TSTool, pumping for these structures was restricted based on the CCWCD augmentation plan quota amount and the portion of acreage served by these wells. Table 1 shows the total acreage and percentage of acreage served by wells covered under CCWCD augmentation plans by structure. Table 2 reflects the annual quotas for 2005 through 2014 for both CCWCD augmentation plans. Table 3 and Table 4 reflect the list of wells used to estimate the percentage of acreage served by CCWCD WAS and GMS wells, respectively.

Table 1
CCWCD WAS and GMS Acreage Assignments

WDID	2005 Irrigated Acreage	WAS	GMS	Non – CCWCD
01_AWP002	1,576	6.8%	0%	93.2%
01_AWP004	1,701	1.8%	0%	98.2%
01_AWP010	1,720	14.6%	7.7%	77.7%
01_AWP0260	1,434	47.2%	0%	52.8%
01_AWP027	2,617	34.5%	12.6%	52.9%
01_AWP028	3,633	11.6%	37.1%	51.2%
01_AWP029	2,169	12.8%	33.5%	53.7%

WDID	2005 Irrigated Acreage	WAS	GMS	Non – CCWCD
01_AWP030	2,045	23.4%	56.2%	20.4%
01_AWP031	3,725	0%	2.2%	97.8%
01_AWP032	2,492	29.6%	56.3%	14.1%
01_AWP033	1,824	10.3%	0%	89.7%
01_AWP034	8	0%	100%	0%
01_AWP035	754	0%	73.8%	26.2%
01_AWP037	73	0%	100%	0%
01_AWP041	184	0%	100%	0%
01_AWP042	4,474	31.3%	60.7%	8.0%
01_AWP044	90	65.4%	34.6%	0%
02_AWP001	3,544	27.5%	53.0%	19.5%
02_AWP002	4,681	14.6%	74.8%	10.7%
02_AWP003	888	48.6%	42.8%	8.6%
02_AWP004	3,175	9.4%	67.2%	23.4%
02_AWP005	139	0%	100%	0%
03_AWP001	2,431	0.3%	0%	99.7%
05_AWP004	135	100%	0%	0%
0100507	22,067	1.7%	0%	98.3%
02_ADP003	189	0.0%	100%	0%
0200805	13,939	0%	26.2%	73.8%
0200808	2,928	11.6%	86.7%	1.7%
0200809	295	0%	100%	0%
0200810	429	0%	62.5%	37.5%
0200812	1,088	48.9%	51.1%	0%
0200813	1,496	73.4%	21.7%	4.9%
0200817	7,826	42.8%	56.7%	0.6%
0200821	455	58.2%	41.8%	0%
0200822	1,539	41.5%	58.5%	0%
0200824	6,094	41.5%	57.4%	1.1%
0200825	4,772	41.2%	43.3%	15.6%
0200828	3,525	11.7%	25.4%	62.8%
0200830	99	0%	100%	0%
0200834	7,221	0%	50.7%	49.3%
0200915	527	0%	91.7%	8.3%
0203837	4,377	8.7%	85.0%	6.4%
0203876	3,768	29.8%	66.4%	3.9%
0300911	15,176	0.3%	0%	99.7%
0300929	15,380	2.8%	0%	97.2%
0300934	205	0%	13.7%	86.3%

WDID	2005 Irrigated Acreage	WAS	GMS	Non – CCWCD
0400502	872	3.0%	97.0%	0%
0400522	137	0%	100%	0%
0400523	774	56.4%	28.4%	15.2%
0400524	32	38.5%	0%	61.5%
0500523	44	0%	100%	0%
0700569	419	0%	100%	0%

Table 2
CCWCD Pumping Quotas for 2005 through 2014

Year	WAS	GMS
2005	40%	50%
2006	0%	50%
2007	0%	30%
2008	0%	35%
2009	0%	35%
2010	0%	45%
2011	0%	40%
2012	0%	35%
2013	5%	35%
2014	20%	45%

Table 3
CCWCD WAS Wells Assigned in 2005

WDID	Exhibit / Amendment
0100565	Exhibit 3
0200779	Exhibit 3
0105039	2nd Amend
0105196	Exhibit 1
0105277	Exhibit 3
0105390	2nd Amend
0105391	2nd Amend
0105511	3rd Amend
0105515	Exhibit 1
0105536	Exhibit 1
0105658	Exhibit 1
0105707	Exhibit 1
0105748	Exhibit 1

WDID	Exhibit / Amendment
0105750	Exhibit 3
0105751	Exhibit 3
0105752	Exhibit 1
0105781	Exhibit 1
0105782	Exhibit 3
0105946	Exhibit 3
0105947	Exhibit 3
0105948	Exhibit 3
0106063	Exhibit 3
0106069	Exhibit 3
0106137	2nd Amend
0106137	3rd Amend
0106141	2nd Amend

WDID	Exhibit / Amendment
0106141	3rd Amend
0106460	Exhibit 1
0106574	Exhibit 1
0106576	Exhibit 3
0106579	Exhibit 1
0106609	Exhibit 3
0106616	Exhibit 3
0106719	Exhibit 3
0106720	Exhibit 1
0106721	Exhibit 3
0106729	3rd Amend
0106797	Exhibit 3
0106798	Exhibit 1

WDID	Exhibit / Amendment
0106848	3rd Amend
0106900	Exhibit 1
0107017	Exhibit 3
0107018	Exhibit 1
0107019	Exhibit 3
0107026	Exhibit 3
0107027	Exhibit 3
0107043	Exhibit 1
0107044	Exhibit 3
0107069	Exhibit 1
0107106	Exhibit 3
0107108	Exhibit 3
0107109	Exhibit 3
0107126	Exhibit 1
0107128	Exhibit 3
0107131	Exhibit 3
0107132	Exhibit 3
0107193	Exhibit 1
0107221	Exhibit 1
0107222	Exhibit 1
0107412	Exhibit 3
0107413	Exhibit 3
0107414	Exhibit 3
0107540	2nd Amend
0107619	2nd Amend
0107631	Exhibit 1
0107654	Exhibit 3
0107655	Exhibit 1
0107660	Exhibit 3
0107666	Exhibit 1
0107674	Exhibit 3
0107687	Exhibit 3
0107688	Exhibit 1
0107689	Exhibit 1
0107731	Exhibit 1
0107839	Exhibit 1
0107881	Exhibit 1
0107882	2nd Amend
0107882	3rd Amend
0107932	Exhibit 1
0108135	Exhibit 1
0108148	Exhibit 1
0108150	Exhibit 1
0108151	Exhibit 1
0108152	Exhibit 1

WDID	Exhibit / Amendment
0108153	Exhibit 1
0108157	Exhibit 1
0108213	Exhibit 1
0108266	Exhibit 3
0108312	Exhibit 1
0108313	Exhibit 3
0108314	Exhibit 1
0108315	Exhibit 3
0108410	Exhibit 1
0108677	Exhibit 3
0108678	Exhibit 1
0108679	Exhibit 3
0108680	Exhibit 3
0108681	Exhibit 3
0108683	Exhibit 1
0108684	Exhibit 3
0108685	Exhibit 3
0108687	Exhibit 1
0108688	Exhibit 3
0108689	Exhibit 1
0108690	Exhibit 1
0108691	Exhibit 3
0108692	3rd Amend
0108693	Exhibit 1
0108694	Exhibit 3
0108695	Exhibit 3
0108697	Exhibit 1
0108698	Exhibit 3
0108699	Exhibit 3
0108700	Exhibit 3
0108778	Exhibit 3
0108782	Exhibit 1
0108813	2nd Amend
0108813	3rd Amend
0108814	2nd Amend
0108814	3rd Amend
0108815	2nd Amend
0108815	3rd Amend
0108816	2nd Amend
0108816	3rd Amend
0108817	2nd Amend
0108817	3rd Amend
0108828	Exhibit 1
0108829	Exhibit 3
0108837	Exhibit 3

WDID	Exhibit / Amendment
0108839	Exhibit 1
0108840	Exhibit 3
0108841	Exhibit 3
0108842	2nd Amend
0108857	Exhibit 3
0108858	Exhibit 3
0108859	Exhibit 3
0108860	Exhibit 3
0108905	Exhibit 3
0108906	Exhibit 3
0108907	Exhibit 3
0109095	Exhibit 1
0109611	Exhibit 3
0109612	Exhibit 3
0109613	Exhibit 1
0109835	Exhibit 1
0205006	Exhibit 1
0205006	Exhibit 1
0205006	Exhibit 1
0205006	Exhibit 1
0205031	Exhibit 3
0205038	Exhibit 1
0205048	Exhibit 2
0205048	Exhibit 3
0205049	Exhibit 3
0205050	Exhibit 3
0205079	Exhibit 1
0205084	Exhibit 1
0205087	Exhibit 1
0205171	Exhibit 1
0205171	Exhibit 2
0205217	Exhibit 1
0205235	Exhibit 1
0205248	2nd Amend
0205249	Exhibit 3
0205252	Exhibit 3
0205257	Exhibit 1
0205257	Exhibit 2
0205283	Exhibit 3
0205284	Exhibit 1
0205285	Exhibit 1
0205293	Exhibit 3
0205314	Exhibit 1
0205315	3rd Amend
0205316	Exhibit 3

WDID	Exhibit / Amendment
0205327	Exhibit 1
0205377	Exhibit 1
0205382	Exhibit 3
0205385	Exhibit 3
0205392	Exhibit 1
0205412	Exhibit 1
0205415	Exhibit 1
0205416	Exhibit 3
0205417	Exhibit 3
0205421	Exhibit 1
0205422	Exhibit 3
0205435	Exhibit 1
0205436	Exhibit 1
0205443	Exhibit 2
0205446	Exhibit 3
0205448	Exhibit 1
0205448	Exhibit 1
0205449	Exhibit 3
0205450	Exhibit 3
0205452	Exhibit 1
0205518	2nd Amend
0205519	2nd Amend
0205520	2nd Amend
0205521	Exhibit 1
0205522	Exhibit 3
0205524	Exhibit 3
0205528	Exhibit 3
0205529	Exhibit 3
0205580	Exhibit 1
0205587	Exhibit 1
0205591	Exhibit 1
0205615	Exhibit 3
0205616	Exhibit 1
0205618	Exhibit 3
0205620	Exhibit 1
0205723	2nd Amend
0205758	Exhibit 1
0205759	Exhibit 3
0205760	Exhibit 3
0205815	Exhibit 1
0205816	Exhibit 1
0205818	3rd Amend
0205820	Exhibit 1
0205821	Exhibit 1
0205822	Exhibit 3

WDID	Exhibit / Amendment
0205825	Exhibit 1
0205826	2nd Amend
0205827	Exhibit 1
0205828	Exhibit 3
0205864	Exhibit 1
0205869	2nd Amend
0205869	3rd Amend
0205899	Exhibit 3
0205900	Exhibit 1
0205901	Exhibit 1
0205902	Exhibit 3
0205909	Exhibit 3
0205910	Exhibit 1
0205954	Exhibit 1
0205997	Exhibit 1
0206014	2nd Amend
0206016	Exhibit 3
0206017	Exhibit 3
0206018	Exhibit 3
0206019	Exhibit 3
0206021	Exhibit 1
0206022	Exhibit 1
0206024	Exhibit 1
0206027	Exhibit 3
0206104	Exhibit 2
0206105	Exhibit 2
0206106	Exhibit 3
0206107	Exhibit 1
0206108	Exhibit 2
0206110	Exhibit 1
0206122	Exhibit 1
0206152	Exhibit 1
0206154	Exhibit 3
0206155	Exhibit 1
0206156	Exhibit 3
0206158	Exhibit 3
0206159	2nd Amend
0206159	3rd Amend
0206164	Exhibit 1
0206206	Exhibit 1
0206207	Exhibit 3
0206246	Exhibit 1
0206348	Exhibit 1
0206376	Exhibit 2
0206379	Exhibit 3

WDID	Exhibit / Amendment
0206380	Exhibit 3
0206381	Exhibit 1
0206383	Exhibit 3
0206406	Exhibit 1
0206407	Exhibit 3
0206459	Exhibit 1
0206497	Exhibit 3
0206498	Exhibit 1
0206499	Exhibit 3
0206518	Exhibit 1
0206519	Exhibit 3
0206531	Exhibit 2
0206532	Exhibit 1
0206534	Exhibit 3
0206540	2nd Amend
0206540	3rd Amend
0206541	Exhibit 3
0206554	Exhibit 1
0206556	Exhibit 3
0206558	Exhibit 1
0206562	Exhibit 1
0206575	Exhibit 3
0206576	Exhibit 1
0206612	Exhibit 1
0206613	Exhibit 3
0206666	Exhibit 1
0206667	Exhibit 3
0206687	Exhibit 1
0206688	Exhibit 2
0206690	Exhibit 2
0206702	Exhibit 1
0206713	Exhibit 2
0206749	Exhibit 1
0206769	Exhibit 1
0206770	Exhibit 3
0206785	Exhibit 1
0206788	Exhibit 1
0206789	Exhibit 3
0206790	Exhibit 3
0206800	Exhibit 1
0206801	Exhibit 3
0206810	Exhibit 1
0206811	Exhibit 1
0206848	Exhibit 1
0206856	Exhibit 1

WDID	Exhibit / Amendment
0206857	Exhibit 3
0206860	Exhibit 3
0206861	Exhibit 3
0206862	Exhibit 1
0206867	2nd Amend
0206868	2nd Amend
0206886	2nd Amend
0206908	Exhibit 1
0207023	Exhibit 3
0207025	Exhibit 3
0207026	Exhibit 1
0207032	Exhibit 3
0207036	Exhibit 3
0207037	Exhibit 1
0207040	Exhibit 3
0207041	Exhibit 3
0207044	Exhibit 3
0207056	Exhibit 1
0207057	Exhibit 3
0207058	Exhibit 3
0207059	Exhibit 3
0207096	Exhibit 3
0207096	Exhibit 3
0207097	Exhibit 1
0207097	Exhibit 2
0207098	Exhibit 1
0207098	Exhibit 2
0207104	Exhibit 1
0207105	Exhibit 1
0207106	Exhibit 3
0207107	Exhibit 3
0207108	Exhibit 3
0207139	Exhibit 1
0207139	Exhibit 2
0207140	Exhibit 3
0207147	Exhibit 3
0207148	Exhibit 3
0207149	Exhibit 1
0207150	Exhibit 3
0207151	Exhibit 1
0207153	Exhibit 1
0207164	Exhibit 2
0207165	Exhibit 2
0207192	Exhibit 3
0207193	Exhibit 3

WDID	Exhibit / Amendment
0207194	Exhibit 1
0207195	Exhibit 3
0207205	Exhibit 3
0207206	Exhibit 1
0207207	Exhibit 3
0207209	Exhibit 3
0207242	Exhibit 1
0207245	Exhibit 1
0207248	Exhibit 1
0207250	Exhibit 1
0207251	Exhibit 3
0207256	Exhibit 3
0207268	Exhibit 3
0207269	Exhibit 1
0207352	Exhibit 1
0207354	Exhibit 3
0207354	Exhibit 3
0207355	Exhibit 1
0207357	Exhibit 1
0207365	Exhibit 3
0207375	Exhibit 3
0207378	Exhibit 1
0207379	Exhibit 1
0207380	Exhibit 1
0207381	Exhibit 1
0207382	Exhibit 1
0207383	Exhibit 3
0207444	Exhibit 1
0207455	Exhibit 3
0207457	Exhibit 3
0207458	Exhibit 1
0207459	Exhibit 1
0207460	Exhibit 3
0207464	Exhibit 1
0207465	Exhibit 1
0207472	Exhibit 3
0207473	Exhibit 3
0207524	Exhibit 1
0207525	Exhibit 1
0207526	Exhibit 3
0207542	Exhibit 1
0207543	2nd Amend
0207544	2nd Amend
0207545	Exhibit 1
0207546	Exhibit 2

WDID	Exhibit / Amendment
0207546	Exhibit 3
0207561	Exhibit 1
0207561	Exhibit 3
0207593	Exhibit 3
0207596	Exhibit 3
0207599	Exhibit 1
0207617	Exhibit 1
0207618	Exhibit 1
0207634	Exhibit 1
0207635	Exhibit 1
0207636	Exhibit 1
0207637	Exhibit 1
0207713	Exhibit 1
0207726	Exhibit 2
0207786	Exhibit 1
0207787	Exhibit 1
0207788	Exhibit 3
0207793	2nd Amend
0207793	3rd Amend
0207794	2nd Amend
0207794	3rd Amend
0207805	Exhibit 1
0207806	Exhibit 3
0207807	Exhibit 3
0207808	Exhibit 3
0207809	Exhibit 3
0207851	2nd Amend
0207853	Exhibit 1
0207853	Exhibit 2
0207855	Exhibit 2
0207855	Exhibit 3
0207933	Exhibit 1
0207934	Exhibit 3
0207935	Exhibit 3
0207968	Exhibit 2
0207976	Exhibit 2
0207977	Exhibit 2
0207979	Exhibit 2
0207986	Exhibit 3
0207992	Exhibit 3
0207994	Exhibit 3
0208001	Exhibit 1
0208002	Exhibit 1
0208013	Exhibit 1
0208014	Exhibit 1

WDID	Exhibit / Amendment
0208015	Exhibit 1
0208016	Exhibit 1
0208017	Exhibit 3
0208034	Exhibit 1
0208036	Exhibit 3
0208098	Exhibit 1
0208109	Exhibit 3
0208110	Exhibit 3
0208127	Exhibit 3
0208128	Exhibit 1
0208129	Exhibit 3
0208130	Exhibit 3
0208131	Exhibit 1
0208222	Exhibit 1
0208223	2nd Amend
0208223	3rd Amend
0208255	Exhibit 1
0208256	Exhibit 1
0208257	Exhibit 3
0208259	Exhibit 1
0208260	Exhibit 3
0208261	Exhibit 1
0208261	Exhibit 3
0208262	Exhibit 3
0208263	Exhibit 3
0208265	Exhibit 3
0208275	Exhibit 3
0208314	4th Amend
0208336	Exhibit 1
0208367	Exhibit 1
0208403	Exhibit 3
0208404	Exhibit 1
0208405	Exhibit 3
0208408	Exhibit 1
0208410	Exhibit 3
0208414	Exhibit 3
0208415	Exhibit 3
0208416	Exhibit 3
0208417	Exhibit 1
0208418	Exhibit 1
0208419	Exhibit 3
0208449	Exhibit 2
0208475	Exhibit 1
0208505	Exhibit 2
0208517	Exhibit 1

WDID	Exhibit / Amendment
0208531	Exhibit 3
0208532	Exhibit 2
0208532	Exhibit 3
0208533	Exhibit 2
0208533	Exhibit 3
0208534	Exhibit 2
0208534	Exhibit 3
0208535	Exhibit 2
0208535	Exhibit 3
0208536	Exhibit 2
0208536	Exhibit 3
0208577	Exhibit 2
0208577	Exhibit 3
0208578	Exhibit 3
0208579	Exhibit 1
0208579	Exhibit 2
0208595	Exhibit 1
0208596	Exhibit 3
0208597	Exhibit 3
0208629	Exhibit 3
0208630	Exhibit 1
0208631	Exhibit 1
0209084	Exhibit 3
0209383	Exhibit 1
0209578	Exhibit 1
0305210	Exhibit 1
0307285	Exhibit 1
0307286	2nd Amend
0307286	3rd Amend
0405102	Exhibit 1

Table 4
CCWCD GMS Wells Assigned in 2005

#	Name	Permit	WDID	Case	Approp. Date
484	J & M Partnership	19741	0105012	W-7840	19-03-75
485	J & M Partnership	19741	0105012	W-7840	02-06-75
184	Wenger, Linda S.	22231F	0105018	W-8299-77	23-07-76
313	Meisner Farms, LTD	18107	0105019	W-7455	17-08-73
636	Geisick Brothers,	12741R	0105118	W-1931	30-07-44
28	Higashi Nihon House Company Ltd/Empire Dairy	12180	0105434	W-4085	31-05-56
28	Higashi Nihon House Company Ltd/Empire Dairy	15083	0105435	W-4085	31-12-53
341	Millage Brothers, Inc.	7099	0105610	W-6312	30-09-35
341	Millage Brothers, Inc.	7100	0105611	W-6312	22-06-56
162	Walker, Patrick W.	013412F	0105702	W-441	31-05-43
41	Bernhardt, Albert W.	14603	0105703	W-4371	30-06-45
655	Alan E. Mazzotti	7115	0105704	W-441	08-05-41
655	Alan E. Mazzotti	7116	0105706	W-441	30-05-55
47	Bihain, Connie	1-20389	0105729	W-543	01-08-53
47	Bihain, Connie	2-20389	0105730	W-543	01-06-54
462	Stinar, Carl	10671	0105763	W-1033	31-07-39
462	Stinar, Carl	10672	0105765	W-1033	30-09-52
462	Stinar, Carl	10673	0105766	W-1033	31-12-53
462	Stinar, Carl	10674	0105767	W-1033	30-11-54
462	Stinar, Carl	6560F	0105768	W-1033	23-12-64
654	Box Elder Ranch	APD#4	0105794	82-CW-053	31-08-53
656	Nursery Acres Limited Partnership	19548R	0105797	W-16704	25-06-60
656	Nursery Acres Limited Partnership	19548S	0105798	W-16704	25-12-31
656	Nursery Acres Limited Partnership	19548T	0105799	W-16704	25-05-45
94	Cockroft, Loren R.	R12495RF	0105981	W-1932	31-12-38
95	Cockroft, Loren R.	R12495RF	0105981	W-1932	31-12-38
96	Cockroft, Loren R.	R12495RF	0105981	W-1932	31-12-38
94	Cockroft, Loren R.	12494R	0105985	W-1932	21-09-37
95	Cockroft, Loren R.	12494R	0105985	W-1932	21-09-37
96	Cockroft, Loren R.	12494R	0105985	W-1932	21-09-37
100	Corsentino, Joan	425	0106121	W-2571	20-06-42
573	Reinick, Richard/Debus		0106204	W-4476	30-07-45
288	Lockman, Steven J.	4484	0106311	W-4211	30-11-55
123	Dinner, Albert et. al.	11831	0106346	W-3686	31-03-41
560	Wolfe, Vernon E.	12613	0106385	W-887	31-05-34
560	Wolfe, Vernon E.	12614	0106386	W-887	30-04-47
560	Wolfe, Vernon E.	6359-F	0106387	W-887	30-11-64
560	Wolfe, Vernon E.	12915	0106388	W-886	31-03-54
560	Wolfe, Vernon E.	12916	0106389	W-886	31-03-55
560	Wolfe, Vernon E.	6360-F	0106390	W-886	30-11-64
588	Danks, William C.	7168	0106452	W-2596	31-05-46
10	Centennial Valley Ranch, LLC,	7169	0106453	W-2596	30-06-54

#	Name	Permit	WDID	Case	Approp. Date
647	Loose, Robert R. and Loose, Dale E.	426	0106549	W-5698	20-05-52
155	Foley, Oren	5004F	0106550	W-1476	30-01-64
155	Foley, Oren	6043	0106552	W-1476	30-04-42
658	The Edward Foos Family Trust	1961	0106553	W-2950	04-01-42
658	The Edward Foos Family Trust	1962	0106554	W-2950	31-05-43
658	The Edward Foos Family Trust	1963	0106555	W-2950	31-07-52
658	The Edward Foos Family Trust	1964	0106556	W-2950	31-05-54
163	Frank, Robert et.al.	5886	0106575	W-465	31-12-43
163	Frank, Robert et.al.	5885	0106578	W-465	10-06-58
163	Frank, Robert et.al.	6835	0106580	W-465	23-03-65
97	Coleman, Ivan	5914	0106639	W-1215	30-06-37
97	Coleman, Ivan	5915	0106640	W-1215	31-07-55
188	Gurtler, Russell	10472	0106773	W-1063	31-05-54
188	Gurtler, Russell	10471	0106774	W-1063	31-05-51
728	Mary Vesper Frenzel	21013F	0106811	W-6264	31-12-33
191	Wenger, Linda S.	427	0106831	W-6801	26-02-53
116	Dechant, Alvin	R06427	0106840	W-635	30-10-47
192	Hanson, Irwin	7601	0106841	W-584	30-06-57
603	Dinis, Jack	044925-F	0106866	94-CW-117	06-11-63
210	Hendricks, Gladys	04030F	0106887	W-1166	22-06-55
726	Baker, Leroy J.	11320	0106895	W-4463	20-06-57
727	Burough, David	10676	0106897	W-1840	31-07-47
212	Vrooman, D. Anthony	10677	0106898	W-1840	31-03-57
120	Dinnel Family Limited Liability	11689	0106899	W-987	31-12-38
113	Dechant, Alvin	5282F	0106903	W-4463	30-03-64
113	Dechant, Alvin	5281F	0106903	W-4463	20-06-64
113	Dechant, Alvin	1531	0106905	W-4463	28-03-60
113	Dechant, Alvin	5283F	0106907	W-4463	16-03-64
743	Borys, Richard M.	8409	0106908	W-1840	30-06-35
215	Hergenreder, Carl	1787	0106911	W-695	31-12-35
220	McWilliams, Carolyn E.	5972	0106913	W-1964	31-07-51
220	McWilliams, Carolyn E.	5973	0106914	W-1964	08-03-55
220	McWilliams, Carolyn E.	9131F	0106915	W-1964	14-04-65
172	Geisick Brothers,	6428	0106966	W-2070	03-05-56
172	Geisick Brothers,	7177	0106967	W-2070	17-06-49
172	Geisick Brothers,	5947	0106968	W-2070	24-06-53
172	Geisick Brothers,	6058	0106969	W-2070	05-06-46
178	Kobobel, Larry A.	2461F	0107033	W-2226	25-01-60
48	Bockius, Walter	13451	0107084	W-4971	30-05-51
48	Bockius, Walter	10798	0107085	W-4971	01-05-66
97	Coleman, Ivan	12500	0107111	W-1726	30-06-34
97	Coleman, Ivan	8914RF	0107112	W-1726	30-05-58
519	Watkins, Carol (Trust)	10518	0107119	W-8158-76	31-05-40
519	Watkins, Carol (Trust)	12913	0107120	W-8158-76	31-05-39
519	Watkins, Carol (Trust)	32	0107121	W-8158-76	30-06-46
519	Watkins, Carol (Trust)	RF798	0107122	W-8158-76	31-07-55

#	Name	Permit	WDID	Case	Approp. Date
519	Watkins, Carol (Trust)	10519	0107123	W-8158-76	31-08-55
519	Watkins, Carol (Trust)	4064F	0107124	W-8158-76	25-04-63
519	Watkins, Carol (Trust)	6361F	0107125	W-8158-76	04-11-64
519	Watkins, Carol (Trust)	9269F	0107127	W-8158-76	08-05-65
519	Watkins, Carol (Trust)	9271F	0107129	W-8158-76	10-08-65
519	Watkins, Carol (Trust)	6601F	0107130	W-8158-76	30-12-64
519	Watkins, Carol (Trust)	12912	0107133	W-8158-76	12-04-37
519	Watkins, Carol (Trust)	12914	0107134	W-8158-76	20-07-51
374	Booth Bros. Land & Livestock	9400F	0107162	W-657	01-05-38
374	Booth Bros. Land & Livestock	9401F	0107164	W-657	27-06-54
325	Platte Valley School District	15049-RR	0107203	W-1489	24-07-53
270	Lang, Kenneth	12191	0107378	W-2312	07-06-54
622	Vern Johnson Farms, LLC/Duarte	P-04574F	0107521	W-371	23-08-63
181	Greenwalt, David L.	11521	0107524	W-363	01-05-45
182	Greenwalt, David L.	11521	0107524	W-363	01-05-45
640	Greenwalt, David L.	11521	0107524	W-363	20-11-71
746	HHR Family Farms, LLC	6331	0107576	W-1950	26-08-52
614	EMR Family Farms, L.P.	RF89	0107577	W-1950	05-05-37
615	Emanuel W. Rothe Family Farms	13035	0107578	W-1950	04-02-45
612	Empire Dairy LLC	1397	0107579	W-3687	30-06-46
121	Dinnel Family Limited Liability	5847	0107611	W-354	30-06-34
121	Dinnel Family Limited Liability	5848	0107612	W-354	31-07-55
688	Anacapa Land Company, LLC	10599F	0107617	W-2705	17-05-49
688	Anacapa Land Company, LLC	12317F	0107618	W-2705	25-06-53
745	James E. Smith Trust	1693	0107622	W-1678	30-04-44
608	Boos, Donald C.	14539	0107626	W-2200	15-06-34
612	Empire Dairy LLC	1396	0107627	W-3687	31-07-38
216	Hergenreder, Carl L.	10104	0107765	W-564	24-04-54
584	Dinis, Jack	036535-F	0107837	89-CW-042	15-12-89
362	Park, James	RF418	0107896	W-468	31-12-41
362	Park, James	12316	0107897	W-468	30-09-34
365	Peggram, B. J.		0107930	W-1457-79	17-04-74
366	Peggram, B.J.		0107930	W-1457-79	17-04-74
365	Peggram, B. J.		0107931	W-1457-79	17-04-74
366	Peggram, B.J.		0107931	W-1457-79	17-04-74
653	Centennial Valley Ranch, LLC,	13949	0107942	W-3933	26-05-46
323	Monfort Feedlot	6531	0107943	W-3933	30-05-49
630	Butler, Michael A.		0108071	84-CW-205	14-02-56
758	Rein, Shirley May	13958	0108072	W-4532	31-12-38
619	Curd, Beverly/Axton	11695-RR	0108073	W-4533	15-04-48
629	Sandau, Bruce D.	R129	0108073	W-4787	25-06-20
389	Bender, David A.	11241	0108113	W-3260	11-05-52
394	Roskop, Peter	1133	0108136	W-2746	30-06-55
396	Rothe, Roy	13071	0108160	W-2609	30-12-40
396	Rothe, Roy	13073	0108163	W-2609	31-05-54
395	Rothe, Roy	11057	0108164	W-2609	31-05-54

#	Name	Permit	WDID	Case	Approp. Date
398	Rothe, Roy W.	10836	0108166	W-3559	20-06-53
322	Monfort Feedlot	8571	0108168	W-3705	26-06-54
226	Hoshiko, Dennis	RF806	0108169	W-1218	15-06-54
574	Danks, William C.	13960	0108172	W-3705	01-07-36
400	Aigaki T.	5911	0108178	W-371	25-06-01
400	Aigaki T.	4533	0108179	W-371	16-06-46
32	Beauprez, Ralph	2498F	0108204	W-4253	11-04-60
158	Ford, Jeffrey	C-14466	0108207	W-3223	30-06-42
158	Ford, Jeffrey	D-13929	0108208	W-3223	20-07-50
674	SLW Ranch Company	10480	0108216	W-3595	31-12-35
675	Winpeglar, Lorraine	10480	0108216	80-CW-341	31-12-35
487	Ochsner Kevin Kenneth		0108219	W-3595	31-07-50
185	Lockman, Steven J.	13072	0108245	W-182	30-06-50
397	Rothe, Roy	15931	0108253	W-2181	30-06-48
397	Rothe, Roy	04137F	0108254	W-2181	21-05-63
395	Rothe, Roy	16392	0108255	W-2181	31-07-54
652	Centennial Valley Ranch LLC,	15930	0108259	W-2181	30-06-36
652	Centennial Valley Ranch LLC,	RF763	0108260	W-2181	29-08-55
429	Hoshiko Farms	8672	0108279	W-1571	09-06-54
280	Lehfeldt, Richard	9386F	0108296	W-5030	31-10-44
280	Lehfeldt, Richard	11999	0108297	W-5030	28-07-55
452	Siebring, Neeland B. (Trust)	11526	0108352	W-2017	31-12-61
451	Siebring, Neeland (Trust)	12019	0108353	W-1632	01-05-54
455	Smith, LeRoy	10591	0108405	W-4706	26-06-47
364	Peggram, B. J.	RF991	0108407	W-3296	31-12-50
693	Foiles, Larry B.	6203F	0108465	W-3618	30-09-64
693	Foiles, Larry B.	1429	0108466	W-3618	27-05-44
693	Foiles, Larry B.	1428	0108467	W-3618	28-07-55
147	Foos, Steven P.	15879	0108665	W-1450	13-07-54
453	Siebring, Norma	12021	0108733	W-2019	01-06-51
499	Van Wyke, Norma J.	D4303F	0108734	W-2018	01-07-63
86	Millage Brothers, Inc.	1512	0108775	W-5185	30-04-55
514	Walker, Robert W.	1369	0108779	W-1477	30-03-54
514	Walker, Robert W.	6864F	0108784	W-1477	20-06-65
513	Walker, Robert W.	1368	0108786	W-1477	20-06-36
32	Beauprez, Ralph	24685F	0108788	W-4263	11-04-60
457	Gurtler, Russell	P6288F	0108794	W-363	31-10-64
457	Gurtler, Russell	13829	0108796	W-363	31-12-44
522	Weimer, Elizabeth	7291	0108846	W-2224	01-01-37
522	Weimer, Elizabeth	7292	0108851	W-2224	27-06-50
538	Dinis, Jack	044924-F	0109026	94-CW-117	26-05-64
16	A5 Farms, LLC,	13502	0205005	W-2727	31-07-34
44	Beskas Trust	6371	0205007	W-6261-79	13-06-41
44	Beskas Trust	6372	0205008	W-6261-79	30-06-54
119	Robbins, James E.	6400F	0205017	W-2784	10-11-64
677	L.G. Everist, Inc.	11082-F	0205018	W-2784-77	07-08-66

#	Name	Permit	WDID	Case	Approp. Date
119	Robbins, James E.	13320F	0205019	W-2784	31-12-32
637	Luevano, Maria D.	16218	0205022	W-709	04-02-53
222	Holton, Tom	13697	0205023	W-959	20-12-31
463	Fritzler, Edward	15862	0205032	W-1925	30-05-35
463	Fritzler, Edward	624	0205033	W-1925	30-06-54
696	Magnum Land Ventures, LLC d/b/a Cherry	20454F	0205034	W-4552	12-06-54
203	Anderson, Anne E.	1920	0205035	W-478	31-12-34
204	Hattendorf, Robert	1905	0205036	W-479	31-05-55
763	Herbster Family Trust	11990	0205040	W-1448	07-03-43
739	Klein, James D.	R5964RF	0205044	W-2718-79	31-10-01
465	Strear Farms Company		0205053	W-175	01-05-18
465	Strear Farms Company		0205054	W-175	01-05-18
465	Strear Farms Company		0205055	W-175	18-05-01
465	Strear Farms Company		0205056	W-175	18-05-01
465	Strear Farms Company		0205057	W-175	18-05-01
506	Greiman, Grant	R-318	0205060	W-1873	29-04-65
339	Nichols, Everett	11584	0205062	W-1712	01-06-64
345	Ocker, William	13914	0205063	W-2235	31-12-46
420	Sasaki, Joe	18769A	0205071	W-666	11-09-52
700	Sharp, William Jr. (Trust)	20318	0205073	W-909	15-08-54
459	Kawata, Wayne/Western Equip	786	0205077	W-6449	25-05-55
509	Kremer, Marvin D.	13183	0205083	W-3640-78	31-05-55
509	Kremer, Marvin D.	17884	0205085	W-3640-78	30-11-47
516	Villano, Robert P.	19490-1	0205086	W-572	04-12-65
682	Blue Ribbon Nursery, Inc.	6639	0205155	W-4910	31-08-46
579	Abbett, Clyde L.	R07231	0205168	W-317	01-06-42
579	Abbett, Clyde L.	R10364	0205169	W-317	01-07-55
706	Adams, Gerald A., James L., & Gray, Shirley	19944	0205187	W-690	25-12-31
558	Hop, Andrew J.	2932-F	0205188	W-300	01-07-36
207	Kirby, Kirk S.	15119	0205189	W-2434	15-12-31
706	Adams, Gerald A., James L., & Gray, Shirley	20583	0205190	W-690	28-06-04
706	Adams, Gerald A., James L., & Gray, Shirley	12800	0205191	W-690	31-12-42
373	Pralle, Dale	15503F	0205198	W-8597-77	30-12-31
8	Alexander, Roger	11117	0205207	W-399	31-08-54
8	Alexander, Roger	11118	0205208	W-399	30-04-57
225	Hoshiko Farms	11651	0205226	W-879	31-12-33
606	Weld County School Dist. RE-1	14969	0205229	W-2245	30-06-44
607	Amend Partners, A General	11111	0205230	W-1907	12-04-46
15	Anderson, Ron	12259F	0205241	W-5231	03-12-69
114	Dechant, Alvin	8319	0205242	W-389	05-12-57
114	Dechant, Alvin	5187F	0205246	W-389	24-04-64
114	Dechant, Alvin	8318	0205247	W-389	24-04-47
701	Willard, Kevin D., Willard, Heather M.	10655RF	0205250	W-2163	31-12-35
16	A5 Farms, LLC,	13503	0205251	W-2727	31-03-51
676	Willard, Kevin D.	2R10656	0205253	W-2163	19-02-55
701	Willard, Kevin D., Willard, Heather M.	WELL NO. 3	0205254	W-2163	11-01-55

#	Name	Permit	WDID	Case	Approp. Date
16	A5 Farms, LLC,	13504	0205255	W-2727	30-04-55
705	English Farms, Inc.	14823	0205261	W-4585	12-09-55
705	English Farms, Inc.	28896-F	0205271	W-4585	31-12-37
705	English Farms, Inc.	14826	0205272	W-4585	31-12-38
705	English Farms, Inc.	5944F	0205273	W-4585	28-07-64
705	English Farms, Inc.	5998F	0205274	W-4585	28-07-64
705	English Farms, Inc.	2337F	0205275	W-4585	25-09-59
705	English Farms, Inc.	14824	0205276	W-4585	14-05-51
22	Arens, Fred/Arens Trust	12041	0205287	W-3301	30-04-54
24	Arens, Grant	12042	0205288	W-3300	21-06-51
24	Arens, Grant	12043	0205290	W-3300	21-06-43
24	Arens, Grant	12045	0205291	W-3302	31-03-55
208	Hemple, Edward	6179	0205302	W-675	31-03-51
208	Hemple, Edward	6288	0205303	W-675	31-08-39
671	C.P. Cooper Family Trust, d/b/a Consolidated	12093F	0205306	W-5029	27-03-68
29	McBride, Will	13203	0205313	94-CW-080	01-01-46
30	Bangert, W. Jean	12596	0205317	W-366	03-03-56
99	Tucson Water Company	420	0205318	W-5205	01-08-46
99	Tucson Water Company	421	0205319	W-5205	01-08-51
380	Reinoehl, Dale/Ready Mixed	10500	0205329	W-1990	01-04-54
399	Cranmer, Scott	3427F	0205338	W-1821	17-04-47
413	Sandau, Robert	AD2551	0205339	W-1336	12-09-56
413	Sandau, Robert	AD2550	0205340	W-1336	30-11-53
413	Sandau, Robert	AD2549	0205341	W-1336	19-07-52
35	Bell, James	13517	0205347	W-4453	15-04-34
35	Bell, James	3614P	0205348	W-4453	28-05-62
556	Weigandt, Steven G.	7164	0205354	W-3050	01-05-47
556	Weigandt, Steven G.	7165	0205355	W-3050	01-05-40
660	The Conservation Fund/Colorado State Parks	109143	0205359	W-5353	30-06-55
38	Bergstrom, Ray	10432	0205374	W-2607	30-04-33
38	Bergstrom, Ray	10433	0205375	W-2607	30-04-55
40	Berig, William	11095F	0205376	W-700	13-06-66
42	Bernhardt, Edward	7117	0205379	W-3177	30-06-32
42	Bernhardt, Edward	7118	0205384	W-3177	30-09-50
43	Bernhardt, Lydia/Schneider	13940	0205386	W-486	30-04-56
43	Bernhardt, Lydia/Schneider	23881F	0205394	82-CW-345	21-06-33
44	Beskas Trust	6373	0205401	W-6261-79	16-06-30
45	Betz, Fred	6904	0205404	W-351	20-03-65
33	Beddo, Dearal	12595	0205418	W-3330	31-08-35
33	Beddo, Dearal	04109F	0205419	W-3330	10-05-63
49	Bockius, Walter	12609	0205423	W-1843	31-12-38
49	Bockius, Walter	12610	0205424	W-1843	31-03-55
52	Frazier, Janet	11495	0205427	W-2730	06-01-55
628	Ferrell, Timothy R.	15038	0205427	W-1190	01-04-34
759	Anderson, Norman N.	1955	0205428	W-6453	10-05-53
51	Anderson Farms, L.L.C.	4494	0205429	W-536	05-07-44

#	Name	Permit	WDID	Case	Approp. Date
559	Andersen, Robert L.	8597-R	0205432	W-310	31-07-54
557	Longmont Foods Company, Inc.	4565	0205433	W-310	23-10-45
563	Longmont Foods	4565	0205433	90-CW-50	23-10-45
54	Hoff, Bradley G./Bernard, Kevin	12066	0205437	W-3338	28-04-01
721	Bollers, Kenneth Dean	R10159	0205439	W-2548	30-04-52
721	Bollers, Kenneth Dean	R10160	0205440	W-2548	30-08-55
607	Amend Partners, A General	11112	0205457	W-1907	07-05-54
703	Boos, Donald C.	14540	0205459	W-2200	31-07-40
239	Ptasnik, Michael	14541	0205460	W-2200	31-03-36
239	Ptasnik, Michael	14542	0205461	W-2200	31-03-51
471	Dreiling, Michael	13599	0205511	W-2926	31-05-32
471	Dreiling, Michael	03227-F	0205512	W-2926	01-07-61
297	Aigaki, Dale	4864F	0205513	W-2926	26-11-63
1	ALE Partnership	6124	0205523	W-4526	01-10-39
64	Brantner, Louis	1523	0205526	W-234	31-05-55
64	Brantner, Louis	1522	0205527	W-234	31-03-34
733	Eppinger, Linda Kay	3-19924	0205531	W-359	09-12-31
733	Eppinger, Linda Kay	4-19924	0205532	W-359	31-12-51
733	Eppinger, Linda Kay	5-19924	0205533	W-359	31-12-39
733	Eppinger, Linda Kay	6-19924	0205534	W-359	04-09-54
65	Brethauer, Jerrold	8673	0205536	W-598	31-08-50
65	Brethauer, Jerrold	8674	0205537	W-598	30-09-56
619	Curd, Beverly/Axton	RF1018	0205538	W-4533	20-04-46
626	Murray, Roy W. Jr.	13039-R	0205538	W-598	31-05-54
620	Smith, Richard A.	11699-RF	0205539	W-4533	15-04-48
197	Harkis, Richard	4901	0205541	W-2057	30-04-64
66	Briggs, John G.	RF342	0205543	W-387	29-04-10
66	Briggs, John G.	7026	0205544	W-387	04-05-53
69	Brown, Bill/Trust	169	0205577	W-1602	31-07-55
70	Brown, Jean	883	0205578	W-1666	23-07-40
70	Brown, Jean	884	0205579	W-1666	10-07-53
25	Ells, Benjamin	12838	0205581	W-2049	05-02-54
695	The Thomas and Marjorie Brown Family Trust	12971	0205582	W-196	30-04-34
737	Weinmeister, David L.	12973	0205584	W-196	18-05-56
71	Brown, Jean	11150F	0205585	W-1665	15-03-44
11	Southgate, Inc.	2526F	0205598	W-471	01-06-60
717	Cottonwood Lanes Homeowners Association	A	0205601	83-CW-120	31-03-54
717	Cottonwood Lanes Homeowners Association	B	0205602	83-CW-120	31-03-54
717	Cottonwood Lanes Homeowners Association	C	0205603	83-CW-130	31-03-54
717	Cottonwood Lanes Homeowners Association	D	0205604	83-CW-120	31-03-54
717	Cottonwood Lanes Homeowners Association	E	0205605	83-CW-120	31-03-54
717	Cottonwood Lanes Homeowners Association	F	0205606	83-CW-120	31-03-54
717	Cottonwood Lanes Homeowners Association	G	0205607	83-CW-120	31-03-54
717	Cottonwood Lanes Homeowners Association	H	0205608	83-CW-120	31-03-54
717	Cottonwood Lanes Homeowners Association	I	0205609	83-CW-120	31-03-54
84	Campbell, Dean W.	8717	0205629	W-1239	31-08-52

#	Name	Permit	WDID	Case	Approp. Date
657	Wes Moser & Sons	3421F	0205645	W4963	17-03-64
657	Wes Moser & Sons	3525F	0205648	W4963	19-09-62
89	Carlson, Clarence	4404	0205654	W-874	31-07-48
89	Carlson, Clarence	4405	0205657	W-874	31-07-54
90	Carlson, Janet	13157	0205659	W-4372	14-06-51
89	Carlson, Clarence	4403	0205660	W-874	25-09-30
89	Carlson, Clarence	04262F	0205661	W-874	30-06-63
24	Arens, Grant	31779	0205696	91-CW-086	31-03-55
92	Chesnut, Byron	12045	0205696	W-3302	31-03-55
319	Chikuma, Josephine	13205	0205697	W-3634	31-07-54
298	Axelson, Howard N.	1361	0205730	W-5773	01-10-54
604	Mathisen, George W.	5851	0205753	W-7945-75	18-03-58
259	Kingman-Parker Farm	11871	0205780	W-965	17-06-54
346	Oden, Weldon	4694F	0205836	W-2823	16-10-63
486	Gulliksen, Vern J.	013391F	0205840	W-4098	23-03-41
732	Anders Partnership	2-13822	0205842	W-3767	13-06-30
106	Rittenhouse, Donald L.	013699F	0205844	W-4940	30-06-20
107	Davis, John	5890	0205857	W-847	29-06-22
107	Davis, John	5889	0205865	W-847	25-06-22
109	DeCrescentis, Louis	1628	0205877	W-844	22-09-38
430	Desperado Dairy	8640	0205878	W-4271	20-04-50
118	Deines, Glen	15285	0205879	W-846	09-05-49
700	Sharp, William Jr. (Trust)	RF212	0205888	W-910	07-12-31
305	Mayer, Glen	15358	0205903	W-769	31-07-50
305	Mayer, Glen	15357	0205904	W-769	30-04-48
14	Stauffer, Charles/Rodarte	587	0205911	W-1014	30-04-32
26	Marvin J. Dinner Family Trust	1587	0205921	W-6405	30-04-40
26	Marvin J. Dinner Family Trust	1588	0205925	W-6405	30-04-55
123	Dinner, Albert et. al.	11832	0205926	W-3686	31-12-45
123	Dinner, Albert et. al.	11833	0205927	W-3686	31-01-50
122	Dinner, Albert et. al.	11834	0205929	W-3686	30-04-50
122	Dinner, Albert et. al.	11830	0205930	W-3686	20-04-30
124	Dittmer, Walter	RF97	0205933	W-1316	31-07-32
125	Doll, Ronald J.	1200	0205951	W-316	31-07-54
98	Cook, Dennis	1R70	0205956	83-CW-39	31-05-32
186	Guest, Raymond	12172	0205957	W-673	30-06-51
186	Guest, Raymond	12173	0205959	W-673	30-04-55
200	Harkis, Richard	1305	0205960	W-672	14-11-56
200	Harkis, Richard	10671F	0205961	W-672	30-04-66
127	Dreiling, Michael	10743	0205963	W-592	31-12-55
498	Delamont, Rick A.	016643F	0205986	W-7669-74	21-04-65
129	Dunn, Rose/Cecil Farms	12735	0205991	W-487	31-08-35
130	Dupper, Calvin	6334F	0205996	W-6454	30-06-50
670	Eckhardt, Frank Jr., David F., & Steven A.	12736	0206023	W-5931	31-07-01
670	Eckhardt, Frank Jr., David F., & Steven A.	12737	0206025	W-5931	01-07-44
618	Shoemaker, Larry D., Candace M., Wade E.,	11699-RF	0206026	W-4533	15-04-48

#	Name	Permit	WDID	Case	Approp. Date
623	Fritzler, Edward J.	12740	0206026	W-5930	01-06-35
132	Elledge, Joseph et. al.	013670F	0206040	W-3016	21-09-46
133	Ells, Ben	11158	0206047	W-1399	30-04-47
290	Loeffler, Elmer	13857	0206049	W-3217	31-07-38
290	Loeffler, Elmer	13858	0206050	W-3217	30-09-46
290	Loeffler, Elmer	4538F	0206051	W-3217	05-08-63
646	Schmidt, Kevin W.	13859	0206052	W-3217	31-08-39
646	Schmidt, Kevin W.	13860	0206053	W-3217	14-07-55
76	Buckley Acres Homeowners Association	NO. O	0206065	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. E	0206066	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. F	0206067	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. G	0206068	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. H	0206069	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. I	0206070	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. J	0206071	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. K	0206072	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. L	0206073	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. M	0206074	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. N	0206075	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. P	0206076	W-8255-76	23-03-05
76	Buckley Acres Homeowners Association	NO. Q	0206077	W-8255-76	23-03-05
139	Evanoff, Iris/Evanoff, Joe	R12672RF	0206094	W-1688	03-05-26
757	Peterson, Andrew S.	EWING #1	0206100	W-6141	06-05-40
142	Ewing, Lloyd	1-19923	0206104	W-557	29-12-31
93	Clement, Margaret	8946	0206105	W-6281	25-06-58
142	Ewing, Lloyd	2-19923	0206108	W-557	09-12-31
93	Clement, Margaret	19926	0206109	W-6281	28-10-31
526	Younger, Howard	455	0206111	86-CW-237	10-08-48
23	Arens, Fred/Arens Trust/Shelton Land and Cattle	12044	0206113	W-3303	28-02-57
548	Wolf, Richard	R-13417	0206115	92-CW-029	27-06-30
145	Wilhelm Andrew J., Brian A.	013669F	0206116	W-5305	31-12-40
548	Wolf, Richard	R-13416	0206124	92-CW-029	31-03-46
548	Wolf, Richard	R-13420	0206125	92-CW-029	30-12-31
548	Wolf, Richard	R-13418	0206126	92-CW-029	07-06-47
548	Wolf, Richard	R-13419	0206127	92-CW-029	02-04-48
548	Wolf, Richard	R-13421	0206128	92-CW-029	22-11-52
644	Johnie Vaughn	13752	0206131	W-5198	23-03-15
644	Johnie Vaughn		0206132	W-5198	23-03-15
222	Holton, Tom	13698	0206177	W-959	25-12-31
27	B & M Land Company	RF620	0206180	W-4668	25-03-64
27	B & M Land Company	RF619	0206181	W-4668	30-06-52
734	Winden, Thomas E./Basset Properties/Ricks Farms	5817	0206182	W-4668	31-03-52
656	Nursery Acres Limited Partnership	8357	0206187	W-2950	25-05-45
656	Nursery Acres Limited Partnership	8359	0206188	W-2950	25-12-31
656	Nursery Acres Limited Partnership	2629F	0206189	W2950	25-06-60
161	Fort Lupton Greens	11828	0206214	W-862	30-06-50

#	Name	Permit	WDID	Case	Approp. Date
161	Fort Lupton Greens	11829	0206215	W-862	25-05-55
463	Fritzler, Edward	619	0206219	W-1925	30-06-60
463	Fritzler, Edward	623	0206220	W-1925	30-06-54
463	Fritzler, Edward	620	0206221	W-1925	10-07-64
166	Front Range Land & Livestock, LLC	10476	0206222	W-7481	17-07-51
166	Front Range Land & Livestock, LLC	10475	0206223	W-7481	13-06-46
642	Off, Don and Jeanne Partnership	12993	0206228	W-5311	31-12-54
642	Off, Don and Jeanne Partnership	12992	0206229	W-5311	05-12-31
169	Funakoshi, Sam	6229	0206345	W-752	30-04-55
111	DeSanti, Kathleen	12426	0206347	W-5880	04-08-47
170	Gabel, Philip	13473	0206353	W-625	31-12-54
170	Gabel, Philip	13474	0206355	W-625	31-12-55
683	Sparboe Horizon Corporation	7289	0206369	85-CW-50	19-03-46
217	Hergert, Richard	10711	0206372	W-1286	31-05-57
217	Hergert, Richard	10712	0206373	W-1286	31-07-38
102	Bogner, Susan G.	5746F	0206374	W-5487	01-07-64
716	Gee, William E.		0206375	W-5487	01-04-54
173	Nursery Acres Limited Partnership	4360F	0206390	W-2220	31-12-34
601	Springer, Gerald W.	4361-F	0206391	W-2220	31-03-55
174	Gilmore, Susanna K.	13458	0206401	W-1721	30-06-38
237	James Nursery	13459	0206402	W-1721	30-04-54
550	James Nursery	16239	0206403	W-1721	10-08-38
549	Kuettel, Theodore	6903	0206404	W-1721	31-03-65
175	Gittlein, Frank	2628F	0206411	W-3723	23-06-60
175	Gittlein, Frank	471	0206412	W-3723	29-07-59
175	Gittlein, Frank	472	0206413	W-3723	23-06-66
175	Gittlein, Frank	3500F	0206414	W-3723	27-03-62
569	Goodner, Emma U.	10651	0206418	W-258	01-01-38
569	Goodner, Emma U.	652	0206419	W-258	01-01-38
176	Green Valley Turf	13710	0206423	W-1902	30-04-33
176	Green Valley Turf	13711	0206424	W-1902	31-05-55
176	Green Valley Turf	13712	0206425	W-1902	31-05-45
176	Green Valley Turf	13713	0206426	W-1902	30-06-56
176	Green Valley Turf	13714	0206427	W-1902	30-04-53
176	Green Valley Turf	13515	0206428	W-1902	31-05-44
176	Green Valley Turf	13516	0206429	W-1902	31-05-46
176	Green Valley Turf	13517	0206430	W-1902	30-04-50
602	Serbousek, Christopher J.	20455F	0206433	W-4552	14-06-54
696	Magnum Land Ventures, LLC d/b/a Cherry	20456F	0206436	W-4552	10-05-44
179	Green, Kenneth/Chavez, Blas	9004F	0206440	W-274	25-04-65
180	Greenleaf Wholesale Florist	RF542	0206444	W-488	18-03-68
187	Gunzner Investment Company	15457	0206453	W-2490	30-05-32
187	Gunzner Investment Company	15458RF	0206454	W-2490	30-04-56
187	Gunzner Investment Company	15458	0206454	W-2490	30-05-52
478	Tappan, Dr. Major W.	17884	0206471	W-2816	17-11-47
567	Hoecher, Charles	04093-F	0206473	W-2022	31-05-63

#	Name	Permit	WDID	Case	Approp. Date
152	Kerbel, Laura Lee	16144	0206474	W-2022	01-04-31
12	Amen, Joe	RF1031	0206475	W-1813	31-03-38
12	Amen, Joe	11876F	0206476	W-1813	31-03-44
12	Amen, Joe	11877F	0206477	W-1813	24-04-57
12	Amen, Joe	5896F	0206478	W-1813	23-07-64
679	Western Equipment & Truck, Inc.	#2	0206480	W-6217	30-09-50
679	Western Equipment & Truck, Inc.	#3	0206481	W-6217	31-05-54
668	Bischoff, Blake C.	10045	0206482	W-6217	31-12-37
668	Bischoff, Blake C.	10044	0206483	W-6217	31-12-37
679	Western Equipment & Truck, Inc.	6794	0206485	W-6217	02-03-65
189	Haller, Andrew	RF487	0206487	W-3494	09-06-68
190	Beman, Scott	12791	0206491	W-6061	25-08-10
372	Platteville, Town of	13125	0206501	W-1848	27-09-20
198	Harkis, Richard	6611F	0206505	91-CW-120	23-12-64
198	Harkis, Richard	2044F	0206506	91-CW-120	11-06-54
195	Harkis, Richard	2380	0206507	91-CW-120	11-12-59
198	Harkis, Richard	6391	0206508	91-CW-120	21-11-58
287	Little Valley Wholesale	20960	0206510	W-3974	31-08-45
202	Hattendorf, Robert H.	1901	0206517	W-479	26-12-31
205	Hause, Laurance/Hunt Brothers	20138F	0206522	W-138	31-05-33
572	Kline, Brady A.	13032-R	0206523	W-4307	01-05-46
209	Henad Company/120th Estate	10898	0206544	W-2924	28-11-38
209	Henad Company/120th Estate	10899	0206545	W-2924	01-06-40
292	Lucky Four Ranch/Lochbuie Land	335	0206549	W-362	04-05-41
213	Bacon, Lyman C/Bunting	12726	0206553	W-1448	29-07-29
583	Ptasnik, Michael J.	10747	0206573	W-1818	01-09-53
583	Ptasnik, Michael J.	10746	0206574	W-1818	01-06-42
595	Taylor, Anna Maria	10902	0206585	W-2030	31-03-47
595	Taylor, Anna Maria	10903	0206586	W-2030	31-03-47
222	Holton, Tom	2216F	0206598	W-959	31-12-59
222	Holton, Tom	13699	0206599	W-959	25-12-31
222	Holton, Tom	13700	0206600	W-959	20-12-31
222	Holton, Tom	20098	0206601	W-1325	31-12-50
222	Holton, Tom	5923F	0206602	W-1325	24-07-64
223	Hood, Bessie B.	10949	0206608	W-3720	31-08-54
641	Beaman, Charles J.	1-7016R	0206614	W-2617	30-04-47
227	Howard, Cecil	11611	0206622	W-2236	31-12-39
232	Ianelli, Joseph	23226F	0206635	W-4909	20-09-43
230	Walker, Harold et.al.	13159F	0206636	W-490	01-06-54
692	James L. Oster Revocable Living Trust	6824	0206637	W-490	31-12-50
231	Huwa, Jake	15261	0206643	W-2048	31-12-39
501	Vargo, Isabell	11855	0206648	W-613	15-12-31
236	Smith, Jerry L.	15017	0206669	W-4817	15-03-54
229	Hungenberg Farms	1138	0206688	W-385	15-05-53
672	Reisbeck Subdivision, LLC	20547-1	0206692	W-4330	15-03-50
672	Reisbeck Subdivision, LLC	20547-2	0206693	W-4330	04-04-53

#	Name	Permit	WDID	Case	Approp. Date
427	Schaumberg, Patricia	10990	0206696	W-4801	21-09-35
243	Sandau, Bruce	208	0206704	W-4714	10-05-55
627	South Adams County Water & Sanitation Dist.	11785	0206705	W-1899	30-07-33
243	Sandau, Bruce	207	0206713	W-4714	20-06-40
218	Huwa, Kevin et. al.	12248F	0206715	W-4787	20-06-34
17	Anjo Construction Company, Inc	211	0206718	W-4787	20-06-37
665	Clarkson, David G.	8942F	0206721	W-4787	19-06-58
268	Sakata Farms Inc.	12389	0206740	W-4800	30-05-56
268	Sakata Farms Inc.	12388	0206741	W-4800	30-05-54
268	Sakata Farms Inc.	12387	0206742	W-4800	31-05-56
268	Sakata Farms Inc.	12386	0206743	W-4800	30-06-55
477	Taoka Brothers/Kornman	12529	0206744	W-4800	30-04-49
477	Taoka Brothers/Kornman	12530	0206745	W-4800	31-05-54
248	Dechant Farms Partnership,	6379	0206750	W-5322	27-06-55
248	Dechant Farms Partnership,	15982	0206751	W-5322	30-06-55
253	Kammerzell, Vern	11407	0206753	W-571	23-02-27
249	Kammerzell, Albert	249	0206754	W-357	15-11-41
249	Kammerzell, Albert	250	0206755	W-357	20-05-54
694	RML Property Investors LLC, a Colorado	10777	0206756	W-382	31-12-34
21	Arborland Farm	8302	0206757	W-158	20-05-31
694	RML Property Investors LLC, a Colorado	10778	0206758	W-382	31-12-40
82	Camenisch, Phillip	8303	0206759	W-158	31-07-50
82	Camenisch, Phillip	8304	0206760	W-158	30-06-52
401	Rusch, Rosalie	RF795	0206761	W-571	31-05-54
401	Rusch, Rosalie	14134	0206762	W-571	30-05-40
255	Kawata, Byron H.	14716	0206775	W-765	30-06-56
255	Kawata, Byron H.	14717	0206776	W-765	31-03-50
255	Kawata, Byron H.	14718	0206777	W-765	30-06-44
703	Boos, Donald C.	22306R	0206778	W-8330-76	22-12-31
256	Nelson, Thyra	630	0206779	W-2388	30-05-42
256	Nelson, Thyra	631	0206781	W-2388	30-05-54
256	Nelson, Thyra	632	0206782	W-2388	30-05-53
256	Nelson, Thyra	6132	0206783	W-2388	31-12-42
256	Nelson, Thyra	CWCB644	0206784	W-2388	12-05-55
50	Spayd Hay Company	12683	0206791	W-190	30-06-35
257	Kern, Robert N.	04218F	0206793	W-1956	01-06-63
258	Kern, William F/Hunt	12053	0206794	W-1955	30-05-34
258	Kern, William F/Hunt	12054	0206795	W-1955	31-07-54
258	Kern, William F/Hunt	12055	0206796	W-1955	31-07-55
308	Newton/Bishop Bromley Park	20095	0206802	W-3426	30-04-53
308	Newton/Bishop Bromley Park	1068	0206803	W-3426	30-09-55
308	Newton/Bishop Bromley Park	23958F	0206804	80-CW-113	30-04-53
262	Kissler, Mildred R.	11687	0206813	W-657	24-12-31
262	Kissler, Mildred R.	11688	0206814	W-657	31-12-52
261	Kissler, James	13959	0206815	W-657	31-12-31
263	Kiyota, John	752	0206817	W-519	31-05-50

#	Name	Permit	WDID	Case	Approp. Date
263	Kiyota, John	753	0206820	W-519	31-10-56
414	Sandin, Milton	4482	0206832	W-3036	29-04-54
68	Broberg, Gale L.	13626	0206833	W-253	30-12-31
46	Doperalski, Matthew J.	8736	0206847	W-577	31-07-32
46	Doperalski, Matthew J.	8737	0206851	W-577	31-07-54
749	Highland Properties/Hein	1050	0206864	W-2213	30-06-55
246	Lookhart, Dick	4281	0206874	83-CW-152	10-07-63
633	PRR Groundwater, LLC	14018	0206886	W-5791	31-07-39
633	PRR Groundwater, LLC	14019	0206887	W-5791	30-04-33
633	PRR Groundwater, LLC	14021	0206889	W-5791	31-05-37
599	Ready Mixed Concrete Company	15424	0206891	W-5791	31-07-46
632	City of Brighton	14023	0206893	W-5791	31-12-60
581	Morton, Margaret V.	1-12790R	0206920	W-550	18-08-54
736	Nursery Acres Limited Partnership	8905F	0206929	W-992	28-05-58
736	Nursery Acres Limited Partnership	8358	0206930	W-992	30-04-50
273	Leadbetter, Lynn/Linda	6037F	0206958	W-3224	15-09-64
735	Leaming, Olga R.	R13565	0206962	W-401	14-12-31
279	Di Lorenzo, Janet M.	183	0206964	W-6079	30-11-72
667	D. Schlup LTD.	047468F	0206967	APD TO 3783F	
281	Lehl, Marguerite	132	0206968	W-679	07-07-36
266	Johnson, Stephen R.	20492	0206969	W-2582	5/12/1936
282	Shelton, Ray	13487-RF	0206970	W-1054	30-06-38
697	Kplatteville, LLC	RF197	0206976	W-1829	15-06-41
13	An-Land Partnership/Robinson NW LLC	1364	0206977	W-2694	31-07-53
580	Kremer, Marvin D. & Diane	RF480	0206980	W-6013	30-09-45
580	Kremer, Marvin D. & Diane	RF774	0206982	W-6013	31-08-32
580	Kremer, Marvin D. & Diane	RF481	0206984	W-6013	20-11-37
580	Kremer, Marvin D. & Diane	13181	0206988	W-6013	5/1/1955
580	Kremer, Marvin D. & Diane	16138	0206989	W-6013	10-08-55
507	Waddle, Randall Scott	1746	0206992	W-651	31-03-32
722	Aschenbrenner, William	2-1747	0206993	W-651	31-05-29
286	Lindgren, Ron	AD8635	0206997	79-CW-053	19-03-79
689	Wiedeman, Terry	952	0207013	W-6450	30-06-33
689	Wiedeman, Terry	953	0207014	W-6450	24-05-52
433	Hickman, Maxwell Kent	787	0207033	W-544	31-07-36
659	Lorenz, Virgil N.	13056	0207046	W-1826	31-08-25
659	Lorenz, Virgil N.	13058	0207047	W-1826	31-08-55
659	Lorenz, Virgil N.	13057	0207048	W-1826	31-07-40
659	Lorenz, Virgil N.	4838F	0207049	W-1826	12-05-64
616	Joule Inc, a Colorado Corporation	11039	0207066	W-2114	30-09-52
617	Scotch Pine Estates Homeowners Association	15095-R	0207066	W-1563	31-07-55
271	Cohill, Elizabeth	10894	0207067	W-4826	31-12-33
592	Finley, Tony et. al.	11620	0207072	92-CW-031	31-12-22
117	Dechant, David	7122	0207090	W-3499	30-06-39
296	Martin, Amelia	267	0207100	W-384	5/31/1957
296	Martin, Amelia	268	0207103	W-384	30-06-37

#	Name	Permit	WDID	Case	Approp. Date
729	TeSodCo, Ltd.	1383	0207118	W-2854	31-10-51
729	TeSodCo, Ltd.	1384	0207119	W-2854	31-08-54
729	TeSodCo, Ltd.	13067	0207120	W-2854	30-04-60
729	TeSodCo, Ltd.	3499	0207121	W-2854	30-04-62
729	TeSodCo, Ltd.	1385	0207122	W-2854	31-08-55
729	TeSodCo, Ltd.	5730	0207123	W-2854	30-06-64
425	Schafer, Richard C.	14969	0207127	W-2245	30-06-44
718	Matsushima, Lillian Y.	11859	0207131	W-3409	20-07-50
302	Wetco Farms, Inc. a Colorado	11903	0207132	W-3410	31-12-34
719	Matsushima, Ronald L.	11344	0207133	W-3409	16-10-56
302	Wetco Farms, Inc. a Colorado	11904	0207134	W-3410	30-04-41
719	Matsushima, Ronald L.	11860	0207135	W-3409	12-08-54
302	Wetco Farms, Inc. a Colorado	11905	0207136	W-3410	30-04-41
302	Wetco Farms, Inc. a Colorado	11906	0207137	W-3410	31-03-42
302	Wetco Farms, Inc. a Colorado	11907	0207138	W-3410	31-05-55
144	Reifschneider, Darrel E.	13979	0207168	W-597	31-12-28
144	Reifschneider, Darrel E.	13980	0207169	W-597	31-08-46
307	Rossi, Raymond Lee	6843F	0207174	W-436	22-03-65
688	Anacapa Land Company, LLC	12318F	0207210	W-2705	25-06-53
685	Parker, John B.	11201	0207212	W-619	01-06-55
685	Parker, John B.	5289F	0207213	W-619	15-04-64
310	Meguire, William	R12069	0207214	W-1140	23-03-48
315	Melbon Ranch	923	0207215	W-524	01-08-46
593	Ewing, James L.	21749-F	0207223	W-694	20-08-30
167	Front Range Land & Livestock, LLC	0738R	0207227	W-2342	31-12-29
167	Front Range Land & Livestock, LLC	0739RR	0207229	W-2342	30-09-56
167	Front Range Land & Livestock, LLC	15094R	0207229	W-2342	03-07-57
347	McCormick, G. Todd	14131	0207243	W-1055	31-12-54
316	Miller, Jack	6066R	0207247	W-5196	31-10-39
317	Ogg, Paul Joe	12481R	0207254	W-5196	31-12-35
347	McCormick, G. Todd	14132	0207255	W-1055	31-12-53
318	Cushman, Danny W.	269	0207259	W-2714	30-06-41
662	Vetting, James E.	12705	0207271	79-CW-250	01-04-43
321	Monaghan Farms	11673F	0207302	W-6045	31-12-50
321	Monaghan Farms		0207303	W-6045	15-05-67
562	Ochsner, Daniel Lee		0207347	W-4513	03-03-52
562	Ochsner, Daniel Lee		0207349	W-4513	03-03-52
377	Reichardt, Carl		0207351	W-6768	30-08-55
506	Greiman, Grant	11226	0207362	W-1873	23-07-54
506	Greiman, Grant	11224	0207363	W-1873	01-08-43
326	Morimitsu, Henry	7374	0207366	W-957	31-08-34
326	Morimitsu, Henry	7375	0207367	W-957	14-04-55
327	Moser & Sons	CP10198	0207368	W-1814	05-11-65
328	Moser & Sons	14748	0207369	W-1814	31-03-35
328	Moser & Sons	3741F	0207371	W-1814	01-10-62
328	Moser & Sons	5177F	0207371	W-1814	11-03-64

#	Name	Permit	WDID	Case	Approp. Date
328	Moser & Sons	14749	0207373	W-1814	25-03-57
577	Moser, Vernon L.	11867	0207376	W-5184	25-09-50
576	Moser, Vernon L.	14509	0207377	W-3289	31-08-49
332	Mowery, Irma		0207387	W-4282	30-03-57
333	Warinner, Mark	13736	0207388	W-2144	21-12-22
343	Oakland Ranchettes, Inc.	8800R	0207391	79-CW-046	31-12-40
335	Murata, Steven T.	1365	0207394	W-1207	21-11-16
626	Murray, Roy W. Jr.	13040-R	0207395	W-598	31-05-54
724	Murray, Glen P., Murray, Louise M. and	8593	0207398	W-653	22-09-54
724	Murray, Glen P., Murray, Louise M. and	17844RF	0207399	W-653	22-09-34
724	Murray, Glen P., Murray, Louise M. and	178442A	0207401	W-653	22-09-35
724	Murray, Glen P., Murray, Louise M. and	178442B	0207402	W-653	22-09-38
724	Murray, Glen P., Murray, Louise M. and	17844-3	0207403	W-653	22-09-44
56	Ptasnik, Michael J.	11493	0207413	W-2126	30-08-38
56	Ptasnik, Michael J.	11494	0207414	W-2126	30-09-48
418	Sasaki, Joe	20317	0207417	W-1142	01-04-27
684	Nelson, Ralph Carl	RF354	0207445	W-332	18-10-37
684	Nelson, Ralph Carl	20025	0207446	W-332	06-07-54
527	Werning, Glenn	1282	0207448	W-4347	10-09-48
615	Emanuel W. Rothe Family Farms	R35	0207452	W-1950	21-04-44
359	Palombo, Sam		0207483	W-5228	02-05-55
201	Hatheway, James	CP10066	0207484	W-1742	21-06-65
712	Sakata Land Company	R11383	0207485	W-1741	31-12-51
360	Palombo, Silvia	13396	0207486	W-4945	20-02-32
361	Palombo, Silvia (Trust)	13397	0207487	W-4945	5/15/1935
361	Palombo, Silvia (Trust)	13398	0207488	W-4945	31-12-42
344	McWilliams, Steven	1147	0207517	W-827	31-12-53
345	Ocker, William		0207518	W-2235	31-12-48
344	McWilliams, Steven	1146	0207520	W-827	31-12-50
344	McWilliams, Steven	1145	0207522	W-827	31-12-17
348	Clyncke, Joyce	11649	0207525	W-547	30-06-55
348	Clyncke, Joyce	11650	0207527	W-547	31-05-34
497	Valdez, Jesse	12271	0207529	W-4833	30-04-30
283	Lengel, Richard	12946	0207548	W-2080	01-04-47
352	Opdyke Agency Inc.	12884	0207574	W-3077	30-04-47
367	Flynn, James T.	13987	0207591	W-537	31-05-53
368	Asphalt Paving Company	#1	0207607	W-6314	08-10-09
368	Asphalt Paving Company	#2	0207608	W-6314	30-04-55
368	Asphalt Paving Company	#3	0207609	W-6314	30-04-26
368	Asphalt Paving Company	SUMP #1	0207610	W-6314	31-05-55
368	Asphalt Paving Company	SUMP #2	0207611	W-6314	31-05-55
193	Cress, Frank L.	14269	0207620	W-1844	30-06-49
194	Harding, Marlene	RF1172	0207620	W-1844	30-06-49
370	Pettinger, Len	13007	0207621	W-912	27-07-55
260	Kissler, James	476	0207626	W-1319	29-07-37
112	Dean, Joe E.		0207707	W-745	22-06-27

#	Name	Permit	WDID	Case	Approp. Date
196	Harkis, Richard	2281F	0207716	W-1998	03-09-59
199	Harkis, Richard	03150F	0207717	W-1998	08-05-61
199	Harkis, Richard	11038	0207718	W-1998	30-06-38
375	Ray, William		0207726	W-1957	31-07-46
575	Backus, Robert E.	11529	0207757	W-2418	01-05-54
575	Backus, Robert E.	11530	0207758	W-2418	30-07-12
651	Willard, Kevin D.	11725F	0207760	W-6062	5/9/1967
651	Willard, Kevin D.	10729	0207763	W-6062	12-07-52
19	Appelhanz, John	6286	0207764	W-4777	01-07-54
381	Reynolds, Frank	6860	0207766	W-3326	30-06-55
402	Sable Estates	26033F	0207767	80-CW-339	01-06-46
402	Sable Estates	26034F	0207768	80-CW-339	01-06-46
402	Sable Estates	26035F	0207769	80-CW-339	01-06-46
402	Sable Estates	26036F	0207770	80-CW-339	01-06-46
402	Sable Estates	26037F	0207771	80-CW-339	01-06-46
402	Sable Estates	26038F	0207772	80-CW-339	01-06-46
664	Cook, Ronald A.	RF1188	0207773	W-4947	17-06-50
664	Cook, Ronald A.	2285F	0207774	W-4947	11-09-59
643	Martindale, Delores O.	11024	0207776	W-1634	31-12-21
383	McCormick, Gary	11025	0207777	W-1634	31-12-35
678	P. & H. Joint Venture, a Colorado	11534	0207778	W-1634	31-05-30
678	P. & H. Joint Venture, a Colorado	11538	0207779	W-1634	31-12-30
385	Rickers, Henry		0207792	W-9220-78	15-07-48
510	Wagner, Sam	20308	0207796	W-4774	01-04-40
510	Wagner, Sam	20948	0207797	W-4774	04-06-56
386	Riley, Margaret H.	13627	0207798	W-755	22-06-55
386	Riley, Margaret H.	11193	0207800	W-755	30-06-45
591	Ritchey, Eugene	R-20306-RF	0207810	88-CW-174	29-03-55
391	Romero, Leo F.	6257	0207825	W-260-77	30-05-54
393	Roskop, George	013606F	0207837	W-3785	15-05-50
553	Ruhge, Margaret		0207844	W-2889	31-07-40
707	Sakata Farms, a partnership	4271F	0207848	W-5854	03-06-63
648	Sakata Farms, Inc.	1248	0207852	W-602	5/31/1948
648	Sakata Farms, Inc.	1249	0207854	W-602	31-05-54
358	Palombo, Pete	8356	0207904	W-1685	20-06-31
673	Sakaguchi, Katherine, Sakaguchi, Robert	91	0207905	W-2143	28-05-54
673	Sakaguchi, Katherine, Sakaguchi, Robert	92	0207906	W-2143	25-03-55
673	Sakaguchi, Katherine, Sakaguchi, Robert	93	0207907	W-2143	5/9/1956
709	Sakata Land Company	13741	0207908	W-5854	01-06-40
708	Sakata Farms, a partnership	13744	0207909	W-5853	31-12-38
710	Sakata Land Company	12221F	0207911	W-5854	20-04-64
710	Sakata Land Company	6818	0207912	W-5854	30-05-35
404	Sakata Farms, a partnership	5998	0207920	W-5854	06-07-55
405	Sakata Farms, a partnership	19986	0207924	W-5854	01-06-43
707	Sakata Farms, a partnership	R318R	0207927	W-6109	27-10-54
709	Sakata Land Company	13742	0207929	W-5854	01-06-50

#	Name	Permit	WDID	Case	Approp. Date
709	Sakata Land Company	1211	0207930	W-5854	30-08-40
765	Broomfield, City and County	12192	0207938	W-3772	30-07-54
354	Oster, James L. Revocable Living Trust	949	0207939	W-845	31-12-44
63	Brannan Sand & Gravel Co.	13842	0207941	W-1204	31-12-38
63	Brannan Sand & Gravel Co.	13844	0207942	W-1204	31-12-46
416	Sarchet, William	812	0207944	W-523	31-05-55
416	Sarchet, William	811	0207948	W-523	31-05-52
422	Sasaki, Tom	1408	0207949	W-666	15-04-37
420	Sasaki, Joe	18769B	0207950	W-666	19-06-50
753	Sasaki Family Trust	20959	0207951	W-3583	30-04-35
419	Sasaki, Joe	570	0207952	W-666	31-12-46
752	Yoshiko Sasaki, Amy Tokunaga, Sam Sasaki,Jr.,	11020	0207953	W-3583	31-12-40
419	Sasaki, Joe	571	0207954	W-666	31-12-42
419	Sasaki, Joe	9090F	0207955	W-666	30-05-65
419	Sasaki, Joe	572	0207956	W-666	31-12-51
753	Sasaki Family Trust	3343F	0207957	W-3583	10-03-62
713	Schaefer, William L.	11575	0207968	W-636	31-12-37
423	Schaefer, Elaine	19802	0207969	W-2259	25-07-34
254	Kanzler, Donald	15861	0207971	W-226	31-12-30
426	Schafer, Carl	209	0207976	W-3971	20-06-30
426	Schafer, Carl	1960	0207977	W-2246	30-04-36
426	Schafer, Carl	12043	0207978	W-2246	01-05-53
426	Schafer, Carl	13044	0207979	W-2246	31-12-27
219	Howard, Cecil	12017	0207984	W-2334	30-08-36
645	Schmidt, Kevin W.	14499	0207989	W-3760	5/31/1949
731	Schmidt, Paul	1-15504-F	0207990	W-1000	15-05-44
649	Roy A. Schmidt Family Trust	3587F	0207991	W-1919	25-10-55
680	Maxey, Jeffrey A.	6324	0207993	W-2713	21-04-48
431	Schmidt, Edith	12013	0207995	W-766	30-04-55
502	Villano Brothers Farms	12014	0207996	W-767	03-11-64
645	Schmidt, Kevin W.	14498	0207999	W-3760	30-06-57
650	Roy A. Schmidt Family Trust	8588	0208003	W-1919	31-03-45
650	Roy A. Schmidt Family Trust	8589	0208006	W-1919	31-03-53
177	Green Valley Turf	557	0208007	W-707	03-05-55
681	Schmier, Wilbert H.	6718F	0208008	W-2557	18-02-65
681	Schmier, Wilbert H.	15500F	0208009	W-2557	21-07-55
440	Schroder, Duane	12743F	0208018	W-4885	31-12-37
439	Superior Turf Farms, Inc.	20539	0208019	W-4886	15-11-50
91	Mistler, Candace L.	11178	0208021	W-6039	30-06-57
635	City of Brighton	SCHWARTZ WEL	0208023	L NO. 1	31-12-32
87	Cannon, Brown	3423F	0208024	W-4967	24-05-62
711	Sakata Land Company	1-19491	0208029	W-3846	31-05-11
711	Sakata Land Company	2-19491	0208031	W-3846	30-04-13
699	Star Promotions LLC, a Colorado limited	10194	0208034	W-1536	30-04-57
87	Cannon, Brown	15036	0208042	W-4967	01-05-40
442	Seader, Alvin	RF522	0208044	W-259	01-06-37

#	Name	Permit	WDID	Case	Approp. Date
443	Segal, Ethel	11835	0208054	W-3684	31-05-46
443	Segal, Ethel	11836	0208055	W-3684	31-07-45
443	Segal, Ethel	11837	0208056	W-3684	30-04-50
443	Segal, Ethel	11838	0208057	W-3684	31-03-55
443	Segal, Ethel	2666F	0208058	W-3684	31-12-38
444	Seltzer Farms, Inc.	20989	0208062	W-579	28-01-63
445	Shable, Donna	14691	0208064	W-2337	20-05-40
445	Shable, Donna	270	0208065	W-1511	20-06-55
445	Shable, Donna	271	0208066	W-1511	20-06-55
446	Keller, Robert B	RF210	0208067	W-2337	12-06-41
747	Zelda H. Shaklee Living Trust	6795	0208073	W-938	01-07-43
748	C C Open A, LLC	6796	0208074	W-938	20-03-57
748	C C Open A, LLC	2470F	0208075	W-938	01-07-60
747	Zelda H. Shaklee Living Trust	03275F	0208076	W-938	01-07-61
747	Zelda H. Shaklee Living Trust	013659F	0208077	W-938	31-08-64
568	Sharp, Ernest J.	14211	0208079	W-1312	21-07-55
221	Hoffman, John	15360	0208080	W-634	31-05-56
568	Sharp, Ernest J.	14212	0208081	W-1312	31-03-49
700	Sharp, William Jr. (Trust)	33312	0208082	W-910	31-12-07
284	Lewis, William M.		0208090	W-2861	15-08-44
450	Sholdt, Bertha/Scholdt Sub Water Users	13258	0208095	W-1029	30-04-47
127	Dreiling, Michael	10744	0208132	W-592	31-12-38
127	Dreiling, Michael	ALTERNATE	0208133	W-7322	31-10-78
582	Walker, Virginia M/Western Equip	8577	0208191	W-1003	31-07-34
582	Walker, Virginia M/Western Equip	8578	0208192	W-1003	31-05-55
458	Steinmetz, Sam	11291	0208193	W-181	31-12-49
115	Dechant, Alvin	1770	0208194	W-1125	27-03-47
459	Kawata, Wayne/Western Equip	788	0208198	W-6449	30-06-53
686	Olando Ltd. Liability Co.	10222	0208200	W-3510	27-11-48
686	Olando Ltd. Liability Co.	10223	0208201	W-3510	28-04-56
464	Hunt, David	RF371	0208219	W-5324	31-05-50
464	Hunt, David	665	0208220	W-5324	30-04-55
464	Hunt, David	666	0208221	W-5324	30-04-55
31	Streed, Rodger S.	11167	0208224	W-736	30-06-54
466	Street, Edwin	13894	0208225	W-2929	31-03-51
467	Stroh, Robert	014477F	0208226	W-1788	18-06-18
720	Advanta USA, Inc.	2834F	0208228	W-872	05-03-42
720	Advanta USA, Inc.	2835F	0208229	W-872	12-06-54
469	Stromberger, Carl	1345	0208230	W-872	31-12-29
469	Stromberger, Carl	11700	0208231	W-872	31-12-34
331	Moser, John	041426-F	0208249	92-CW-012	29-04-60
331	Moser, John	041425-F	0208250	92-CW-012	12-09-67
330	Arndt, Mary	5451	0208251	W-1037	23-03-64
330	Arndt, Mary	3422F	0208252	W-1037	03-05-62
470	Schmidt, Paul	8772	0208253	W-861	30-04-15
473	Tagawa Greenhouses, Inc.	195	0208278	W-917	16-06-44

#	Name	Permit	WDID	Case	Approp. Date
474	Tagawa Greenhouses, Inc.	014531F	0208279	W-917	23-01-70
476	Taoka Brothers/Taoka Family	10039	0208295	W-833	31-05-44
476	Taoka Brothers/Taoka Family	10040	0208296	W-833	31-07-55
476	Taoka Brothers/Taoka Family	11709	0208297	W-833	30-11-37
476	Taoka Brothers/Taoka Family	11710	0208298	W-833	31-07-55
390	Romero, Joe A.	8690	0208299	W-3596	07-06-55
67	Brighton Industrial North	11214	0208306	W-826	31-05-40
596	Villano Brothers Farms	11214	0208306	W-826	31-05-40
67	Brighton Industrial North	11215	0208307	W-826	31-08-55
596	Villano Brothers Farms	11215	0208307	W-826	31-08-55
67	Brighton Industrial North	11384	0208308	W-826	31-12-40
596	Villano Brothers Farms	11384	0208308	W-826	31-12-40
482	Thomason, Orville	11585	0208335	W-1710	15-03-54
687	Collier, Warren J.	THOMPSON #1	0208337	W-3816	15-04-52
81	Villano Brothers Farms	6418F	0208366	W-2784	22-05-44
81	Villano Brothers Farms	20582	0208366	W-2784	30-04-53
80	Villano Brothers Farms	R-962	0208369	W-3982	20-09-19
39	Berig, William	8997F	0208387	W-1660	25-08-58
39	Berig, William	43325-F	0208388	93-CW-108	02-02-65
489	Two Bar C Dairy		0208421	W-4702	31-12-48
491	Ulrich Farms, Inc.		0208424	85-CW-174	31-07-36
493	Ulrich, Max	8492	0208425	W-3157	10-08-40
494	Ulrich, Rodnick	410	0208426	W-1722	31-08-47
494	Ulrich, Rodnick	R412RF	0208427	W-1722	30-08-49
494	Ulrich, Rodnick	411	0208428	W-1722	30-08-49
490	Ulrich Farms	133	0208430	W-304	31-12-36
491	Ulrich Farms, Inc.		0208430	W-3356	
744	Ulrich, Rodnick E. and Elsie J.	6555	0208431	W-1723	31-12-45
490	Ulrich Farms	134	0208433	W-304	31-07-55
491	Ulrich Farms, Inc.		0208433	W-3356	28-02-54
744	Ulrich, Rodnick E. and Elsie J.	6556	0208434	W-1723	30-06-53
744	Ulrich, Rodnick E. and Elsie J.	6557	0208435	W-1723	31-08-54
415	Unruh, Aelard M.	R6532	0208442	W-4623	30-04-55
415	Unruh, Aelard M.	R6533	0208443	W-4623	30-04-57
500	Hungenberg, David L.	12721	0208449	W-963	31-05-07
505	VonFeldt, Daniel L.	829	0208453	W-6132	31-07-54
505	VonFeldt, Daniel L.	830	0208456	W-6132	30-09-56
669	Wittemyer, Nancy J., as Trustee	832	0208457	W-4025	15-08-56
669	Wittemyer, Nancy J., as Trustee	831	0208460	W-4025	15-10-54
666	Katharin Vincent	833	0208461	W-4025	10-08-56
36	Berger, Jack Jr.	5739-F	0208470	W-569	20-06-64
272	Lauridson, William	2372F	0208473	W-2384	04-12-59
691	The Bernard Wagner Trust	6905	0208474	W-717	31-08-34
272	Lauridson, William	2074F	0208477	W-2384	31-01-59
691	The Bernard Wagner Trust	6906	0208478	W-717	31-08-39
512	Walker, Clifford		0208480	W-1224	30-06-23

#	Name	Permit	WDID	Case	Approp. Date
512	Walker, Clifford	14364	0208481	W-1224	04-06-57
295	Market Place - 85	1250	0208484	W-1047	22-09-34
515	Decker, Beth K.	12948	0208486	W-297	31-12-44
738	Moser, John R.	14101R	0208487	W-3801	15-04-35
738	Moser, John R.	6137F	0208488	W-3801	01-09-64
356	Petrocco, David		0208492	W-4082	20-06-44
518	Watada Brothers	1657	0208500	W-572	22-09-45
517	Villano Brothers Farms	19490-2	0208501	W-572	31-05-20
517	Villano Brothers Farms	7280	0208502	W-572	30-06-55
521	Weber, Wayne	13042	0208505	W-6449	01-04-44
449	Shelton Land and Cattle, LTD	015776F	0208528	W-6177	20-07-55
523	Wellington Reservoir Company	Wellington Res	0208542		
525	Wenzel, Samuel/WEN37 Holdings	14307	0208544	W-2229	21-06-37
600	Wenzel, William	10451	0208545	W-998	31-05-55
730	Mathis, Betty H.	10451	0208545	W-998	5/31/1955
525	Wenzel, Samuel/WEN37 Holdings	14308	0208546	W-2229	10-02-45
528	Bledsoe, Thomas	1450	0208547	W-3706	01-07-54
528	Bledsoe, Thomas	9631F	0208548	W-3706	06-06-65
531	Wethington, Elizabeth	019458RF	0208560	W-4637	04-03-55
533	Consolidated Nursery	7257	0208567	W-1237	28-06-57
534	Southwick, Ruth	20134	0208568	W-526	31-05-11
454	Dechant Farms Partnership	20148	0208569	W-671	01-04-54
454	Dechant Farms Partnership	2328F	0208570	W-671	28-10-59
363	Parker, John B/Sanchez	11653	0208573	W-5661	27-04-46
387	Rock, John	12741F	0208575	W-5661	21-06-54
388	Rock, Pete	12741F	0208575	W-5661	21-06-54
387	Rock, John	5	0208576	W-5661	20-06-35
388	Rock, Pete	5	0208576	W-5661	20-06-35
535	Wilch, Douglas	6825F	0208583	W-975	20-02-65
740	Lane, Elton Keith/Diehl	WILTFANG #1	0208587	W-1561	01-03-48
541	Wuertz, Katherine	10508	0208613	W-576	01-06-54
539	Wuertz, Joe	10502	0208614	W-575	30-04-41
539	Wuertz, Joe	10503	0208615	W-575	31-05-38
541	Wuertz, Katherine	10501	0208616	W-576	30-04-41
539	Wuertz, Joe	10504	0208617	W-575	5/31/1955
540	Wuertz, Katherine	9591F	0208618	W-576	24-05-65
539	Wuertz, Joe	10505	0208619	W-575	30-04-54
539	Wuertz, Joe	10506	0208620	W-575	30-04-34
539	Wuertz, Joe	10507	0208621	W-575	31-05-54
539	Wuertz, Joe	10509	0208622	W-575	31-08-54
539	Wuertz, Joe	10510	0208623	W-575	30-04-34
76	Buckley Acres Homeowners Association	2-11411-F	0208625	W-8255-76	05-03-23
143	Ewing, Lloyd	11373	0208626	W-2682	31-12-31
143	Ewing, Lloyd	4819F	0208627	W-2682	31-12-37
143	Ewing, Lloyd	11375	0208628	W-2682	27-11-54
543	Yokooji, Frank	RF1151	0208638	W-4257	30-05-28

#	Name	Permit	WDID	Case	Approp. Date
543	Yokooji, Frank	P02820F	0208639	W-4257	30-05-35
545	Ziemer, Eugene	6710F	0208649	W-885	31-12-64
546	Magnuson, Larry	6170	0208655	W-288	01-01-40
627	South Adams County Water & Sanitation Dist.	11786	0208669	W-1899	30-06-45
725	Victor, Bruce M.	035173F	0208670	W-4668	31-03-52
2	Adams County Board of Commissioners	49856F	0208731	85CW082	17-10-74
272	Lauridson, William	17884	0208829	W-2384	31-12-47
691	The Bernard Wagner Trust	6907	0208830	W-717	31-08-55
705	English Farms, Inc.	8865F	0208837	W-4585	04-03-58
392	Root Farms, LLC	41963-F	0209242	92-CW-127	16-11-66
571	Mt. Calvary Lutheran Church		0209297	91-CW-013	01-01-91
741	Edmundson Land, LLC	6285	0209991	80-CW-339	01-06-46
355	Oster, Richard	226	0306736	W-1799	24-05-55
224	Thomson, Paul D.	JORDAN #1	0405006	W-8140-76	02-07-55
73	Binder, Floyd et. al.	CROWLEY #1	0405145	W-1920	31-12-38
252	Kammerzell, Vern	R12065	0405264	W-1009	31-12-37
714	Nelson, Paul A.	12891	0405383	W-1407	30-06-37
714	Nelson, Paul A.	12892	0405384	W-1407	13-07-46
445	Shable, Donna	272	0405467	W-1511	20-06-55
251	Kammerzell, Doug et. al.	14692	0405468	W-2337	20-05-40
211	Hepp, Donald R.	10745-F	0505255	W-4958	05-05-66
128	Duell, Lucille	12972	NA	W-196	29-07-55
566	Adams County Board of Comm.		NA		
589	J Bar B, Inc.		NA		
638	Thaine J. Michie	5519F	NA	W-681	30-04-64
667	D. Schlup LTD.	3783-F	NA	W-6076	02-10-62
667	D. Schlup LTD.	047467F	NA	APD TO 3783F	
690	Clark, C.H.	12429	NA	W-265	31-12-47
698	Bakes, Robert A.	019889-F	NA	W-554	22-06-20

7.9 Development of Augmentation Plan to Well Data File (*plw)

The following describes the process of creating a PLW from the WER file and HydroBase Associated Structure List. The PLW file requires three fields: Aug Plan ID, Well Right ID, and Well Structure Model ID. Additionally, the Well WDID, Well Name, and Well Right Administration number have been included for informational purpuses. In order to generate the PLW file, the WER file and Structure List were processed within a relational database with according to the following methods.

1) The table named StructureAssocWDID within the HydroBase database (Aug 16, 2011 version) contains a list of Augmentation (Aug) Plans associated with wells (see below for TSTool commands). In this table, the field called WDID identifies the wells, and the field WDID_Assoc

lists the associated Aug Plan ID. From this table, a list of wells and associated Aug Plans was extracted for all Water Districts in the South Platte River Basin.

ReadTableFromDataStore(DataStore="HydroBase-HBGuest",DataStoreTable="vw_HBGuest_StructureAssocWDID", OrderBy="div,WDID",TableID="HBStructureAssoc_20160407")

WriteTableToDelimitedFile(TableID="HBStructureAssoc_20160407",OutputFile="HBStructureAssoc_20160407.csv")

2) Certain individual Aug Plans were grouped (aggregated) together according to the recommendations of Task 7.2 – Well Use and Well Augmentation Plans. As prescribed in the Task 7.2 documentation, individual plans were aggregated "to represent the localized geographic extent of well depletions and augmentation due to the integrated nature of operations." The table of explicitly modeled Aug Plans below shows which Plans were aggregated.

3) All unique combinations of Well Right ID and Model ID in the WER were maintained as unique records in the PLW. Duplicate combinations of Well Right ID and Model ID were aggregated and assigned a single PLW Aug Plan ID. The Aug Plan ID for each unique WER WDID-Model ID combination was defined as follows:

a) The following Aug Plans were modeled explicitly or in aggregate; the Aggregated Aug Plan ID should be used in the PLW file association.

Original Aug Plan ID	Aggregated Aug Plan ID	Original assoc_str_name	Aggregated assoc_str_name
0102456	0102456	FT MORGAN CITY AUG	FT MORGAN CITY AUG
0102513	0102513	ROTHE AUG	ROTHE AUG
0102518	0102518	PIONEER AUG PLAN	PIONEER AUG PLAN
0102522	0102522	RIVERSIDE AUG	RIVERSIDE AUG
0102525	0102522	RIVERSIDE AUG-HEADLEY	RIVERSIDE AUG
0102536	0102522	RIVERSIDE AUG-GOODRICH FARMS	RIVERSIDE AUG
0102581	0102522	RIVERSIDE AUG-EQUUS	RIVERSIDE AUG
0102725	0102522	SUBLETTE AUG	RIVERSIDE AUG
0102528	0102528	FT MORGAN CNL AUG PLAN	FT MORGAN CNL AUG PLAN
0102574	0102528	FT MORGAN FARMS AUG	FT MORGAN CNL AUG PLAN
0102529	0102529	UPPER PLATTE & BEAVER AUG	UPPER PLATTE & BEAVER AUG
0102535	0102535	LOWER PLATTE BEAVER AUG	LOWER PLATTE BEAVER AUG
0102662	0102662	BRUSH AUG	BRUSH AUG
9903334*	0103334	CENTRAL GMS AUG	CENTRAL GMS AUG

Original Aug Plan ID	Aggregated Aug Plan ID	Original assoc_str_name	Aggregated assoc_str_name
0103339	0103339	BIJOU AUG PLAN	BIJOU AUG PLAN
9903394*	0103394	CENTRAL WAS AUG	CENTRAL WAS AUG
6402517	6402517	SEDGWICK CTY WL USERS AUG	SEDGWICK CTY WL USERS AUG
6402518	6402518	HARMONY DITCH CO AUG	HARMONY DITCH CO AUG
6402519	6402519	DINSDALE AUG	DINSDALE AUG
6402525	6402525	CONDON AUG	CONDON AUG
6402526	6402526	STERLING AUG	STERLING AUG
6402536	6402536	LOWER LOGAN WELL USERS AUG	LOWER LOGAN WELL USERS AUG
6402537	6402539	SMART LAND/LIVESTOCK AUG	LOGAN WELL USERS AUG
6402539	6402539	LOGAN WELL USERS AUG	LOGAN WELL USERS AUG
6402546	6402539	PAWNEE WELL USERS AUG	LOGAN WELL USERS AUG
6402547	6402539	RIVERSIDE PIT M-1976-056 AUG	LOGAN WELL USERS AUG
6402548	6402539	VANDEMOER AUG	LOGAN WELL USERS AUG
6402554	6402539	ACCOMASSO BROS AUG	LOGAN WELL USERS AUG
6402540	6402540	LOWLINE DITCH CO AUG	LOWLINE DITCH CO AUG
6402542	6402542	LSPWCD AUG	LSPWCD AUG
6403392	6403392	NORTH STERLING AUG	NORTH STERLING AUG

* WAS and GMS plans were divided up into reaches A-F, see b) below and the table at the end of the memo

b) Well Right IDs associated with WAS (9903394) and GMS (9903334) Aug Plans are further divided up into augmentation plans represented as reaches A-F based on Central Colorado WCD's recent accounting database. To assign wells to the impact reaches, the HydoBase Associated Structure List was queried for all structures associate with a Central Augmentation Plan. These plans are stored under ID *03394 (WAS) or *03334 (GMS). The irrigation service area for each of the 50 structures associate with a Central Plan was compared to the impact reaches on a map. The closest impact reach was selected and the wells associated with the structure were assigned the same impact reach. This assignment was made in "Central_ImpactReach_Assignment.xlsx". A description of the impact reaches listed from upstream to downstream is below:

- Reach F = Fulton (0200808) to Jay Thomas (0200826)
- Reach C = Jay Thomas (0200826) to Lower Latham (0200834)
- Reach B = Lower Latham (0200834) to Riverside (0100503)
- Reach A = Riverside (0100503) to Upper Platte Beaver Canal (0100515)

- Reach D = Beebe Draw
- Reach E = Boxelder Creek

c) The following WER Model IDs were identified as being within the designated basins in the SPDSS Study Area. These were aggregated separately from other ground water-only aggregates, and assigned a PLW Plan ID as indicated in the following table.

Model ID	Designated Basin	PLW Plan ID
01_AWP038	Upper Crow Creek	Upper_Crow
01_AWP001	Camp Creek	Camp_Creek
01_AWP022, 023, 024, 025	Lost Creek	Lost_Creek
01_AWP008, 009, 010, 011, 012, 013, 014, 015, 016, 017, 018, 019, 020, 021, 039, 040	Upper or Lower Kiowa Bijou	Kiowa_Bijou

d) Augmentation or recharge wells are associated with an augmentation or recharge well structure in the well rights file based on the AugRch_Wells.csv file. Augmentation wells are assigned to an augmentation plan ID +"_AuW" suffix structure ID; recharge wells are assigned to an augmentation plan ID + "_ReW" suffix structure ID. These augmentation and recharge wells were assigned to their respective augmentation plan based on their structure ID.

e) Several wells are associated with Coors operations and are set specifically in the PLW. The well rights from the following wells need to be associated with the "0703390" augmentation plan.

Well Right ID	Model ID	PLW Plan ID
0705014.1	07_CoorsA	0703390
0705026.1	07_CoorsA	0703390
0705028.1	07_CoorsA	0703390
0705188.1	07_CoorsA	0703390
0705189.1	07_CoorsA	0703390
0705190.1	07_CoorsA	0703390
0705191.1	07_CoorsA	0703390
0705192.1	07_CoorsA	0703390
0705193.1	07_CoorsA	0703390
0705194.1	07_CoorsA	0703390
0705195.1	07_CoorsA	0703390
0705196.1	07_CoorsA	0703390
0705200.1	07_CoorsA	0703390
0705201.1	07_CoorsA	0703390
0705202.1	07_CoorsA	0703390
0705213.1	07_CoorsA	0703390

f) One well ID is modeled that is associated with the Aurora Augmentation Plan; associate the well rights for Aurora Cherry Creek Well (0805065.1 and 0805065.2) with the Aurora Augmentation Plan (0802593) PLW Plan ID.

g) Several wells are associated with South Adams County WSD operations and are set specifically in the PLW. The well rights from wells associated with Model IDs “02_SACWSD_I” and “02_SACWSD_I” need to be associated with the “9902502” augmentation plan.

h) Several wells are associated with City of Brighton operations and are set specifically in the PLW. The well rights from wells associated with Model IDs “02_Bright_I” and “02_Bright_O” need to be associated with the “9902541” augmentation plan.

h1) Well rights associated with 01_AMP001_I/_O should be tied all to 0102456 (FT_MORGAN_CITY_AUG)

h2) Well rights associated with 64_AMP001_I/_O should be tied all to 6403392 (NORTH_AUG_PLAN)

i) Wells in the HydroBase with a Water Supply equal to “GRNDWTR-1953 ADJ” were recognized as Coffin wells, decreed non-tributary in Civil Action 11217. The designation is included in HydroBase version 20150304, but not in version 20160407. The list of wells Coffin wells was collected from the 20150304 HydroBase version These wells were assigned a PLW Plan ID of “Coffin_Well”.

j) Decree language (96CW1034) indicates wintertime depletions from PSCo Pawnee Well Field (0100711) are covered by the North Sterling Augmentation Plan (6403392). There are no well rights associated with the well field in HydroBase, therefore the wells were modeled with a senior well right. As such, the depletions will be considered “in-priority” by the model and not accounted for under this plan. Future modeling efforts should investigate the appropriate well right and augmentation plan agreement for these depletions.

k) Where none of the prior criteria applied to an Aug Plan, the following “buckets” were used to group remaining wells into a PLW Plan ID. The asterisk (*) below is a wildcard, indicating that any characters could follow the specific ones listed.

Model_ID Criteria	PLW Plan ID
Starting with “010*” or “01_ADP*”	AggWell_01
Starting with “020*” or “01_ADP*”	AggWell_02
Starting with “030*” or “01_ADP*”	AggWell_03
Starting with “040*” or “01_ADP*”	AggWell_04
Starting with “050*” or “01_ADP*”	AggWell_05
Starting with “060*” or “01_ADP*”	AggWell_06
Starting with “070*” or “01_ADP*”	AggWell_07
Starting with “080*” or “01_ADP*”	AggWell_08

Starting with “640*” or “64_ADP*”	AggWell_64
Starting with “01_AWP*”	GwOnly_01
Starting with “02_AWP*”	GwOnly_02
Starting with “03_AWP*”	GwOnly_03
Starting with “04_AWP*”	GwOnly_04
Starting with “05_AWP*”	GwOnly_05
Starting with “06_AWP*”	GwOnly_06
Starting with “07_AWP*”	GwOnly_07
Starting with “07_AWP*”	GwOnly_08
Starting with “64_AWP*”	GwOnly_64

4) Note that *AUP* structures represent unincorporated municipal demands. Any ground water use should be associated with exempt wells, and therefore, should not be included in any augmentation plans. The final PLW should be checked to make sure that no *AUP* structures are represented.

5) Note that StateMod will only assign a well to one augmentation plan. Therefore, the different sets of well augmentation classes are ordered as follows (the most important being at the bottom):

- Catch-All (AggWell_* or GwOnly_*)
- Central Augmentation Plans
- Recharge and Augmentation wells
- Individual or Aggregated Plans
- Designated Basins
- Municipal Plans
- Coffin Wells
- Coors

6) All of the above methods were implemented within an MS Access database, yielding a dataset with the following fields: AugPlan_ID, WellRight_ID, WellWDID, Model_ID, Well Name, Well Right Admin Number. This dataset was then exported into a text editor and saved as the PLW.

7.10 Workshop Materials

The following materials were developed by the South Platte Modeling Integrator and presented in a series of workshops to the modeling contractors during sub-basin model development. They provide information on CDSS standard modeling procedures used during model development and calibration.

SPDSS Surface Water Model – Workshop 1

August 29, 2013

Agenda

1. Model Team Update and Questions/Concerns (15 minutes)

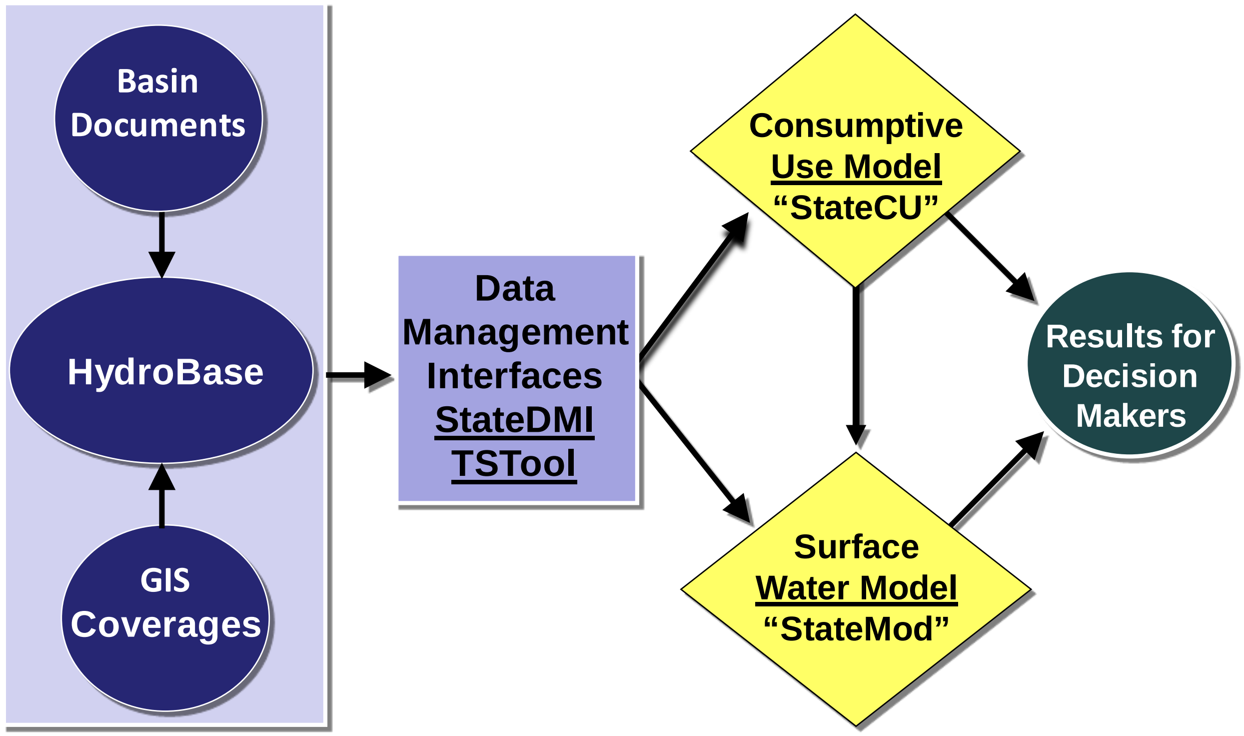
2. Data Centered Approach and Documenting Commands (45 minutes)

3. Baseflow Parameter Development (1 hour)

4. Interaction between Basins (45 minutes)

5. Diversion Coding and Off-channel Demands (1 hour)

Data Centered Approach and Documenting Commands



Information flows from HydroBase to StateCU and StateMod through the Data Management Interfaces (DMIs).

StateDMI – generally extracts physical properties associated with structures and stations, including water rights information.

TSTool – generally extracts time-series data associated with structures and stations, including streamflow measurements, acreage, and diversion records.

StateMOD GUI – only use for "viewing". DO NOT use for editing or creating commands.

Data-centered = Command Driven. Command files are developed to create and format the input files required for StateCU and StateMod.

- Input files can be easily revised or updated to include additional periods
- Input files can be reproduced
- Input files are transparent and self-documenting because each command use to create an input file is stamped in the header

* Data Centered Doesn't Always Mean Data Comes from HydroBase – It Does Mean the Process is Well Documented and Reproducible

Data-centered command files use the following general approach to create each StateCU and StateMod input file:

1. "**Read**" information from HydroBase or another external database source
2. "**Set**" missing information or overwrite incorrect data
3. "**Fill**" missing time-series data using monthly averages, regression relationships, etc.
4. "**Write**" information to create the input file

Modeling considerations:

- Do you want to include "set data" in your filling process?
- General filling methods, past investigations:
    - Filling missing diversion records based on regression was investigated for the CRDSS and RGDSS efforts and determined to be "not appropriate". Instead, a standard wet, dry, and average year monthly average approach has been adopted.
    - Filling missing reservoir contents is problematic – best bet is to keep searching for available records form operators/commissioners. Take advantage of other available data (i.e. diversion records with reservoir as a "from" location). Can interpolate between data points, but use caution with the "number of months" to interpolate. Don't interpolate across general storing versus releasing seasons.

    - Filling missing stream flow data – fill regression with other gages generally works well. (linear or log, monthly or annual)
- If conflicting data, which is best to use?
    - If administrative data, need really good reason not to rely on HydroBase
    - It is our responsibility as modelers to review data extracted from HydroBase and, if we believe there is an issue, bring it to the Division Engineer's attention for further review and correction **(Question for Division Office – would you like one contact on the modeling team for questions/corrections regarding data? Do you expect field-book verification from us?)**
    - If suggested corrections sent to Division for review, use "set" command for now, with clear documentation that should be fixed in next HydroBase release. If command option allows, turn on "If found" Warn option so when the command is run in the future, it flags the user to review.
    - If operational data, or data based on "after-diversion use", review carefully and make modeling decision on which data to use. Remember that water administration is based on water rights and the ability to put to beneficial use. For example, off-channel EOM content data or off-channel reservoir releases directly to irrigation may be recorded by operators and provided to administrators.
- If data is provided from a source other than HydroBase, need to clearly document in header of *.stm (if time-series data) or in DMI commands, including source entity, person providing, and phone number so additional data can be obtained in the future.
- Know where you data is measured! (more later off-channel discussions)

Documenting Command Files:

- Adopt the "Step Approach"
- Too much documentation is better than not enough documentation

Example NP2008.ddr command file

```
# ddr.commands.StateDMI
# StateDMI command file to create the direct diversion rights file for the North Park model
#
#  Step 1 - read structures from preliminary direct diversion station file
#
ReadDiversionStationsFromStateMod(InputFile="..\StateMod\NP2008.dds")
#
#  Step 2 - Read aggregate, diversion system and multi-structure system assignments.  Note that
#       want to combine water rights for aggs and diversion systems, but
#       water rights are assigned to primary and secondary components of multi-structures
#
SetDiversionAggregateFromList(...
SetDiversionSystemFromList(...
#
#  Step 3 - read diversion rights from HydroBase
#
ReadDiversionRightsFromHydroBase(ID="*",OnOffDefault=1)
#
# Step 4 - set water rights for structure IDs different from or not included in HydroBase,
#   set water rights for alternate points, etc
#
# Ute Pass Ditch water right is for 2 tribs
# 4700929 is primary node on Sand Creek (27.98 CFS FROM SAND CK)
# 4700929_C is secondary node on St. Francis Creek (14.43 CFS FROM ST FRANCES CK)
SetDiversionRight(ID="4700929.01"...
SetDiversionRight(ID="4700929_C.01"...
#
```

```
# 4700984 - Mace Bull Pasture D - has irrigated acreage and recent diversions,
#   no water rights in HB, set junior water right and capacity
#
SetDiversionRight(ID="4700984.01"...
#
# 4700893_C - Secondary Squibob carrier node to take storage diversions to Meadow Creek Res,
#    create a water right just junior to 4700893 right
SetDiversionRight(ID="4700893_C.01"...
#
# Damfino DS (583_D) includes Damfino D (583), Koping D (712) and Seymour D (870).
#   Damfino lands above the Seymour D headgate are served by 8/25th of Damfino water rights
#   The remaining lands are served by Koping, Seymour and the remaining Damfino rights.
#   Assign partial Damfino rights to 583 and remaining DS water rights to 583_D
SetDiversionRight(ID="4700583.01"...
SetDiversionRight(ID="4700583.02"...
SetDiversionRight(ID="4700583.03"...
#
SetDiversionRight(ID="4700583_D.01"...
SetDiversionRight(ID="4700583_D.02"...
SetDiversionRight(ID="4700583_D.03"..
#
# The following commands set alt point or exchange water rights
# StateDMI only pulls direct flow rights!
SetDiversionRight(ID="4700542.02"...
SetDiversionRight(ID="4700558.02"...
SetDiversionRight(ID="4700560.02"...
SetDiversionRight(ID="4700678.02"...
SetDiversionRight(ID="4701199.01"...
#
# The following set the water rights for the primary structure in Multi-Systems
# StateDMI cannot pull water rights if ID does not match WDID in HydroBase!
```

```
SetDiversionRight(ID="4700528_M.01"...
SetDiversionRight(ID="4700530_M.01"...
SetDiversionRight(ID="4700530_M.02"...
SetDiversionRight(ID="4700559_M.01"...
SetDiversionRight(ID="4700593_M.01"...
SetDiversionRight(ID="4700595_M.01"...
SetDiversionRight(ID="4700595_M.03"...
SetDiversionRight(ID="4700996_M.01"...
#
# Cochrane D (1024) can not be called out by Eureka D (614) b/c they are owned by the same rancher (per rancher comments)
#  Set first Cochrane D right one senior to Eureka D right
SetDiversionRight(ID="4701024_M.01"...
SetDiversionRight(ID="4701024_M.02"...
#
# Set Free River Rights
SetDiversionRight(ID="4700501.99"...
SetDiversionRight(ID="4700504_D.99"...
SetDiversionRight(ID="4700506.99"...
SetDiversionRight(ID="4700508.99"...
#
#  Step 5 - create direct diverison rights file
#
WriteDiversionRightsToStateMod(OutputFile=…
```

```
#> FRICO-Standley.stm

#> These data are from FRICO hard copy records, provided by City of Thornton (Greg
Johnson)
#>
#> Yr ID           Jan     Feb     Mar     Apr     May     Jun     Jul     Aug     Sep     Oct     Nov     Dec
Total
#>-e-b----------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb-----
---e
    1/1950  -     12/1965 ACFT  CYR
1950 FRICO-Stand     6830    9593   10870   11014   10841    9072    6430    2864    1289    1128    1487    -999
1951 FRICO-Stand     -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999
1952 FRICO-Stand     -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999
1953 FRICO-Stand     7950    9825   11100   12740   12804    7490    4230    1714       0       0     357    -999
1954 FRICO-Stand     -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999
1955 FRICO-Stand     -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999
1956 FRICO-Stand     -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999
1957 FRICO-Stand     -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999
1958 FRICO-Stand    12770   15845   16360   16560   17487   16101   10425    4797    2045    -999    -999    -999
1959 FRICO-Stand     -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999
1960 FRICO-Stand     -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999
1961 FRICO-Stand     -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999
1962 FRICO-Stand    13123   14246   15141   17116   13464   16633   12816    5308    2411    2332    2576    3110
1963 FRICO-Stand     5091    7331    9282    9296    6420    7874    3870    2146     638    -999    -999    -999
1964 FRICO-Stand     -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999    -999
1965 FRICO-Stand     -999    -999    -999    9504    9451   16545   12643    6863    6727    -999    -999    -999
```

```
# mjm 06/17/2009
# File name - <Julesburg.commands.TSTool>
#
# Output file name - <Julesburg.stm> includes
#      6400511_DDH (total river diversions),
#      6400511_IRR (total irrigation supply - direct plus on-channel reservoir releases),
#      6400511_DRA (ditch loss from total river diversions)
#
# Modeling Information:
#
# a) Harmony Ditch Diversion System is a diversion system that serves irrigated acreage and conveys water rights from
#      Julesburg Reservoir (6403906), Harmony Ditch No. 1 (6400511), Harmony Ditch No. 2 (6400515), Harmony Ditch No. 3
#    (6400510)
#      Harmony Ditch No. 3 (6400510) is not included here because there are no diversion records in HB
# b) Julesburg Reservoir is a key reservoir
#      WDID for the key reservoir and associated filler ditch is as follows:
#      RSVR ID       RESERVOIR                                        FILLER DITCH       FILLER DITCH WDID
#      6403906       Julesburg Reservoir                            Harmony No. 1 Ditch         6400511
#
# c) The measurement point for Harmony No. 1 Ditch is at the river headgate.
# d) Conveyance losses included herein represent losses from the headgate to the reservoir. StateCU calculates
#      additional losses from the reservoir to irrigated lands.
#
# This commands file:
# ~ Calculates diversions to storage and releases from off-channel Riverside Reservoir System based on EOM contents and
#   evaporation losses
# ~ Develops total headgate diversions (6400511_DDH) based on:
#       Calculated diversions to storage (based on EOM contents) + DivTotal at Harmony No. 1 for 1950 - 1973 and 1979 –
#       1988
#       DivTotal at Reservoir (6403906) + DivTotal at Harmony No. 1 for 1974 to 1978
#       DivTotal for Harmony No. 1 for 1988 to present
#       and then adds Harmony No. 2 Ditch irrigation diversions to each of these
# ~ Calculates conveyance losses for input to the drain file (WDID 6400511_DRA) {=negative of (ddh - ditch loss)}
# ~ Calculates the irrigation diversion and any recharge water (WDID 6400511_IRR) associated with the off-channel
#     reservoir system
#      {IRR = DivTotal - DivtoStorage + Reservoir Release - Conveyance Losses}
#
# Values that are copied to "ColX" variables are done so to write these out to a temporary .dv file that should provide
# the input data for modelers to import into Excel to check the calculations herein
#-----------------------------------------------------------------------------------------------------------------------
# Step 1: Set input period
#
# Set input period to include additional year so that last data point from <spdss.eom> (e.g., Dec 2006)
# is shifted forward one month (e.g., January 2007) to allow for release/storage calculation in December 2006
SetInputPeriod(InputStart="01/1950",InputEnd="12/2007")
```

```
null_value...MONTH~StateMod~zero.stm
#-----------------------------------------------------------------------------------------------------------------------
# Step 2: Calculate change in storage for the reservoir, (positive data is storage, negative data is releases)
#
# Analysis of reservoir releases is calculated based on
#     Release(i) = EOM(i) - [ EOM(i-1) - EVAP(i) ]
# or  Change in Storage = Col1 - [ Max(Col2 - Col3, 0)]
#
# Julesburg Reservoir
# Read EOM(i-1)     This value (e.g., May 1950) was shifted forward one month (e.g., June 1950) in
#   <SPDSS2.shift.eom.commands.TSTool>
6403906...MONTH~StateMod~spdssSHIFT.eom
TS Col2 = Copy(TSID="6403906...MONTH",NewTSID="Col2...MONTH")
# Read EVAP(i)          This value, calculated in <SPDSS_Storage_Evaporation_Calculations.xls> based on <spdss.eom>,
#   was output to <SPDSSstoEvap.stm>
3906_EVA...MONTH~StateMod~SPDSSstoEvap.stm
TS Col3 = Copy(TSID="3906_EVA...MONTH",NewTSID="Col3...MONTH")
# Calculate EOM(i-1) - EVAP(i), and then set this calculation (copied to WDID 6403906_k) to zero just in case EVAP(i) >
#    EOM(i-1)
Subtract(TSID="6403906...MONTH",SubtractTSList=SpecifiedTSID,SubtractTSID="3906_EVA...MONTH")
TS 6403906_k = Copy(TSID="6403906...MONTH",NewTSID="6403906_k...MONTH")
SetToMax(TSID="6403906_k",IndependentTSList=LastMatchingTSID,IndependentTSID="null_value...MONTH")
# Read EOM(i)
6403906...MONTH~StateMod~spdss.eom
TS Col1 = Copy(TSID="6403906...MONTH",NewTSID="Col1...MONTH")
TS 6403906_i = Copy(TSID="6403906...MONTH",NewTSID="6403906_i...MONTH")
# The resulting calculation has positive storage values and negative release values
Subtract(TSID="6403906_i",SubtractTSList=SpecifiedTSID,SubtractTSID="6403906_k",HandleMissingHow="IgnoreMissing")
TS Col4 = Copy(TSID="6403906_i",NewTSID="Col4...MONTH")
# Free Julesburg Reservoir parts
Free(TSList=LastMatchingTSID,TSID="6403906...MONTH")
Free(TSList=LastMatchingTSID,TSID="6403906...MONTH")
Free(TSList=LastMatchingTSID,TSID="6403906_k")
Free(TSList=LastMatchingTSID,TSID="3906_EVA...MONTH")
#-----------------------------------------------------------------------------------------------------------------------
# Step 3: Develop the DDH (diversions at the headgate) by parts/time periods - add in all parts of diversion system
#
# DDH - 1950 thru 1973 is equal to calculated diversions to storage + total diversions at 511 - diversions to storage
#    at 511
#
# Create 511_DDH file using 3906_i storage, zero out months with releases and set first month to zero
TS 6400511_DDH = Copy(TSID="6403906_i",NewTSID="6400511_DDH...MONTH")
SetToMax(TSID="6400511_DDH",IndependentTSList=LastMatchingTSID,IndependentTSID="null_value...MONTH")
# Calculated diversions to storage are based on EOM contents measured at the reservoir, therefore scale (1/77%) to
#   account for conveyance efficiencies and 'move' the diversions back to the river headgate
```

```
Scale(TSList=LastMatchingTSID,TSID="6400511_DDH",ScaleValue=1.2987)
# Without actual initial contents data (Dec 1949 EOM) for the reservoirs, storage amounts in January 1950 are very
#   high,since the model sees the initial storage as 0 ac-ft. Absent other data, and to avoid this discontinuity at the
#   beginning of the SPDSS study period, the Jan 1950 calculated storage amounts are set to zero prior to be written to
#   the output file.
SetConstant(TSList=LastMatchingTSID,TSID="6400511_DDH",ConstantValue=0,SetStart="01/1950",SetEnd="01/1950")
TS Col5 = Copy(TSID="6400511_DDH",NewTSID="Col5...MONTH")
#
# Create 511_DivTot minus diversions to storage
# There is minimal diversions to storage data (2 non-consecutive years) under 511 that are not included in these
#   commands.
# There are upstream reservoir release data (2:1) for irrigation in the DivTotal included in these commands b/c we
#    assume it represents releases from reservoirs other than Julesburg and was diverted through the headgate.
#    Reservoir release coded from other reservoirs are included as well.
TS 6400511_DivTot = ReadHydroBase(TSID="6400511.DWR.DivTotal.Month~HydroBase")
6400511.DWR.DivClass-S:1 F: U:0 T: G:.Month~HydroBase
6400511.DWR.DivClass-S:1 F: U:0 T:3 G:.Month~HydroBase
Subtract(TSID="6400511_DivTot",SubtractTSList=SpecifiedTSID,SubtractTSID="6400511.DWR.DivClass…
Subtract(TSID="6400511_DivTot",SubtractTSList=SpecifiedTSID,SubtractTSID="6400511.DWR.DivClass…
Free(TSList=LastMatchingTSID,TSID="6400511.DWR.DivClass-S:1 F: U:0 T: G:.Month")
Free(TSList=LastMatchingTSID,TSID="6400511.DWR.DivClass-S:1 F: U:0 T:3 G:.Month")
# Fill last couple of months in 2006 of 511_DivTot with pattern file
ReadPatternFile(PatternFile="WetDryAverage.pat")
# South Platte River at Julesburg (USGS ID 06764000)
FillPattern(TSList=AllMatchingTSID,TSID="6400511_DivTot",PatternID="06764000")
TS Col6 = Copy(TSID="6400511_DivTot",NewTSID="Col6...MONTH")
#
Add(TSID="6400511_DDH",AddTSList=SpecifiedTSID,AddTSID="6400511_DivTot",HandleMissingHow="IgnoreMissing")
SetConstant(TSList=LastMatchingTSID,TSID="6400511_DDH",ConstantValue=-999,SetStart="11/1973",SetEnd="10/1978")
TS Col7 = Copy(TSID="6400511_DDH",NewTSID="Col7...MONTH")
#
#
# DDH - 1974 thru 1978 is equal to Reservoir DivTotal + 511_DivTot
#
# There is reservoir release data (2:1) in the 6403906 DivTotal from 1988 forward however this data is not used
#  because calculated reservoir releases are incorporated in the IRR structure below.
TS 6403906_DivTot = ReadHydroBase(TSID="6403906.DWR.DivTotal.Month~HydroBase")
TS Col8 = Copy(TSID="6403906_DivTot",NewTSID="Col8...MONTH")
Add(TSID="6403906_DivTot",AddTSList=SpecifiedTSID,AddTSID="6400511_DivTot",HandleMissingHow="IgnoreMissing")
SetConstant(TSList=LastMatchingTSID,TSID="6403906_DivTot",ConstantValue=-999,SetStart="11/1978",SetEnd="12/2006")
TS Col9 = Copy(TSID="6403906_DivTot",NewTSID="Col9...MONTH")
#
#
# DDH - 1988 thru present is equal to 511_DivTot
#
```

```
SetConstant(TSList=LastMatchingTSID,TSID="6400511_DivTot",ConstantValue=-999,SetStart="01/1950",SetEnd="10/1987")
#
# Combine all parts into the 511_DDH
FillFromTS(TSList=LastMatchingTSID,TSID="6400511_DDH",IndependentTSList=LastMatchingTSID,…
FillFromTS(TSList=LastMatchingTSID,TSID="6400511_DDH",IndependentTSList=LastMatchingTSID,…)
TS Col10 = Copy(TSID="6400511_DDH",NewTSID="Col10...MONTH")
Free(TSList=LastMatchingTSID,TSID="6400511_DivTot")
Free(TSList=LastMatchingTSID,TSID="6403906_DivTot")
#-----------------------------------------------------------------------------------------------------------------------
# Step 4: Add in Harmony No. 2 diversions to DDH
#
# Add Harmony No. 2 Ditch to 511_DDH
TS 6400515_DivIrr = ReadHydroBase(TSID="6400515.DWR.DivTotal.Month~HydroBase")
# Fill 515_DivIrr using pattern file and hist. mo. ave. and then set data to zeroes based on Water Commissioner
# Comments of "no water used" or "no water wanted". Future review may want to check field books for data prior to 1960.
SetConstant(TSList=LastMatchingTSID,TSID="6400515_DivIrr",ConstantValue=0,SetStart="11/1960",SetEnd="10/1967")
FillPattern(TSList=AllMatchingTSID,TSID="6400515_DivIrr",PatternID="06764000")
TS Col11 = Copy(TSID="6400515_DivIrr",NewTSID="Col11...MONTH")
Add(TSID="6400511_DDH",AddTSList=SpecifiedTSID,AddTSID="6400515_DivIrr",HandleMissingHow="IgnoreMissing")
TS Col12 = Copy(TSID="6400511_DDH",NewTSID="Col12...MONTH")
#
# 6400510 - HARMONY DITCH 3 - This is excluded due to no data in HydroBase
#-----------------------------------------------------------------------------------------------------------------------
# Step 5: Develop the drain file
#
# Drain values = - (ddh1 - conveyance loss)
# Multiply the river diversions by the negative conveyance efficiency to get the drain values
TS 6400511_DRA = Copy(TSID="6400511_DDH",NewTSID="6400511_DRA...MONTH")
Scale(TSList=LastMatchingTSID,TSID="6400511_DRA",ScaleValue=-0.77)
TS Col13 = Copy(TSID="6400511_DRA",NewTSID="Col13...MONTH")
#-----------------------------------------------------------------------------------------------------------------------
# Step 6: Develop diversions to irrigation for the Irrigation Demand (IRR) structure
#-----------------------------------------------------------------------------------------------------------------------
#
# Step 7: Write all raw input to dv file for use in Check spreadsheet files and write out STM file with resulting files
#
# Write raw input data to .dv file
SelectTimeSeries(TSList=AllMatchingTSID,TSID="Col*",DeselectAllFirst=True)
WriteDateValue(OutputFile="TSFiles2008\Julesburg.dv",TSList=SelectedTS)
#

# Write output file
SortTimeSeries()
WriteStateMod(TSList=AllTS,OutputFile="TSFiles2008\Julesburg.stm",OutputStart="01/1950",OutputEnd="12/2006"…
```

Documenting Command Warnings:

Command files can run with warnings that DO NOT need to be “fixed”, but do need to be understood and documented.

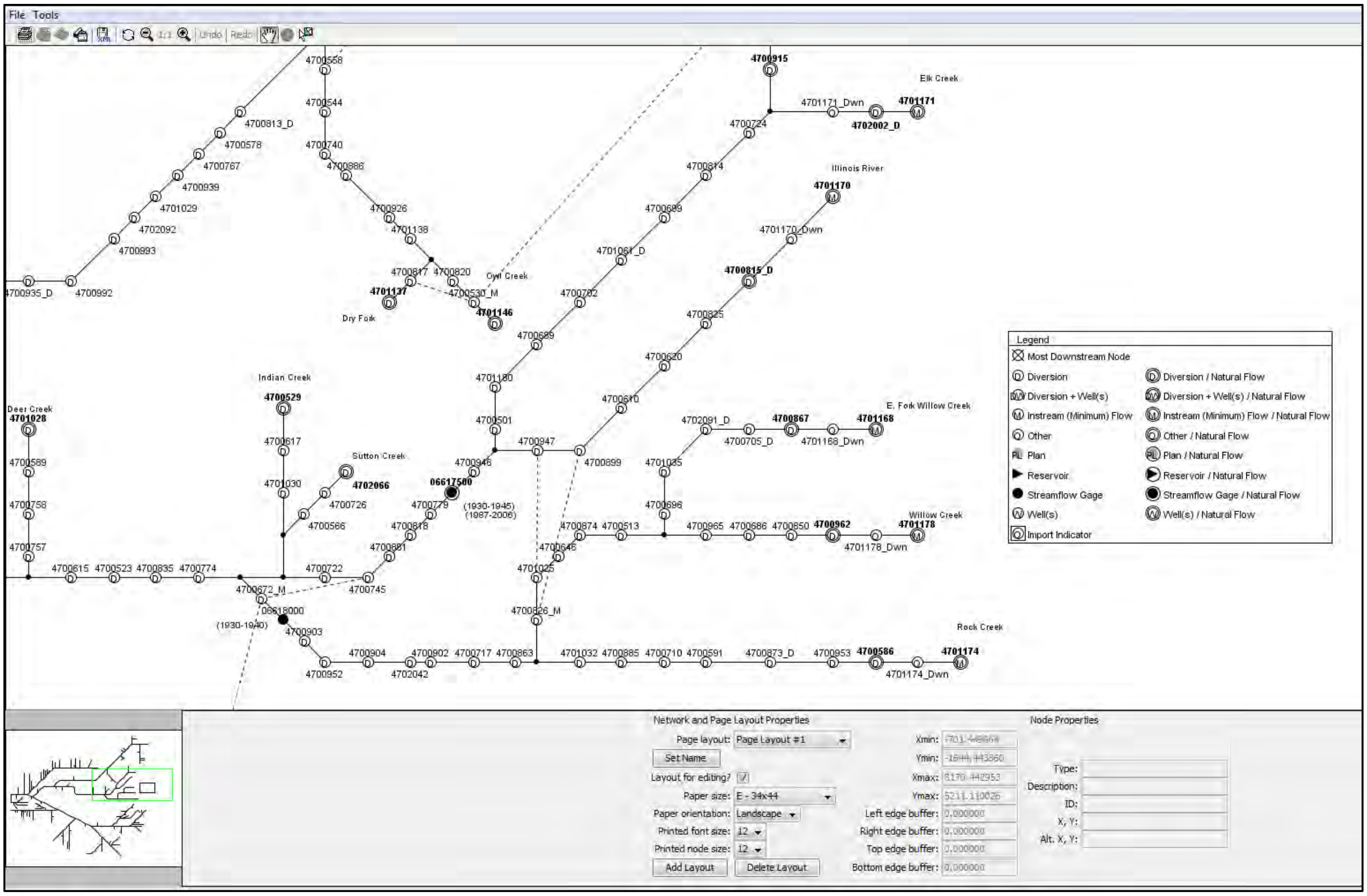
Print all warnings to a document file. Review and either “fix”, or document warnings and why they are okay for the modeling effort. Save the documented warnings with the same name as the command file (for example: ddh.commands.StateDMI.warnings). This will allow modelers who update the command files in the future to avoid duplicating the review.

Baseflow Parameter Development

StateMod generates baseflow parameters used to generate Natural Flows (Baseflows) from area and precipitation factors defined in the Network Diagram.

Important points when setting up a network

- Include structures where you know or need to know information
- Include, at a minimum, structures included in the StateCU consumptive use model and SPDSS memorandum; additional structures will likely be required
- Include “significant” tributaries (e.g. those with diversions, streamflow gages, large drainage areas); may not need to include tributaries with instream flow reaches if no consumptive diversions
- Although not required in the network file, include plan structures in the network so that the network reflects a complete list of structures – note that plan structures can be added later if model is developed in steps
- The Network is used to define structures other model files in StateDMI command files (e.g. *ReadDiversionStationsFromNetwork()*)
- Add annotations and “links” in the diagram while developing, including structure and reservoir names



Structure Naming Conventions

Refer to the SPDSS Historical Crop Consumptive Use Analysis Report and SPDSS Task memoranda for the naming conventions for specific structures. In general:

- When available, use the DWR 7-digit WDID or the USGS Stream Gage ID as the structure ID, including decreed plan structures
- For non-decreed plan structures, include abbreviated entity (e.g. Westminster = Westy) and a plan type; for example “_Aug” (augmentation plans), “_RF” (return flow plans), “_Spl” (split plans), “_Lim” (limit plan), or “_Reu” (reuse plans).
- Use “_C” suffix to designate carrier structures
- Use “_I” suffix to designate irrigation demands
- Use “_D” suffix to designate diversion systems
- Use “_AP” suffix to designate alternate point structures

- Use the decreed plan structure WDID and "_R" suffix to designate an aggregate recharge reservoir
- Use the WD, abbreviated municipality name or "AUP" (Aggregate Unincorporated Platte) or "AMP" (Aggregated Municipal Platte), and "_I" and "_O" suffices to designate indoor and outdoor municipal demands
- Use the WD, "ADP" (Aggregate Diversion Platte) or" AWP" (Aggregate Well Platte), and a unique aggregation ID to designate aggregated diversion and well structures
- Use the WD, "ASP" (Aggregate Stock Platte) or "ARP" (Aggregate Reservoir Platte), and a unique aggregation ID to designate aggregated stock ponds and reservoirs

Natural Flows at Gaged Locations

StateMod starts with the amount of water that would have been in the stream absent the effects of man. This amount of water is referred to as "natural flow" or "baseflow". Natural flow has historically been estimated in a data-centered fashion using tools built into StateMod in two steps; natural flows at gaged locations and distribution of gains to estimate natural flow at ungaged locations.

Natural Flow at Gaged Locations =

Gaged Flow + Diversions – Return Flows +/- Change in Storage

- In general, there is sufficient measured data available in the SPDSS model area to provide a good estimate of natural flows at gaged locations.
- Due to the use of *measured* data, StateMod's method is believed to result in better estimates of natural flow at gaged locations compared to those estimated from other methods (e.g. rainfall/runoff models).
- The uncertainty for natural flows lies in the distribution to ungaged locations (see below).

If an alternative method is used to create Natural Flows, it must be data-centered and the modeler must show that it matches StateMod monthly estimates at gaged locations.

Natural Flows at Ungaged Locations

- Natural flow must be estimated at ungaged headwater nodes.
- Natural flow gains between gages are modeled as entering the system at ungaged points, to better simulate the river's growth due to local runoff and unmodeled tributaries.
- StateMod has several ways to automate the distribution of gains (or losses) seen between or upstream of gages – Gain Approach, Neighboring Gage Approach, or Set Proration Approach.
- Two of the approaches rely on Area/Precipitation factors.

Area/Precipitation Factors

The drainage area and precipitation factors are entered into the network diagram for each gaged and ungaged location.

- The drainage area for gaged natural flow locations is the total drainage area contributing to the gaged location.
- The drainage area for *ungaged* locations is the *incremental* drainage area upstream of the natural flow location and downstream of a gaged location (if any).
- Basin drainage areas are included in the natural flow properties in the network file in units of square miles. They can be delineated using GIS spatial analyses or through the USGS StreamStats program (http://water.usgs.gov/osw/streamstats/index.html).
- Be sure to review the basin delineations from the StreamStats program, and compare basin area delineations at gaged locations to published USGS drainage areas.
- Precipitation factors are input in units of inches and represent the average annual precipitation over the delineated drainage area. Precipitation factors can be estimated from CDSS Isohyetal coverages or through the USGS StreamStats program.

Note that the precipitation factors do not capture basin characteristics such as aspect, elevation, or slope. These characteristics should be considered during calibration efforts, guiding adjustment of the precipitation factor up or down during calibration.

Document the initial area and precipitation factors in a GIS shapefile prior to adjusting during calibration

Gain Approach

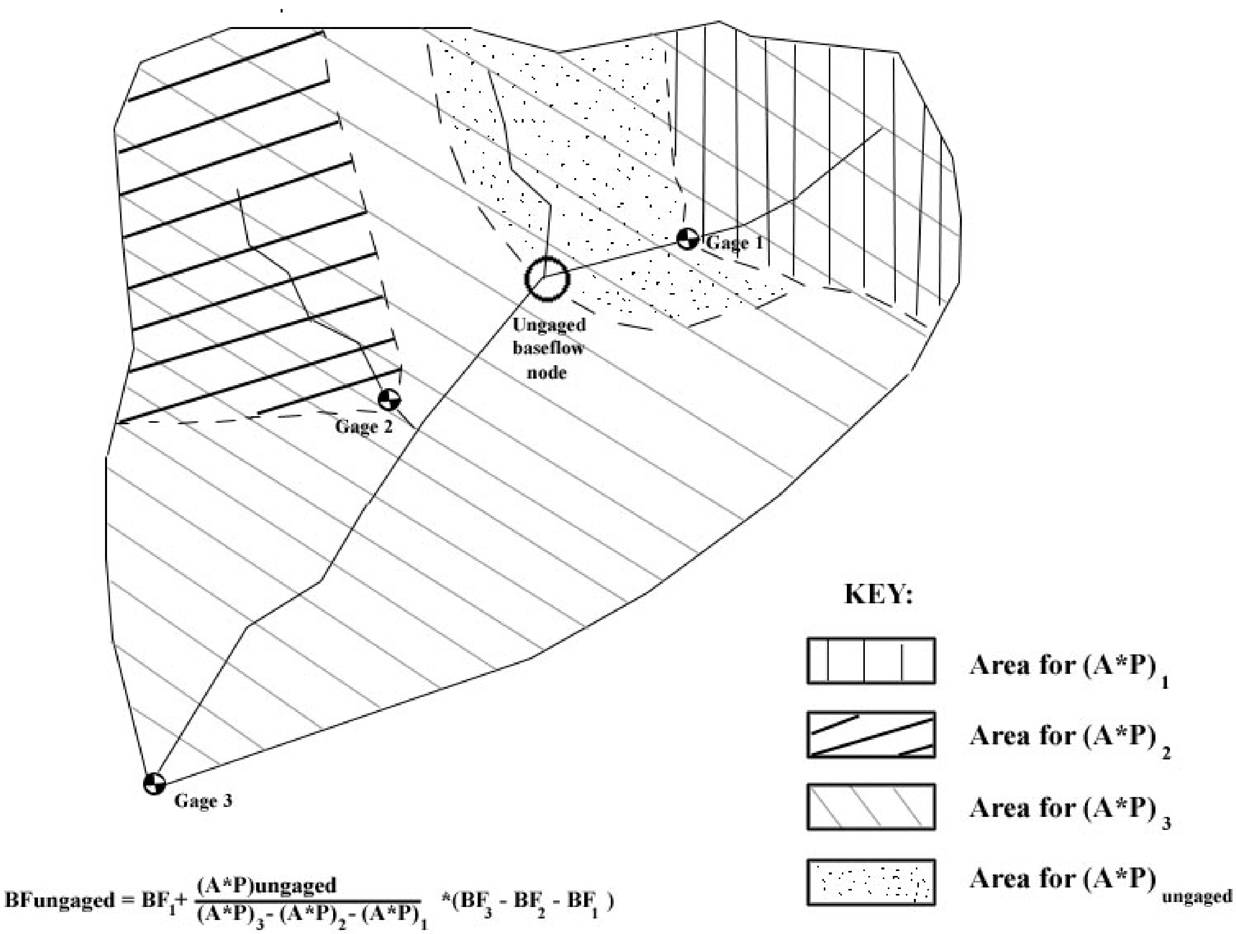
The Gain Approach is the default method for assigning natural flow to ungaged locations. The Gain Approach pro-rates natural flow gain above or between gages according to the product of drainage area and average annual precipitation. That is, each gage is assigned an "Area*Precipitation" (A*P) term, equal to the product of total area above the gage, and average annual precipitation over the gage's entire drainage area. Ungaged natural flow points are assigned an incremental "A*P", the product of the incremental drainage area above the ungaged natural flow point and below any upstream gages, and the average annual precipitation over that area.

In the example below:

- The portion of the natural flow gain below Gages 1 and 2 and above Gage 3 (at the Ungaged location between the gages) is the gage-to-gage natural flow gain

$$(BF_3 - (BF_2 + BF_1)) \times (A*P)_{\text{ungaged}} / \\ [(A*P)_{\text{downstream gage}} - \Sigma\, (A*P)_{\text{upstream gage(s)}}]$$

- Total natural flow at the ungaged location is equal to this term, plus the sum of natural flows at upstream gages. In the example there is only one upstream gage, having natural flow BF_1.



Neighboring Gage Approach

- The neighboring gage approach is used if smaller tributaries do not have the same general runoff pattern as the mainstem downstream gage.
- This method creates a natural flow time series by multiplying the natural flow series at a specified gage by the ratio $(A*P)_{ungaged}/(A*P)_{gage}$.
- This approach may be effective if there is a nearby gaged tributary with similar drainage characteristics (area, aspect, elevation)

Proration Approach

The proration approach is similar to the neighboring gage approach, but allows the modeler to “set” the proration factor directly (eg. Natural Flow $_{ungaged}$ = 0.8 x Natural Flow$_{gaged}$).

Natural Flow Parameter File (*.rib)

Proration factors are calculated based on the area/precipitation factors in the network diagram and commands in StateDMI, and provided to StateMod in the Natural Flow Parameter File (*.rib).

*North Platte Model *.RIB File Excerpt*

```
#>
#> FlowX              mbase    coefB1     FlowB1     coefB2     FlowB2     coefB3    F
#>---------exxxxxxxxb------eb------exb----------eb------exb----------eb------exb
#>             pf      nbase    coefG1    FlowG1     coefG2     FlowG2      coefG3
#>xxxxxxxxxxxb------eb------eb------exb----------eb------exb----------eb------exb
#>
#>EndHeader
#>
4701070                    0
               0.266       2    1.000 06611800      -1.000 06611700
4700552                    1    1.000 06611700
               0.313       2    1.000 06611800      -1.000 06611700
4700624                    0
               0.008       2    1.000 06611300      -1.000 06611200
4700638_D                  0
               0.316       2    1.000 06611800      -1.000 06611700
```

For example:

- Natural Flow for 4701070 = 26.6% * (natural flow at downstream gage 06611800 minus natural flow at the upstream gage 06611700)
- Natural Flow for 4700552 = 31.3% *(natural flow at downstream gage 06611800 minus natural flow at the upstream gage 06611700) + the natural flow at the upstream gage 06611700

Proration factors (pf) in the *.rib file should never be greater than 1.0 if developed using the Gain Approach.

"Negative" Natural Flows

The gain approach can results in estimates of negative natural flows. These occur when the gaged flow is less than the other parameter used in the natural flow calculation.

Gaged Flow + Diversions – Return Flows +/- Change in Storage

- StateMod automatically sets any natural flow estimated to be negative at a gaged location to zero prior to distributing gains to ungaged locations, essentially “creating” water in the system.
- A negative flow summary, including a count of the number of months with negative flow and the average and total amount of negative flow, is provided in the StateMod log file (*.log) when StateMod is run in the Baseflow Mode.

*North Platte Model *.LOG File Excerpt*

```
 ________________________________________________________________________
  Virout; Negative Flows at GAGE Summary  ACFT/mon
    Note: Count is the # of months for a monthly model and
             the # of days for a daily model and
           Est is the average negative flow estimate
             on a monthly basis (af/mo) or a daily basis (af/day)
           Adj is the adjusted value printed to results
           Total is the total adjustment (abs(# * Est)
                                                               Est          Adj        Total        River
    # ID            Name                        Count        af/mon       af/mon         acft           ID

 ____ ____________ ________________________ _______ ____________ ____________ ____________ ____________
    1 06611200     BUFFALO CREEK NEAR HEBRO       5      -171.17         0.00       855.87          289
    2 06611300     GRIZZLY CREEK NEAR HEBRO       8      -220.10         0.00      1760.77          295
    3 06611700     LITTLE GRIZZLY CREEK NEA       0         0.00         0.00         0.00          191
    4 06611800     LITTLE GRIZZLY CREEK ABO       0         0.00         0.00         0.00          206
    5 06611900     LITTLE GRIZZLY CREEK ABO       0         0.00         0.00         0.00          209
    6 06614800     MICHIGAN RIVER NEAR CAME       0         0.00         0.00         0.00          486
    7 06615000     SOUTH FORK MICHIGAN RIVE       0         0.00         0.00         0.00          475
    8 06616000     NORTH FORK MICHIGAN RIVE       0         0.00         0.00         0.00          498
    9 06617500     ILLINOIS CREEK NEAR RAND       1        -2.80         0.00         2.80          415
   10 06619400     CANADIAN RIVER NEAR LIND       0         0.00         0.00         0.00          101
   11 06619450     CANADIAN RIVER NEAR BROW       0         0.00         0.00         0.00          120
   12 06620000     NORTH PLATTE RIVER NEAR        2     -1720.07         0.00      3440.14          555
   13 Line_BF                          _FLO       0         0.00         0.00         0.00            1
   14 Beav_BF      Beaver Creek BF     _FLO       0         0.00         0.00         0.00            6
   15 SFBig_BF                         _FLO       0         0.00         0.00         0.00           14
   16 Wheel_BF     Wheeler Creek BF    _FLO       0         0.00         0.00         0.00           20
   17 Camp_BF                          _FLO       0         0.00         0.00         0.00           29
   18 3mile_BF     Threemile Creek BF  _FLO       0         0.00         0.00         0.00           27

 ____ ____________ ________________________ _______ ____________ ____________ ____________ ____________
      Total Ave                                  16       378.72         0.00      6059.59
```

- As natural flows represent the flow as if “man wasn’t there”, negative natural flows are not “physically-based” and likely caused by data inconsistencies.
- Use the *.xbi file to trouble shoot issues with negative flows – likely they are caused by bad “data points”, often EOM reservoir contents.

*Yampa River Model *.XBI File Excerpt*

Naturalized Flow Information ACFT

Year	Mon	Day	River ID	Gauged Flow (1)	Import (-) (2)	Divert (+) (3)	Return (-) (4)	Well Dep (+) (5)	Delta Sto (+) (6)	Net Evp (+) (7)	Total Base Flow (8)	w/o (-) Base Flow (9)
1982	OCT	31	09238900	1702.	0.	118.	0.	0.	-769.	24.	1074.	1074.
1982	NOV	30	09238900	1160.	0.	83.	0.	0.	1359.	-2.	2600.	2600.
1982	DEC	31	09238900	547.	0.	84.	0.	0.	-731.	-23.	-123.	0.
1983	JAN	31	09238900	413.	0.	90.	0.	0.	533.	-25.	1010.	1010.
1983	FEB	28	09238900	359.	0.	76.	0.	0.	-50.	-7.	379.	379.
1983	MAR	31	09238900	422.	0.	165.	0.	0.	-825.	12.	-226.	0.
1983	APR	30	09238900	489.	0.	155.	0.	0.	187.	28.	858.	858.
1983	MAY	31	09238900	5256.	0.	163.	0.	0.	209.	55.	5683.	5683.
1983	JUN	30	09238900	28428.	0.	187.	0.	0.	-222.	78.	28471.	28471.
1983	JUL	31	09238900	16160.	0.	243.	0.	0.	0.	74.	16477.	16477.
1983	AUG	31	09238900	1201.	0.	247.	0.	0.	1576.	64.	3088.	3088.
1983	SEP	30	09238900	156.	0.	205.	0.	0.	-1268.	57.	-850.	0.

Recommended actions to correct negative natural flows:

- Determine which gages have instances of negative flows using the Log file
- Query the Natural Flow Output file (*.xbi) for each gage with negative flow to determine the month and year (Column 8 does not equal 9)
- Use TSTool to graph the monthly diversions, reservoir content, and streamgage data to check for obvious data errors
- More detailed/specific calibration efforts will be discussed next time

General Checks for Gains and Losses

- Before man's influence, "losing" reaches are not expected
- Check that natural flows increase from upstream to downstream
    - Use TSTool to quickly add natural flows in the *.xbm file above each gage to assure they are equal or greater to the natural flow estimated at the gage.

Estimating Natural Flows Using Other Methods

Incorporate externally developed natural flows. Data inconsistencies or lack of measured data can lead to inaccurate natural flow estimates at gaged or ungaged locations. Natural flows estimated from an alternative method can be used to over-ride estimates from StateMod using a data-centered approach. An example of this occurs in the San Juan/Dolores Model, whereby estimates of natural flows on McElmo Creek are replaced with estimates generated from the VIC model using TSTool.

```
#  xbg_replace.commands.TSTool
#  Replaces StateMod estimated baseflows on McElmo Creek with baseflows
#      generated by the VIC model.  Replace after StateMod baseflow generation at
#      gages, before Mixed Station Model
#
SetOutputYearType(OutputYearType=Water)
09339900...MONTH~StateMod~C:\CDSS\Data\sj2009\StateMod\sj2009_CRWAS.xbg
09341500...MONTH~StateMod~C:\CDSS\Data\sj2009\StateMod\sj2009_CRWAS.xbg
09342000...MONTH~StateMod~C:\CDSS\Data\sj2009\StateMod\sj2009_CRWAS.xbg
09371400...MONTH~StateMod~C:\CDSS\Data\sj2009\StateMod\sj2009_CRWAS.xbg
09371420...MONTH~StateMod~C:\CDSS\Data\sj2009\streamSW\McElmo_VIC.stm
09371500...MONTH~StateMod~C:\CDSS\Data\sj2009\streamSW\McElmo_VIC.stm
09372000...MONTH~StateMod~C:\CDSS\Data\sj2009\streamSW\McElmo_VIC.stm
09379500...MONTH~StateMod~C:\CDSS\Data\sj2009\StateMod\sj2009_CRWAS.xbg
09179500...MONTH~StateMod~C:\CDSS\Data\sj2009\StateMod\sj2009_CRWAS.xbg
WriteStateMod(TSList=AllTS,OutputFile="sj2009_CRWAS2.xbg",Precision=0)
```

Additional Tips

- Can use short-term or Administrative gages to review/revise natural flows
- Previous CDSS models used the Mixed Station Model (MSM) to fill missing natural flows; complete datasets (i.e. diversions, reservoir contents, streamflow) will be developed for the SPDSS models therefore MSM will not be needed
- With complete datasets, StateMod simulation option **Baseflow** will create natural flows at gaged locations and distribute to ungaged locations in a single simulation step
- Call your Water Commissioner – he/she will likely have a good idea of contributing flow from different tributaries

Interaction Between Basins – For Natural Flow Generation and Simulation

Transbasin Imports and "Imports" from other South Platte Tributaries

- Imports from other South Platte Tributaries can include portion of Transbasin Imports (e.g. C-BT water delivered via St. Vrain Supply Canal for use in the St. Vrain basin) or direct diversion or storage water delivered from another basin (e.g. releases from Highland Reservoir #2 in the St. Vrain to irrigate in the Big Thompson)
- Historical Imports will be treated as a streamgage (i.e. will be include in the *.rih file) on a mock "tributary"
- A Type 11 Plan Structure needs to be included on the tributary to temporarily "store" the water for the uses
- A Carrier Structure needs to be included on the tributary above the Plan Structure to act as a "carrier" to the Plan Structure, and to provide the water rights for diversion into the plan.
    - The Carrier Structure water right amount should be "set" in the *.ddr file to be greater than the maximum amount of the import. The priority should be set to 1.0000.
    - The capacity for the Carrier Structure should be set in the *.dds file to be greater than the maximum amount of the import. The efficiency should be set to 0% efficient, with 100 percent returning to the plan structure.
    - The monthly demand for the Carrier Structure should be set to "0" for the entire period.
- A Type 24 Operating Rule should be used to "store" the imported water into the plan, based on the Carrier Structure water right.
- Type 27 or 28 Operating Rules should be used to "release" the import water to the demands in the basin, including demands to export the water to another basin. The priorities should be set based on other water rights

used to satisfy the demands (e.g. junior to direct flow rights or reservoir releases).

- Type 29 Operating Rule needs to be included to “spill” the plan each time step with a very junior “priority”. Note that this will be a calibration point eventually to determine if you have the correct uses identified for the imported water.

“Exports” to other South Platte Tributaries

- Exports to other basins can include Transbasin Imports delivered to another basin (e.g. Denver Moffatt Diversions delivered via South Boulder Diversion Canal to Ralston Reservoir) or direct diversion or storage water released from another basin (e.g. City of Greeley demands for Big Thompson water)
- Exports to other basins will be represented as demand structures on the river
  - The Export Structure water right amount should be “set” in the *.ddr file to be “0”. The priority can be very senior (but junior to an associated Import, if applicable).
  - The capacity for the Export Structure should be set in the *.dds file to be greater than the maximum amount of the export. The efficiency should be set to 100% efficient.
  - The monthly demand for the Export Structure should be set to the desired amount of export.
- Type 27 or 28 Operating Rules should be used to “release” water from the associated plan or Type 2, 3, or 4 Operating Rules should be used to “release” water from a reservoir to the Export Structure demand based on the Export Structure water right priority set above.

Inflow Gages (St. Vrain and Model Representing WD 2, 7, 8, 9, 23, 80)

- Inflows are represented as historical streamflow in the *.rih file

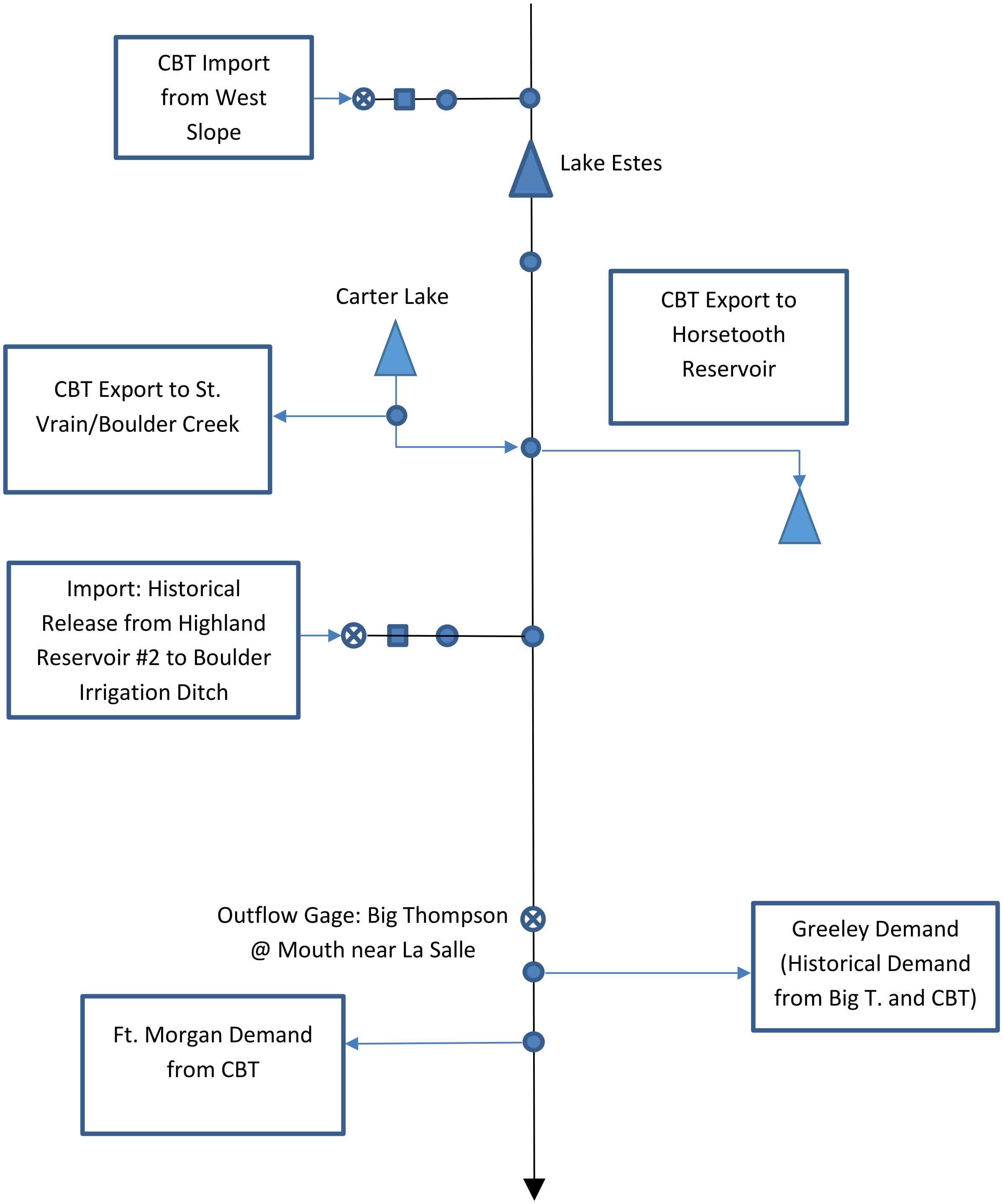
Outflow Gages

- The use of Outflow Gages as a “demand” attempts to represent the effect downstream senior water rights that may place a call up the tributaries.
- Historical downstream uses can be represented by historical gaged streamflows as an instream flow node.
    - The gage needs to be added as an “instream flow” node in the network, allowing it to be included in the *.ifs file.
    - An instream flow water right should be set to “senior” to the typical downstream (WD 1 and 64) calling rights in the *.ifr file.
    - Annual instream flow demands should be set to historical streamflow in the *.ifa file.

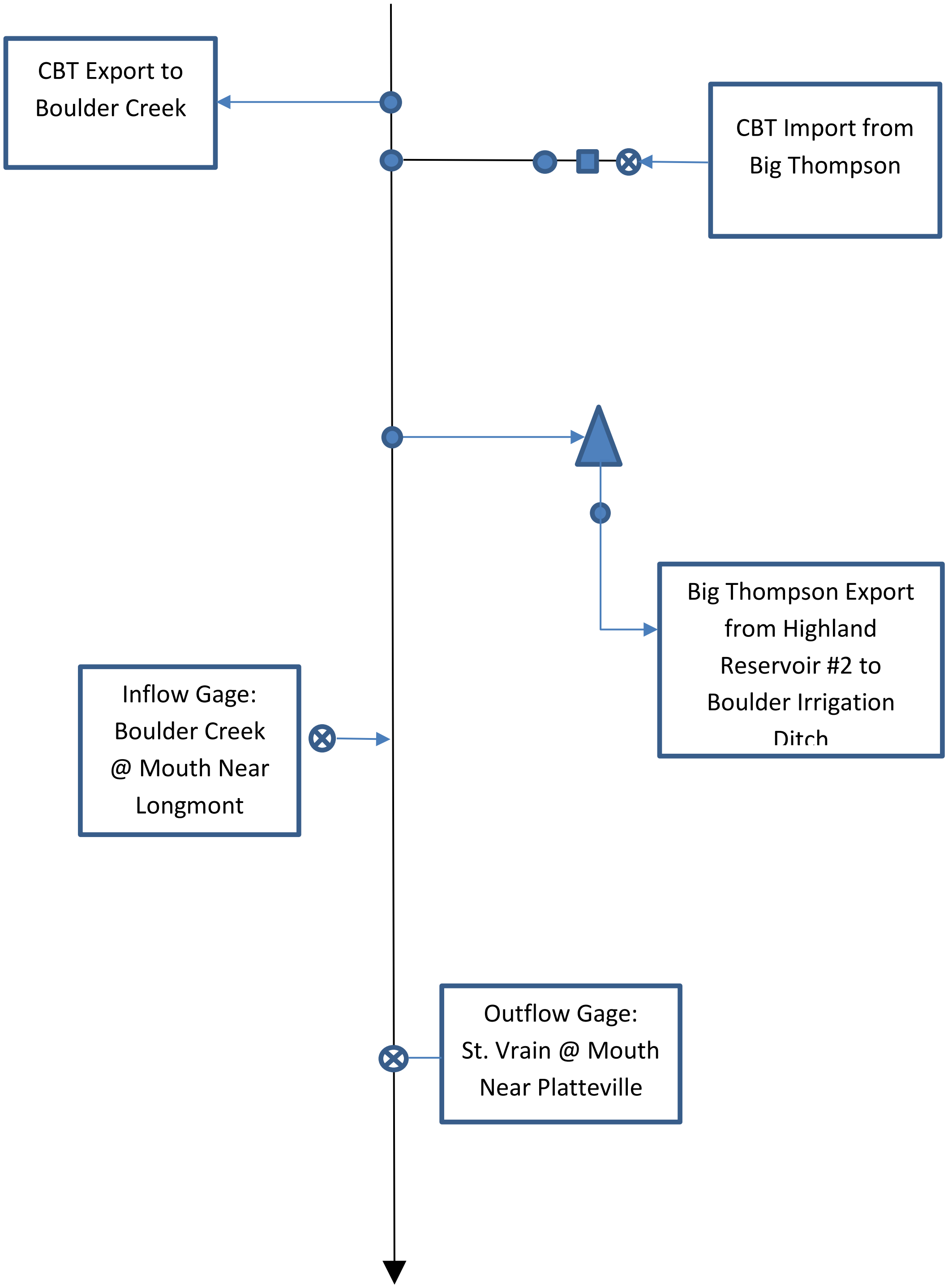
Irrigation Return Flows between South Platte Tributaries

- During model development, identify location of irrigation return flows and determine if significant return flows contribute water to another South Platte Tributary.
- The team will determine on a case-by-case basis if those return flows need to be “imported” into the other tributary, or if it only needs to be handled during Model Integration.

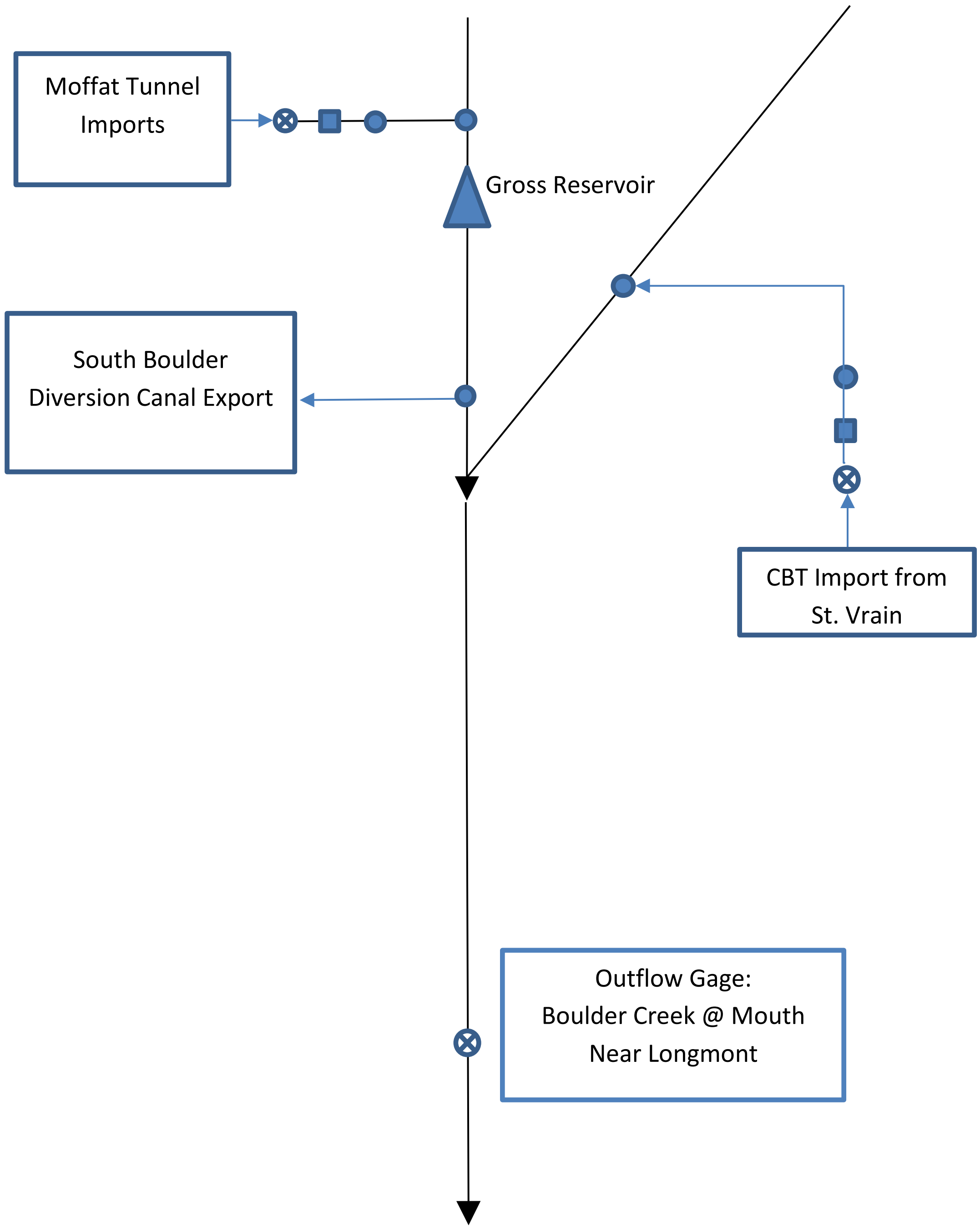
Big Thompson



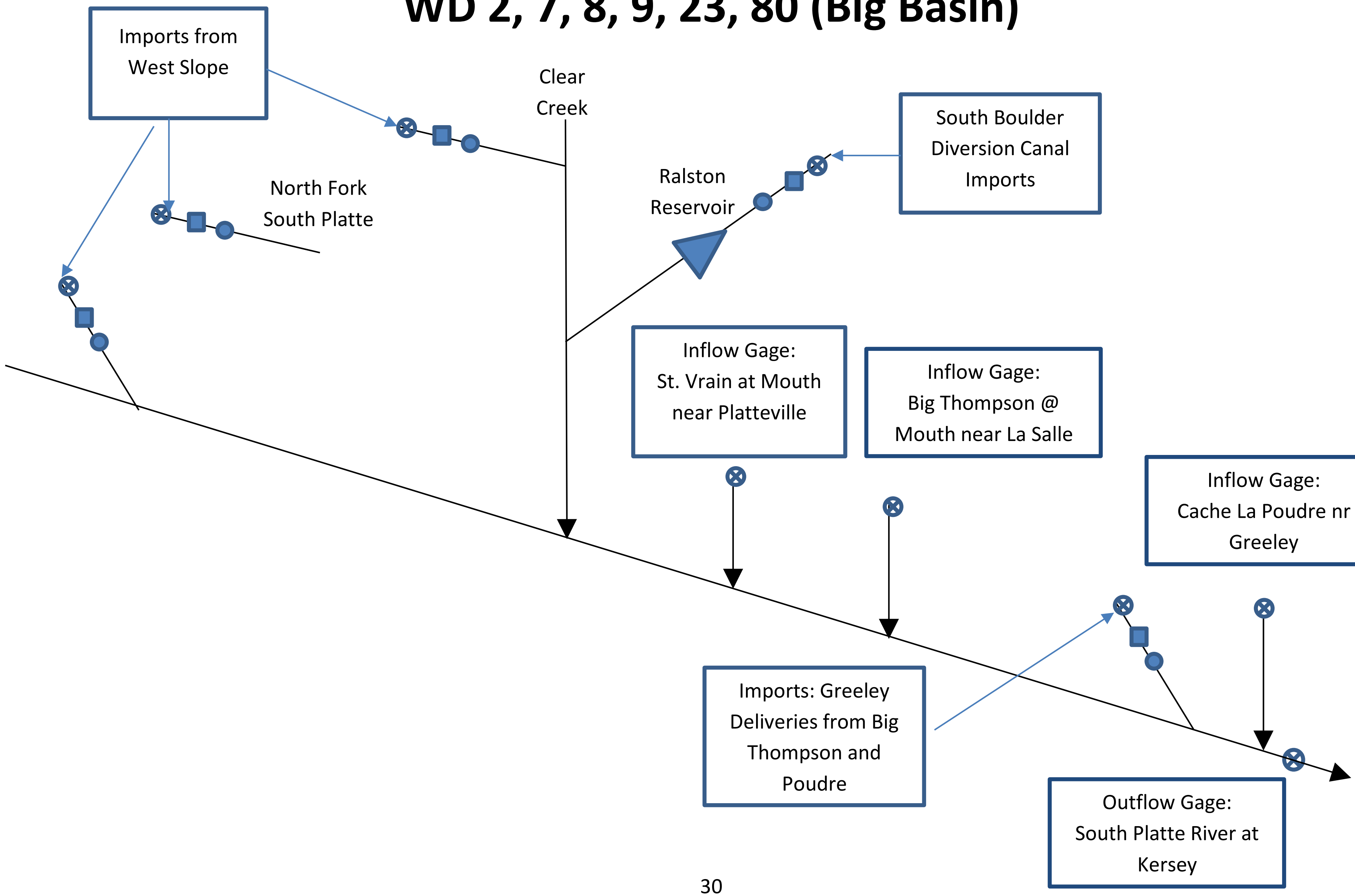
St. Vrain


CBT Export to Boulder Creek
CBT Import from Big Thompson
Big Thompson Export from Highland Reservoir #2 to Boulder Irrigation Ditch
Inflow Gage: Boulder Creek @ Mouth Near Longmont
Outflow Gage: St. Vrain @ Mouth Near Platteville

Boulder Creek



WD 2, 7, 8, 9, 23, 80 (Big Basin)



Diversion Coding and Off-channel Demands

Diversion Coding

River diversions and reservoir releases are coded by source, location of source, use, type, and augmentation plan – known as Diversion Class, DivClass, or SFUTG. In addition, there are standard codes used in Water Commissioner Comments that provide information in lieu of diversion records.

The Diversion Records Standard (formerly called Water Commissioner Handbook) describes standard diversion and use codes and provides examples of how to code specific diversions. Important notes between pre- and post- November, 2010 coding include:

- Current SQL Server versions of HydroBase available to the public do not quite reflect all of the new coding information; specifically the newly added Accounts and TO portions of the water class
- Source codes 6, 7, and R were removed from the new coding
- Defined rules for the use of the FROM portion of the water class
- Changed Use code of Q; previously designated "Other", now means "Quantified"
- Added Use code of Z designating "Other"
- Added Type codes of D, J, F, L, Q, U, V, W, and R; removed Type code 3 and revised meaning of Type code 7
- Added several examples, contact DWR for your copy of the Diversion Records Standard

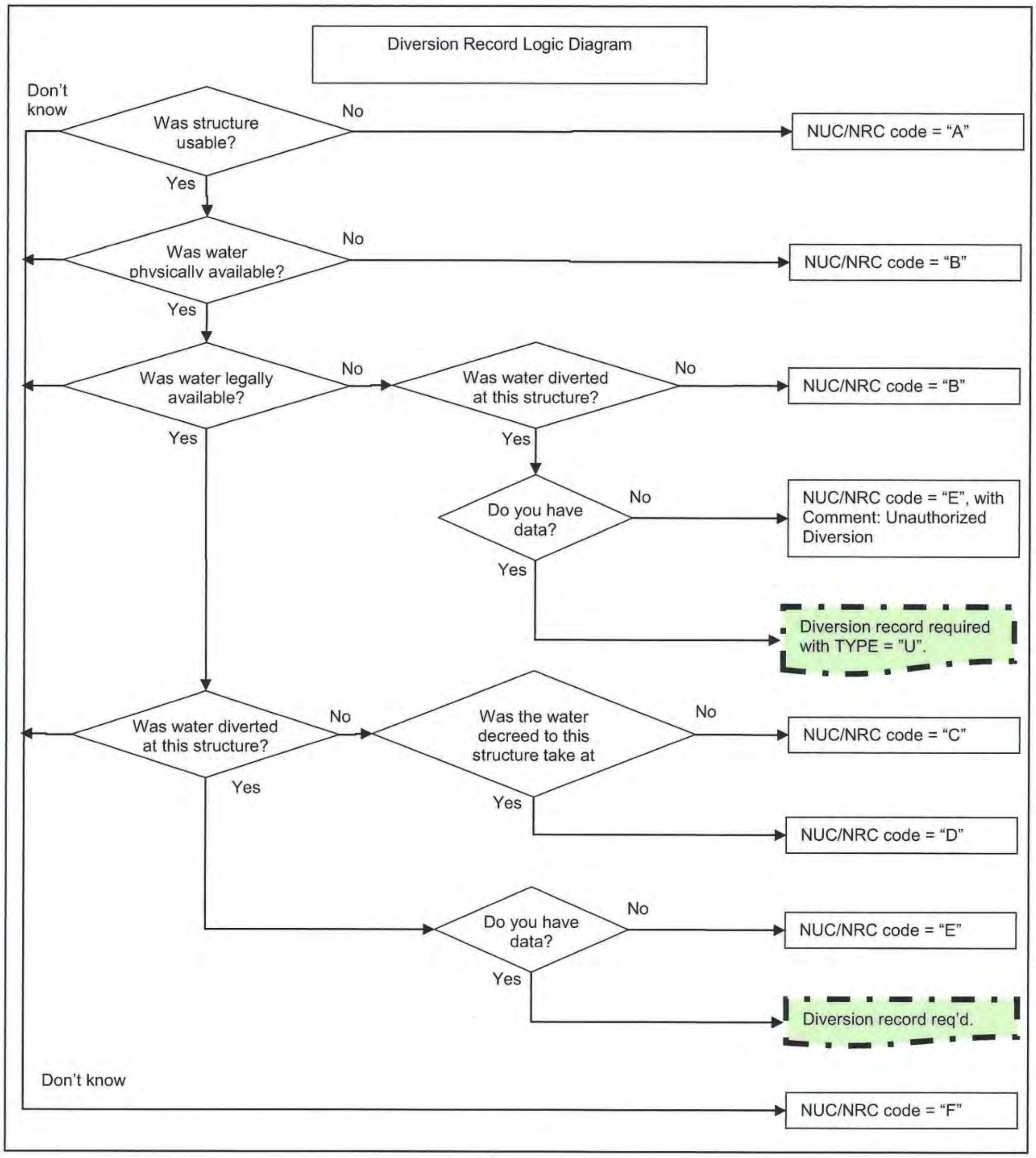
The Diversions Records Standard and associated diagrams are available on-line:

http://water.state.co.us/DWRIPub/DWR%20General%20Documents/Diversion_Records_Standard_Ver_1_6.pdf

http://water.state.co.us/DWRIPub/DWR%20General%20Documents/Diversion%20Water%20Class%20Coding%20Diagrams.pdf

Diversion Record Standard Coding, Post- November, 2010

Appendix A: Diversion Record Logic Diagram



Appendix B: Quick Guide to Diversion Record Codes

SOURCE Code[1]	
1	Natural Stream Flow
2	Reservoir Storage
3	Ground Water
4	Transbasin Water
5	Non-Stream Flow
8	Re-usable Water
X[2]	Unspecified

TYPE Code[1]	
	Blank is acceptable
Types of diversions	
1	Exchange
2	Trade
4	Alternate Point of Diversion
A	Authorized/Augmented
U	Unauthorized Diversion
D	Out-of-priority Depletion
J	In-priority Depletion
Types of releases	
7	Released to Stream
8	Released Off-stream
L	Release of Dominion and Control
E	Release of Excess Diversion
Q	Release of Quantified Amount
V[3]	Release to Alluvial Aquifer
W	Released Underground
Types of data	
0	Administrative Record Only
R	USE Only Volume Data

USE Code[1]	
0	Storage
1	Irrigation
2	Municipal
3	Commercial
4	Industrial
5	Recreation
6	Fishery
7	Fire
8	Domestic
9	Stock
A	Augmentation
B	Sub-basin export
C	Change of Use Return Flows
E	Evaporation
F	Federal reserved
G	Geothermal
H	Household use only
K	Snow making
M	Minimum stream flow/lake level
P	Power generation
Q	Quantification of amount
R	Recharge
S	Export from State
T	Transbasin export
W	Wildlife
Z	Other

OBSERVATION Code	
*	Observed
U	User Supplied - Unknown Reliability
K	User Supplied - Known Reliability
E	Estimated
C	Calculated

Not Used/Not Released Code (NUC/NRC)	
	Blank is acceptable
A	Structure not usable
B	No water available
C	Water available, but not taken
D	Water taken in another structure
E	Water taken, but no data available
F	No information available

Structure Type Allowed to have a Diversion Record[4]		
1	Ditch	N
2	Well	N
WG	Well Group	N
4	Spring	N
5	Seep	N
6	Mine	N
7	Pipeline	N
8	Pump	N
9	Power Plant	N
0	Other	N
M	Measuring Point	N
MF	Minimum Flow	N
R	Reach (Non-Aggregating)	N
WF	Well Field	A
3	Reservoir	A
RS	Reservoir System	A
RA	Recharge Area	A
AR	Aggregating Reach	A

Structure Type **NOT** Allowed to have a Diversion Record	
AQ	Aquifer NNT/NT Reservation
DS	Ditch System
EP	Exchange Plan
P	Augmentation/Replacement Plan

[1] For more complete definitions see Table 5-8, Table 5-9 and Table 5-10.
[2] SOURCE "X" should not be used as the only record for a structure as it provides no understanding regarding the SOURCE of water diverted.
[3] TYPE "V" releases are associated with water that will accrete to the natural stream.
[4] Structure Types are divided into "Aggregating" (A) and "Non-Aggregating" (N); see Section 9.2.

SUMMARY OF DIVERSION CODING..... SOURCES

SOURCE	CODE	COMMENTS
Natural Stream flow	1	Water available for Diversion in priority to satisfy water rights.
Reservoir Storage	2	Water that is actually stored in a Reservoir. Not flow through water.
Ground Water (Wells)	3	Both tributary and non-tributary waters. (The stream # in the structure file will identify the actual source in the diversion reports).
Transbasin	4	The same as transmountain; water imported from another basin
Non-Stream Sources	5	Springs and seepage
Combined	*6	A non-additive source code generally used when water is measured beyond the headgate where sources have been mixed. This code is used to keep from double accounting. At the intake the different sources are identified and the uses are not, while at the delivery points the source equals combined and the use is identified.
Transdistrict	7	Water imported from one sub-basin into another, both sub-basins being part of the same river basin.
Re-Used	8	Water used once and put back in stream to be re-used generally by exchange or for augmentation. Usually sewage effluent water from sources which may be fully consumed.
Multiple	9	Water with numerous sources that aren't separable. Differs from Combined in that each use is identified and Multiple source water totals in structure and district summaries. Another difference is that Multiple source water is only measured once whereas Combined water is measured twice.
Remeasured and Rediverted	R	Water that has been measured, diverted, and used later downstream.

SUMMARY OF DIVERSION CODING......USES

USAGE	CODE	COMMENTS
Storage	0 (Zero)	An intermediate use before the final beneficial use.
Irrigation	1	Water applied to crops
Municipal	2	Urban use
Commercial	3	Ordinary non-manufacturing: retail, stockyards, campgrounds, etc.
Industrial	4	Manufacturing, mining, steam power, etc.
Recreation	5	Non-consumptive (except evaporation)
Fishery	6	Non-consumptive (except evaporation)
Fire	7	emergency and intermittent use
Domestic	8	household, lawn & garden
Stock	9	livestock watering
Augmentation	A	augmentation water, maybe used with type=6 (replacement to river)
Export from Basin	B	Water being diverted from one sub-basin to another in the same basin and or remeasured and coded as to actual use.
Evaporation	E	Non-beneficial use
Geothermal	G	Non-consumptive (except evaporation)
In House	H	Household use only
Snow making	K	Non-consumptive
Min. Stream flow	M	As defined in statute and used in decrees.
Power Generation	P	Non-consumptive
Other	Q	Used with a type code; when the use is recorded elsewhere or there is no actual beneficial use.
Recharge	R	Water used for ground water recharge
Export from State	S	Water being diverted out of state
Transmountain Export	T	Water diverted from one basin to another
Wildlife	W	Non-consumptive

SUMMARY OF DIVERSION CODING......TYPES

TYPES	CODE	COMMENTS
		Blank is acceptable
Administrative Record Only	* 0 (Zero)	Water that is recorded for administrative purposes.
Exchange	1	Where water is diverted out-of-priority at one structure and replaced at another.
Trade	2	A particular part of an exchange where the release is not back to the stream but directly into the effected structures
Carrier	3	Water diverted into a "carrier" ditch or canal within a district and remeasured for diversion and actual use in the same district. Used to avoid duplication of "Uses"
Alternative Point of Diversion	4	Decreed water rights taken in another structure
Re-Used	5	(this code was replaced by Source equals reused and is no longer used as a type code).
Replacement to River	*6	Water replaced as exchange for upstream diversions. Water released for augmentation plans also fall in this category.
Released to River	*7	River being used as a carrier for water to be picked up downstream or water released for no beneficial use.
Released to System	*8	Water released so that it can be picked up and measured in another structure.
User-supplied Information	+9	Diversion information supplied by the user that has not been verified. After 1992, not used as a type code.
Augmented	A	Used only for augmented water. The use of augmented water would be the beneficial use it was being put to.
Geothermal	G	Geothermal
Reservoir Substitution	S	Release made by upstream reservoir in lieu of a release by a downstream reservoir when no exchange between reservoir exist

* water does not add into structure totals

+After 1992, user supplied data is notated in a special field tied to each daily amount field.

CURRENT IN USE CODES

A	Active structure with contemporary diversion records
B	Structure Abandoned by the court
C	Conditional structure
D	Duplicate, ID is no longer used
F	Structure used as FROM number-located in another District
H	Historical structure only-no longer exists or has records, but has historical data
I	Inactive structures which physically exist but no diversion records are kept
N	Non-existent structure with no contemporary or historical records
U	Active Structures but diversion records are not maintained

When a structure with a CIU of A (Active structure with contemporary Diversion Records) has no diversion records for the current year, the Not-Used-Codes (NUC) and in the case of recorded releases from Reservoirs, the Not-Released-Codes (NRC), are used:

NOT-USED AND NOT-RELEASED CODES

A	Structure is not usable
B	No water is available
C	Water available, but not taken
D	Water taken in another structure
E	Water taken but no data available
F	No information available

Diversion Coding Trends in the South Platte Basin

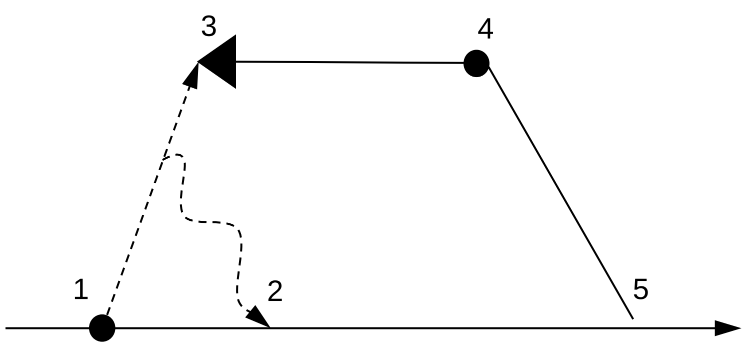
- Diversions to off-channel storage were not commonly recorded during 1950 to the mid-1970s, primarily because water commissioners were seasonal workers. Prior to that time, diversions to storage can be calculated using the change in EOM contents from one month to the next (i.e. if the EOM contents are greater in the following month, the reservoir stored).
- Diversions to storage were commonly recorded under the reservoir ID from the mid-1970s to the late 1980s in Water Districts 1, 2, 5, 6, and 64.
- Diversions to storage were commonly recorded at the carrier headgate (using S:1 U:0 coding) from the late 1980s thru present.

- Diversions to irrigation were commonly coded at the headgate for the entire period (using S:1 U:1); releases from storage for *down-ditch* irrigation are generally not recorded and must be calculated using the change in EOM contents from one month to the next (i.e. if the EOM contents are less in the following month, the reservoir released).
- “Carried” water was commonly coded as S:1 U:Q T:3 and was considered water that was carried through the headgate for many different uses. Coding for the structures that received the carried water was supposed to indicate the destination of this water, but is often not recorded. This carried water may include diversions for recharge, diversions turned out at an augmentation station or other uses, but it is difficult to quantify. Discuss the use of this diversion coding with the Water Commissioner.

Off-Channel Demands

Diversions to both off-channel reservoirs and irrigation demands are more common in the South Platte than in other basins. Therefore, it was necessary to develop a methodology to model them in both the StateCU and StateMod analyses. This approach allows:

1. Natural flows to be calculated correctly without special considerations of natural flow gage locations,
2. Total historical diversion from the river remain at the river location,
3. End-Of-Month (EOM) contents in the reservoir are represented by historical values (if a reservoir is part of the system),
4. Return flows are accounted for at the correct locations and are operated either by variable efficiency (for irrigation structures) or by a constant efficiency (for carrier structures).



Simple Off-Channel Demand Schematic

1. River Diversion (WDID_C)
2. Carrier Return Flow
3. Off Channel Reservoir
4. Off Channel Demand (WDID_I)
5. Demand Return Flow

River Diversion (Location 1)

- Historical Diversions are equal to all water diverted to storage and to other demands from this location (i.e. DivTotal)
    - As discussed above in Diversion Coding trends, some diversions to storage are calculated, not measured.
- The structure is set is 0% efficient in the Baseflow Direct Diversion File (*_N.dds), with locations set as follows:
    - The conveyance loss portion will be returned based on the location(s) and percentage(s) to each location designated in the Direct Diversion Station (*.dds) file in StateMod. *This is represented by Location 2.*
    - Total diversions less ditch loss will be returned to the upstream most node in the off channel system based on location and percentage in the *.dds file. *This is represented by Location 3.*
- In the *.dds file additional information needs to be set so that the basin wide summary tables do not double account diversions for these systems:
    - irturn(1) set to 3 – carrier,
    - demsrc(1) set to 7 – carrier structure.

Off Channel Reservoir (Location 3)

- End-of-month values in the *.eom file are based on historic end-of-month measured or calculated values.
- Operating rules diverting water to storage via Location 1 are included in the *.opr file.

Off Channel Demand (Location 4)

- Historical Diversions are equal to water delivered from River Diversion (Location 1) minus transit losses plus releases from Reservoir (Location 3)
    - Reservoir releases are calculated based on changes in end-of-month values, after evaporation is accounted for.
- Return flow location(s) and percentage(s) are based on locations of returns from the use at Location 4 and are located in the *.dds file for this structure. *This is represented by Location 5*.

- Operating rules diverting water to the off channel demand via Location 1 are included in the *.opr file. Operating rules releasing water from Location 3 to the off channel demand are included in the *.opr file.

The off channel "tributary" will be connected to the network at the furthest downstream location of return flows from the off channel demand(s). Natural Flow calculations on the mainstem of the river network will be calculated correctly in all instances because:

- The river sees the entire historic diversion at Structure 1,
- Return flows from carrier losses are accounted for in their correct location,
- Returns from the river diversion to the off channel "tributary" are balanced by:
  - Increases in storage,
  - Diversion at off channel demand structure(s),
- Reservoir releases are balanced by diversions at off channel demand structure(s),
- And return flows from off channel demands are accounted for in their correct location.

Simulations (forward mode) will model the system correctly because all demands (reservoir, irrigation, etc.) on the off channel system will be satisfied by carried water from River Diversion (Location 1) by operating rules. This will ensure that water is delivered only in amounts up to what is needed on the off channel system. If setup correctly, there will not be excess water returning from the off channel system via the physical network connection (via the river).

Demands in the *.ddm will be simulated as:

- Set to zero for River Diversion (Location 1),
- Targets at Reservoir (Location 3)
  - Historical – historical end-of-month content
  - (Calculated and Baseline – capacity)
- Demands at Off-Channel Demand (Location 4)
  - Historical – same values as in the *.ddh estimated for this structure

- (Calculated and Baseline – irrigation water requirement based)

Reservoir water rights will be located at the reservoir and operating rules will carry water to the reservoir from the river through River Diversion (Location 1) using the reservoir right as the source water right. Diversion rights will be located at the river headgate and operating rules will carry water to the off channel demand from the river through River Diversion (Location 1) using the diversion right as the source water right.

Big Thompson River Example – Consolidated Home Supply Ditch and Reservoir Company

The Consolidated Home Supply Ditch and Reservoir Company was identified as a "key water use facility" therefore the Company manager and Water Commissioner were interviewed to understand the operations of this system. The results of this interview were documented in the SPDSS Task 5 - Key Structure, Consolidated Home Supply Ditch and Reservoir Company memorandum. This memorandum laid the framework for how the off-channel demands were implemented in the StateCU analysis; and in this example, how the off-channel demand would be implemented in StateMod.

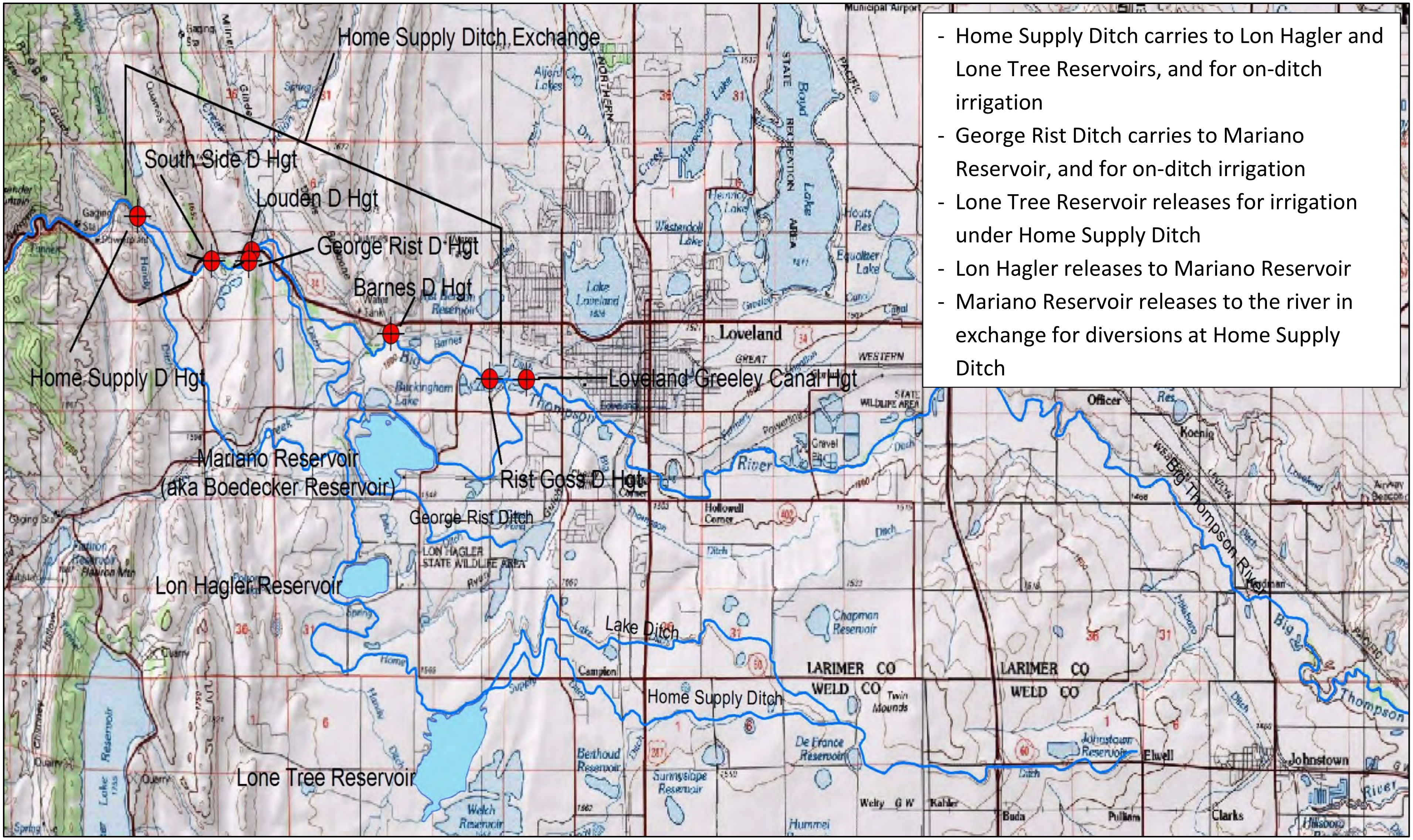
SYSTEM OVERVIEW

The Consolidated Home Supply Ditch and Reservoir Company (the Company) provides direct flow water and storage water to irrigators located south of the Big Thompson River and the City of Loveland. The Company was incorporated in the late-1800s and consists of 2,001 outstanding shares of stock. Municipal water supplies for the Town of Johnstown are provided through the Company's facilities and Johnstown owns approximately 10 percent of company stock. Johnstown is the major shareholder in the Company and is the only municipal interest in the Company. The remaining shares of Company stock are used for irrigation purposes within the service area. Shareholders are entitled to equal portions of water supplies available pursuant to the ditch company's rights holdings.

Direct flow water is conveyed for direct irrigation uses and storage in company reservoirs through the Home Supply Ditch headgate. Storage units owned by the Home Supply Ditch include Lone Tree Reservoir, Lon Hagler Reservoir, and Mariano Reservoir (aka Boedecker Reservoir). The ditch company also uses transbasin water from the Colorado Big Thompson (C-BT) Project.

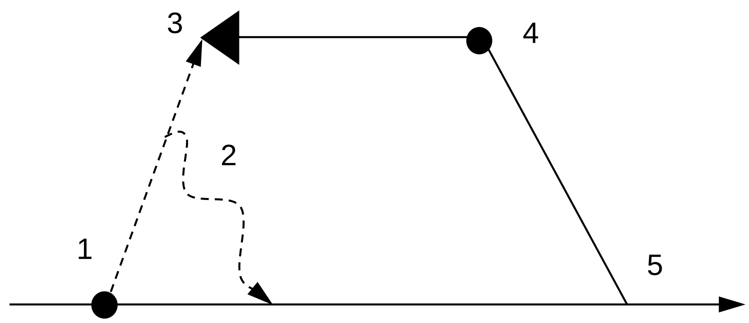
Key structures identified in the Home Supply Ditch System are as follows

1) Home Supply Ditch
2) Lone Tree Reservoir
3) Home Supply Ditch Exchange Reservoir System
    - Mariano Reservoir
    - Lon Hagler Reservoir


- Home Supply Ditch carries to Lon Hagler and Lone Tree Reservoirs, and for on-ditch irrigation
- George Rist Ditch carries to Mariano Reservoir, and for on-ditch irrigation
- Lone Tree Reservoir releases for irrigation under Home Supply Ditch
- Lon Hagler releases to Mariano Reservoir
- Mariano Reservoir releases to the river in exchange for diversions at Home Supply Ditch
Home Supply Ditch Exchange
South Side D Hgt
Louden D Hgt
George Rist D Hgt
Barnes D Hgt
Home Supply D Hgt
Loveland Greeley Canal Hgt
Mariano Reservoir
(aka Boedecker Reservoir)
Rist Goss D Hgt
George Rist Ditch
Lon Hagler Reservoir
Lake Ditch
Home Supply Ditch
Lone Tree Reservoir
Big Thompson River
Loveland
LARIMER CO
WELD CO
Johnstown

Development of Off-Channel Demand Information

River Diversion (Location 1) = Home Supply Ditch (0400524)



- Historical Diversions are currently calculated as:
    - For 1950 – 1964 and 1966: There are no recorded diversions to storage, therefore total diversions under 0400524 + calculated diversions to storage in Lon Hagler Reservoir (0404136) and Lone Tree Reservoir (0404137).
        - Calculated diversions to storage are based on the difference in monthly EOM contents, plus net monthly evaporation, plus conveyance loss. This "moves" the diversions back to the headgate.
    - For 1965, 1967 – 1993: Total diversions under 0400524; includes diversions to irrigation and to storage.
    - For 1994 – 2006: Additional diversions are stored under the reservoirs, therefore total diversions under 0400524 + total diversions under reservoirs (0404136 and 0404137).

Review diversion coding and know where your diversions to storage are measured for the entire study period - make adjustments as necessary and remember to contact your Water Commissioner.

- Conveyance efficiency and return flow information was discussed in the Task 5 memorandum; review information prior to implementing in the model.
    - Develop Natural Flow Direct Diversion Station (*_N.dds) and Simulation Direct Diversion Station (*.dds) reflecting correct return flow locations/timing (*Location 2*) during each mode of model execution.

- The difference between the two *.dds files is the location and percentages of return flows at the carrier structure.

Conveyance Efficiency: The Home Supply Ditch is considered a losing ditch but only experiences about 8 percent to 10 percent shrink down the ditch between the river headgate and Lone Tree Reservoir. The Home Supply Ditch has not historically benefited from significant amounts of return flows from and runoff from up-gradient lands.

Return Flow Locations: Return flows from lands irrigated by the Company water supplies typically accrue based on their location:

- Return flows from irrigated parcels located above Lone Tree Reservoir accrue to South Side Ditch system.
- Return flows from irrigated parcels located north of the Home Supply Ditch below Lone Tree Reservoir accrue to the Big Thompson River, and
- Return flows from irrigated parcels located south of the Home Supply Ditch below Lone Tree Reservoir accrue to the Little Thompson River.

Off Channel Reservoir (Location 3) = Lon Hagler Reservoir (0404136) and Lone Tree Reservoir (0404137)

- Historical End-of-month contents are stored as daily records. The nearest daily value to the end of the month is used to create a monthly time series, and then if necessary, missing data is filled using interpolation (maximum of 2 missing months), pattern gages, and then historical month average.
- Operating rules need to be developed to divert water to storage via Home Supply Ditch to Lon Hagler Reservoir (0404136) and Lone Tree Reservoir (0404137) under the storage rights.

Off Channel Demand (Location 4) = Home Supply Ditch Irrigation Demand (0400524_I)

- Historical Supply to irrigation are currently calculated as the total diversions under Home Supply Ditch (0400524), minus specific diversion classes for diversions to storage, scaled by 90 percent conveyance efficiency, plus releases from Lone Tree Reservoir (0404137).
- Develop Direct Diversion Station (*.dds) reflecting correct return flow locations/timing (*Location 5*) for the irrigated acreage.

- Operating rules need to be developed to divert water to irrigation via Home Supply Ditch to the Home Supply Irrigation Demand (0400524_I), and operating rules to release from Lone Tree Reservoir (0404137) to the Home Supply Irrigation Demand (0400524_I).

SPDSS Surface Water Model – Workshop 2
October 16, 2013

Agenda

1. Model Team Update on Basin Progress (60 minutes)
    - CBT Update
    - Schedule Review, including Workshop #3
    - General Issues and Questions
2. Return Flow Delay Pattern Guidelines (20 minutes)
3. Plan Structures – Definition and Types (15 minutes)
4. Changed Water Right Representation
    - Accounting Plans (45 minutes)

    Break (10 minutes)

    - Terms and Condition Plans (30 minutes)
    - Reuse Plans (20 minutes)
5. Augmentation Plan Representation (45 minutes)

CBT Update

WWG will send the following by 10/25.

Based on discussions with Northern, CBT and Windy Gap supply will NOT be split for the planning model efforts.

1. Monthly CBT/Windy Gap deliveries **TO** your basin in standard StateMod format (*.stm)
2. Monthly CBT/Windy Gap deliveries **FROM** your basin in standard StateMod format
3. Historical EOM contents for Lake Estes, Carter Lake, and Boulder Reservoir in standard StateMod format
4. List of ditches and municipalities who receive CBT shares in your basin; current share distribution
    - Do not plan to split CBT into "share accounts" for modeling
    - Recent share percentage/deliveries will be used to help with calibration only

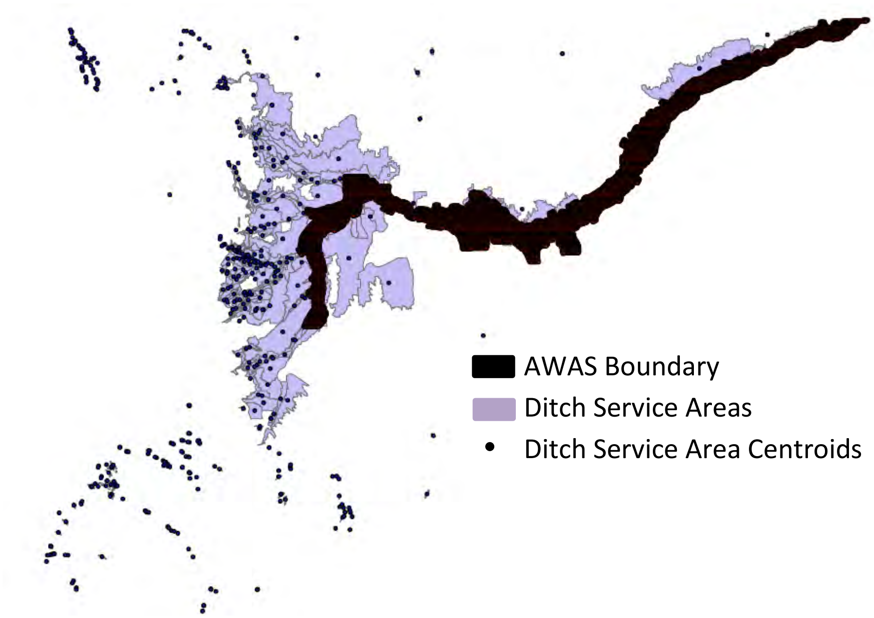
Project Schedule

	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Review Basin Information, Develop Preliminary Model Network and Baseflow Area/Precipitation Parameters (may not include plan structures, gravel pits)																				
Modeling Workshop 1 (Data-Centered Approach, Interaction between Basins, Baseflow Parameters, Diversion Coding and Off-channel Demands)	X																			
Finalize Streamflows, Historical Diversions (SW and GW) and Reservoir EOM Content Data																				
Modeling Workshop 2 (Plan Structures, Operating Rules)			X																	
Finalize Demands																				
Model Workshop 3 (Calibration)						X														
Finalize Step 1 Calibration (Baseflows, Physical Calibration of Structure Locations and Return Flows)																				
Incorporate Changed Ditch Shares/Augmentation Plans/Recharge																				
Complete Operating Rules																				
Finalize Step 2 Calibration (Current Operations)																				
Complete Model Documentation																				
Final Input Files and Documentation to Model Integrator Team															X					
Assist Model Integrator Team																				
Complete Integrated Model																				
Calibrate Integrated Model																				
Finalize Integrated Model Documentation																				X

Return Flow Monthly Delay Pattern Guidelines

1. Develop using Glover analytical solution (can use AWAS Model or other)

   - AWAS GIS tool and layer download http://www.ids.colostate.edu/projects.php?project=spgis&breadcrumb=SPGIS
   - Latest Version of IDS AWAS http://www.ids.colostate.edu/projects.php?project=awas

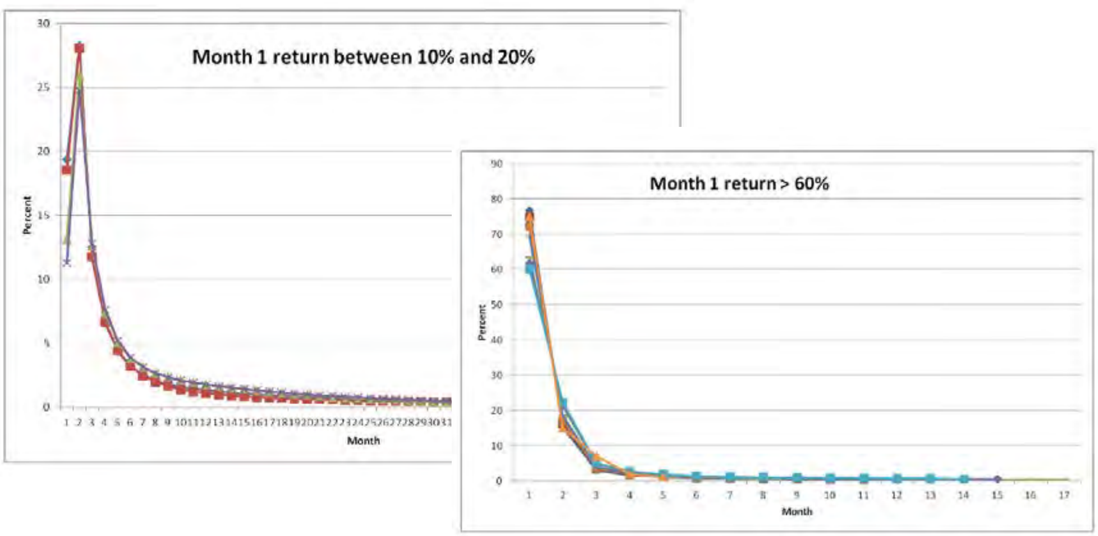


2. AWAS Model - Centroid of area of interest within AWAS Boundary
   - Provide AWAS with UTM location of interest from GIS
   - AWAS will use Effective Transmissivity and Specific Yield at that location
   - AWAS will calculate Distance to Boundary and Distance to Stream based on UTM location

3. AWAS Model – Centroid of area of interest outside AWAS Boundary
   - Estimate parameters and enter into AWAS Model
   - CDM recommended T=1000 ft^2/day for Western Tribs and T=200 ft^2/day for areas east of South Platte; Sy = 0.17

- More extensive Transmissivity and Specific Yield raster grids are available at http://cdss.state.co.us/GIS/Pages/Division1SouthPlatte.aspx
- SPDSS Task Memo 43.3 discusses the alluvial properties

4. Patterns per Tributary?
    - Based on general location of irrigated lands and variation in ground water parameters
    - ~ 7 adequately represent surface water diversions in WD 1 and 64
    - In general, unique patterns for each GW-only aggregate



5. Delay Pattern Normalization
    - Recommend maximum of 3-years of monthly lag or lag pattern cut off of 2 percent (whichever is less)
    - Normalize remaining lag percentages proportionally using the ratio of each month return to total return

Return Flow Location Guidelines

1. Based on location of ditch irrigated acreage and local drainages

2. Can be revised during calibration

Plan Structures

StateMod includes "Plan" structures that allow specific types of administrative activities to be simulated and tracked (e.g. augmentation plans, terms and conditions associated with changed water rights, reusable supplies, etc.).

Refer to Section 3.9 and 7.23 in the StateMod Documentation (Version 13) for information on specific plan types.

Twelve plan types are currently available:

1. Terms and Conditions (T&C)
2. Well Augmentation
3. Reservoir Reuse
4. Non-Reservoir Reuse
5. *Reuse to a Reservoir from Transmountain Import*
6. *Reuse to a Diversion from Transmountain Import*
7. *Transmountain Import*
8. Recharge Plan from a Reservoir or Canal
9. *Out-of-Priority Diversion or Storage*
10. Special Well Augmentation (e.g. Designated Basin, Coffin Wells, etc.)
11. Accounting Plan
12. Release Limit Plan

As discussed in previous training sessions, the preferred modeling approach to representing and simulating transmountain imports does not use Plan Types 5, 6, and 7; these plan types will not be discussed herein.

Out-of-Priority Plans are generally used to represent out-of-priority diversions for direct use or to storage pursuant to specific agreements (e.g. Blue River decree diversions by Denver and Colorado Springs); these plans will not be discussed herein.

Plan Structure Model Input Files

Plan (PLN) File

- Lists Model ID and Name of All Modeled Plans
- Assigns Plan Type (1 thru 12)
- Created in Text Editor

Plan Return Flow (PRF) File

- Distribution/Timing to Route Canal Seepage (Recharge Plans)
- Return Flow Obligations (Terms and Condition Plans)
- Created in Text Editor

Reservoir Return Flow (RRF) File

- Distribution/Timing to Route Reservoir Seepage (Recharge Plans)
- Created in Text Editor

Plan Recharge (PLR) File

- Assigns Recharge Areas and Reservoir Rights to Augmentation Plans
- Created in Text Editor

Plan to Well (PLW) File

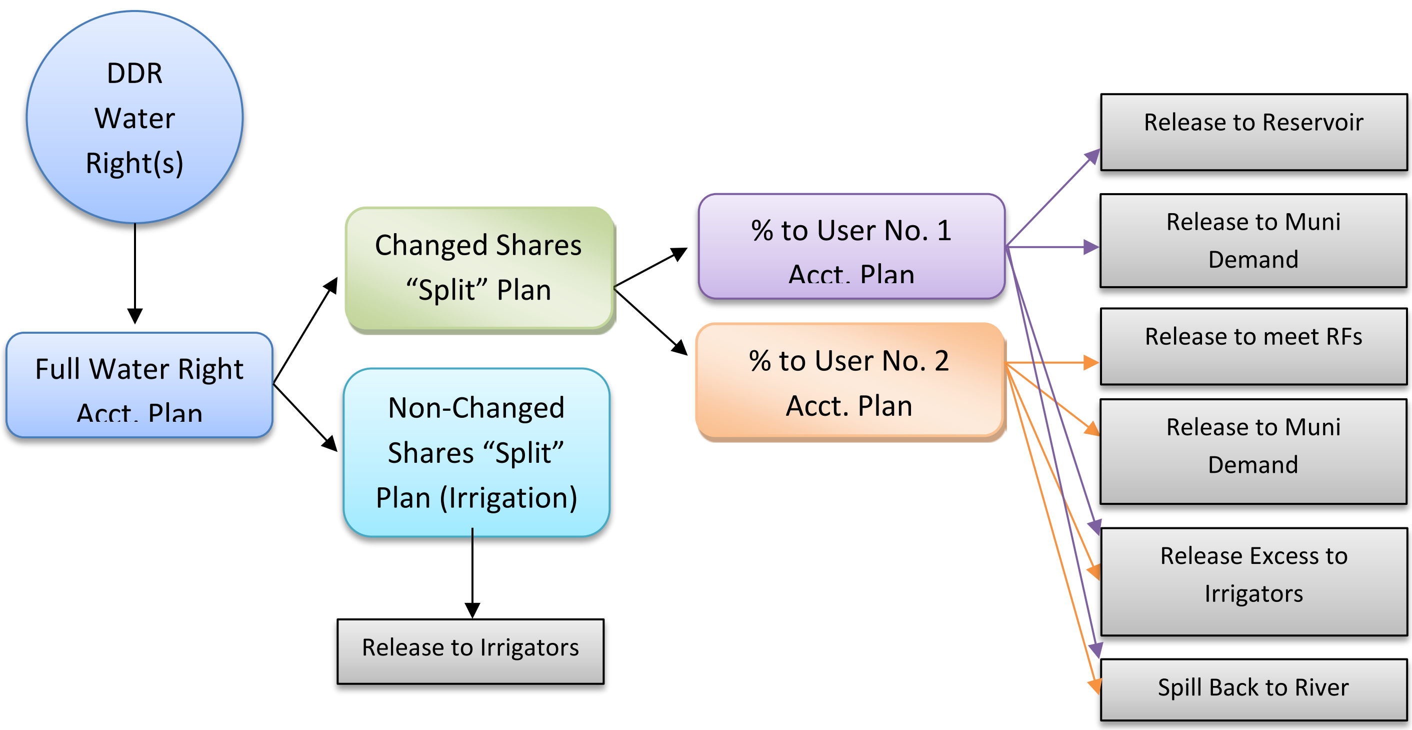
- Assigns Well IDs to Augmentation Plans, wells may be assigned to more than one plan
- Created using database/spreadsheets and Well IDs from the WER file (see further discussion below)

Operating Rule (OPR) File

- Directs StateMod to move water in and out of plans
- Created in Text Editor

Changed Water Rights Representation–Accounting Plans (Type 11)

Changed water rights, or water transfers, are represented in StateMod by "temporarily" diverting the water right into an Accounting Plan (Type 11) when in priority, then releasing the water from the plan in a "priority" defined by the user to meet a demand. Water is diverted into an Accounting Plan to "temporarily store" the associated water right when it is in priority. By placing the right in a plan, the order of its use can be set by the user; and the right can be used to meet multiple demands.



1. Divert water associated with one or more water rights into the Full Water Right Accounting Plan.
    a. Type 24 and 25 operating rules are used to "store" water in a Full Water Right Accounting Plan, and can include monthly and annual limitations, a portion or all of the water right, and intervening structures with/without a loss. Priorities of these operating rules are set to the same priority as the water right(s).
    b. Accounting Plans are used to ensure that any shortages are "shared" by all users

c. Include plan IDs in the PLN file and include on the network file.

2. Split changed water in the Full Water Right Accounting Plan to multiple users.
   a. Type 46 operating rules are used to split water in the Accounting Plan to individual users' Accounting Plans; a maximum of 10 split plans is allowed.
   b. Include plan IDs in the PLN file and include on the network file.
   c. Priorities of these operating rules are set just junior to the priority of the most junior water right in the Full Water Right Accounting Plan.

3. Release water in Accounting Plans to meet individual demands, including storage in reservoirs. If the demands are upstream, the model checks to assure exchange potential.
   a. Type 27 and Type 28 operating rules are used to "release" water in the Accounting Plans to meet specific demands in a "later" priority relative to the Users' other supplies.
   b. Operating rules can include intervening structures (to limit capacity), delivery losses, designation of return flow obligations (Terms and Conditions Plan, see further discussion below), and designation of reusable supplies (Reuse Plan, see further discussion below).

4. Release unused supplies from the Users' Accounting Plans back to the ditch.
   a. "Release" water from the Users Accounting Plans back to the ditch demand, if applicable, using Type 27 and 28 operating rules and priorities junior to all other plan demands.

5. Spill unused supplies from the Full Water Right Accounting Plan and Users' Accounting Plans back to the river.
   a. Accounting plans must "spill" each time step since water is not physically stored; use Type 29 operating rules with a priority junior to all other operations to spill each plan.

Changed Water Rights Representation – Terms and Condition Plans (Type 1)

Terms and Conditions (T&C) Plans (Type 1) are used to calculate and store future return flow (RF) obligations associated with the transfer of water rights. When a T&C Plan is specified, StateMod calculates the obligation "on-the-fly" for the month it occurs and all associated future months. Refer to Sections 3.9; 4.13.27; 4.13.28; and 7.23 in the StateMod Documentation (Version 13) for specific information on T&C Plans and how to incorporate the plans into operating rules.

RF obligations are not associated with operating rules that "store" water in an Accounting Plan; rather they are created when changed water is released from an Accounting Plan (i.e. "used" by a demand).

T&C Obligations are calculated based on the amount of water released from an Accounting Plan and the Return Flow Obligation Pattern.

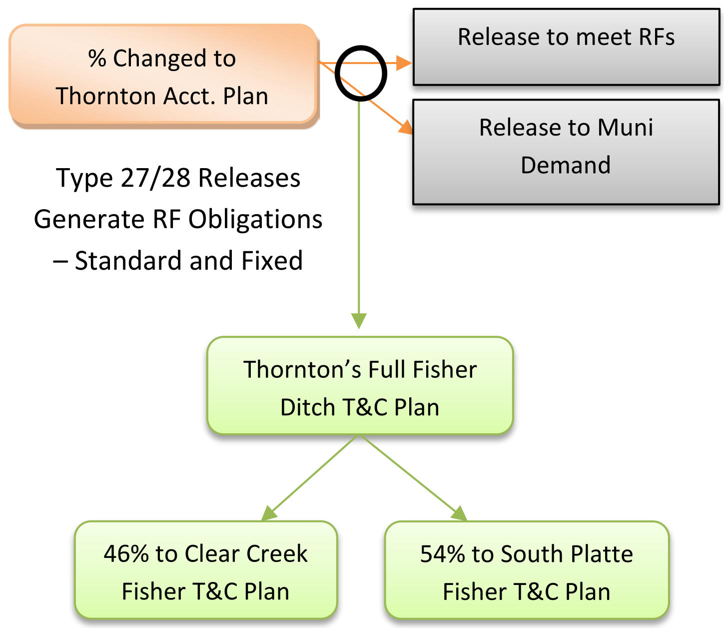
- **Standard Return Pattern** is similar to return flows generated through irrigation use, they are based on the "efficiency" during the time step of diversion = (Data in the return flow file (e.g. URM/DLY file)) * (Released Water) * (1.0-CU Factor), where the CU Factor is provided in Row 5 of the operating rule that releases water from an Accounting Plan.
    - CU Factor is the monthly percentage of diverted water "consumed" as defined in the change decree.
    - Associate the T&C Plan ID with Return Flow Location, Percent, and Return Table ID in the Plan Return File (PRF).

- **Fixed Return Pattern** is used when a decree "fixes" the percent of non-consumed water to be returned in a specific month, regardless of the month of diversion = (Data in the return flow file (e.g. URM/DLY file)) * ((Released Water).
    - Associate the T&C Plan ID with Return Flow Location, Percent, and Return Table ID in the Plan Return File (PRF).

- Generally used to represent "winter return flows" obligations based on the total amount released or "used" during the summer.
  - May require a return table ID in the URM/DLY to reflect the specific T&C for each plan.

- **Mixed Return Pattern** = Standard Return Pattern + Fixed Return Pattern
  - Standard generally used to represent diversion season (immediate or summer) obligations; Fixed used to represent winter obligations
  - "Coors Factors" are one example

Once RF obligations are stored in a T&C plan, the obligations become a demand that can be met either in-priority (e.g. the lagged RF accrue to the river during free river conditions and the demand is "met" using a Type 43 operating rule), or met by other supplies including reusable supplies, reservoir releases, other changed shares.



	Standard Return Pattern			**Fixed Return Pattern**
Month	CU Factor	1-CU Factor	**Month**	URM/DLY Factor
April	35%	65%	**November**	7.2%
May	48%	52%	**December**	5.9%
June	58%	42%	**January**	4.8%
July	60%	40%	**February**	3.9%
August	49%	51%	**March**	2.7%
September	27%	73%		
October	0%	100%		

Example Input Files

Plan File (PLN)

```
# ID         Name                        RiverLoc        ON/Off  iPtype     Peff     iPrf  iPfail    Psto1 Psource       IPAcc
#----------eb-----------------------eb----------eb------eb------eb------eb------eb------eb------exb----------eb------e
Fish_RFs     Fisher_Total_RFs            Fish_RFs             1       1       -1        1       0        0 0700570         0
Fish_CCkRFs  Fisher_RFsAbvCoAg           Fish_CCkRFs          1       1       -1        0       0        0 Fish_RFs        0
Fish_SPRRFs  Fisher_RFsAbvFulton         Fish_SPRRFs          1       1       -1        0       0        0 Fish_RFs        0
```

Plan Return File (PRF)

```
# Plan ID   NA                     Ret ID        Ret % Table #
#----------eb----------------------eb----------eb------eb------e
Fish_RFs                           Fish_CCkRFs    46.00       4
Fish_RFs                           Fish_SPRRFs    54.00       4
Fish_RFs                           Fish_CCkRFs   -46.00     110
Fish_RFs                           Fish_SPRRFs   -54.00     110
```

Return Flow File (URM/DLY)

```
# ID    No. Ret 1   Ret 2   Ret 3   Ret 4   Ret 5   Ret 6   Ret 7   Ret 8   Ret 9   Ret 10  Ret 11  Ret 12
#----------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------e
#
    110 12   7.2     5.9     4.8     3.9     2.7       0       0       0       0       0       0       0      24.5 'Fisher winter return flows
```

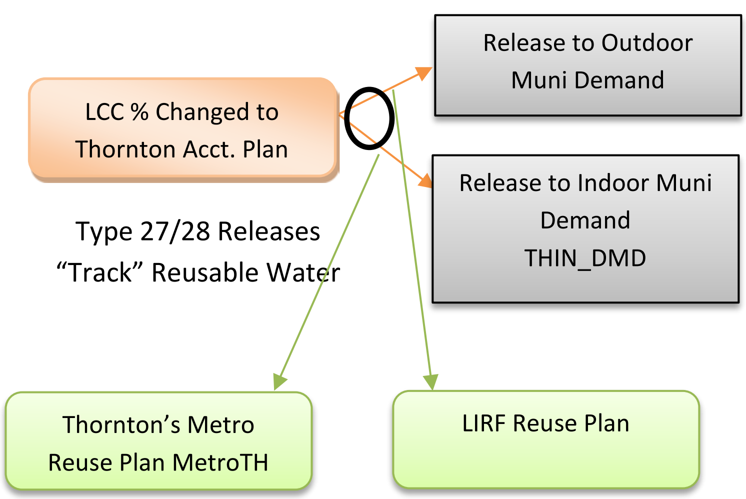
Operating Rule File (OPR)

```
#
# ID       Name                     NA                    Admin#   # Str  On/Off Dest Id      Dest Ac  Soul Id      Soul Ac  Sou2 Id      Sou2 Ac     Type
# ---------eb----------------------eb----------exxxxb----------eb------eb------e-b----------eb------e-b----------eb------e-b----------eb------eb------ex
# Release changed water rights down Lower Clear Creek Ditch to West Gravel Lakes
Fish.05    Opr_ThFish_To_WGravelLks                   55835.00003      3.       1 0203699            4 ThFishPln        100 Fish_RFs            3      27
                            0700570      10         Carrier
                            0700549       0         Return
                            0700547       0         Carrier
                            Fish.01
0.  0.   0.  0.  0. 35. 48. 58. 60. 49. 27.  0.
```

Changed Water Rights Representation – Reuse Plans (Type 3 and 4)

Reuse Plans are used to track (color) the quantity and location of fully-consumable return flows associated with the transfer of water rights. When fully-consumable water is used to meet a demand associated with a Reuse Plan, StateMod "places" the non-consumed water in the Reuse Plan based on the lagged RF pattern associated with the demand.

Refer to Sections 3.9; 4.13.27; 4.13.28; and 7.23 in the StateMod Documentation (Version 13) for specific information on Reuse Plans and how to incorporate the plans into operating rules. The following example uses reusable changed shares; the approach for using reusable transbasin diversions is similar.



Non-Reservoir Reuse Plans

1. Type 27/28 operating rules release water from LLC Accounting Plan to Thornton Indoor Demand (Note that Type 32/33 can also be used in lieu of Type 27/28)
   a. Return flow obligations are accounted for a T&C Plan.
   b. Efficiency and associated physical return flow location of diverted water (Metro WWTP) is defined in the *.dds file under the Thornton Indoor Demand structure (THIN_DMD).
   c. Associated reusable return flows are accounted from in Reuse Plan (MetroTH)
2. Type 48/49 operating rules "release" reusable effluent from Reuse Plan to meet return flow T&C plan demands, to meet reservoir demands, etc.
3. Type 29 operating rule "spills" unused water from Reuse Plan after associated demands have been met.
4. Water can be stored in Reuse plan for multiple time-steps (i.e. Lawn Irrigation Return Flows or LIRFS). Type 29 operating rule will only spill reusable water for the current time step.

Example Input Files

Plan File (PLN)

```
#
# ID        Name                     RiverLoc      ON/Off  iPtype    Peff    iPrf  iPfail    Psto1 Psource     IPAcc
#----------eb----------------------eb----------eb------eb------eb------eb------eb------eb------exb----------eb------e
#
MetroTh     MetroThnPlan             MetroTh            1       4       0       0       0       0 Metro_WWTP     0
```

Direct Diversion Station File (DDS)

```
#>
#> ID                 Name                 Riv ID      On/Off  Capacity        RepType   Daily ID
#>---------eb----------------------eb----------eb------eb------eb------eb------exb---------e
#>              User Name                           DemType   #-Ret    Eff %   Area  UseType DemSrc
#>xxxxxxxxxxxb---------------------exxxxxxxxxxxxxb------eb------eb------eb------eb------eb------e
#>                                    Ret ID       Ret % Table #
#>xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxb----------eb------eb------e
#>EndHeader
THIN_DMD    THIN_DMD               THIN_DMD            1  999.00      1       0 0
            THIN_DMD                                   1       1     5. -999.00      2       7
                                   Metro_WWTP    100.00       4
```

Operating Rule File (OPR)

```
#
# ID        Name                    NA                     Admin#   # Str  On/Off Dest Id     Dest Ac  Sou1 Id     Sou1 Ac  Sou2 Id     Sou2 Ac     Type ReusePlan
# ---------eb----------------------eb----------exxxxb----------eb------eb------e-b----------eb------e-b----------eb------e-b----------eb------eb------exb---------
#
# Remaining uses for Thornton's LCC shares not used as part of Cosmic Booking Over Exchange
#       Release changed water rights to Inside and Outside uses through Wes Brown WTP, just junior to uses of water for Booking Over Exchange
#       0% ditch loss assigned for use of changed LCC shares (based on Thornton recommendation). No losses through WTP.
LCC.03      Opr_ChangedLCC_To_Inside_Uses                50404.00005     2.       1 THIN_DMD          1 ThLCCPln         100 LCC_RFs            3      27 MetroTh
                                    0700547       0         Carrier
                                    WesBrownWTP   0         Carrier
                                    LCC.01
 0.   0.   0.   0.   0.   44. 54. 55. 51. 33.  7.  0.

# Use reusable effluent to meet return flow obligations after Clear Creek water rights used to meet return flows (Fisher, FHL) have exhausted all of their uses
Metro.01    OprMetroThFHL_CCkRFs                         55835.00006     0.       1 FHL_CCkRFs        0 MetroTh            0 NA                 0      49 NA
Metro.02    OprMetroThFish_CCkRFs                        55835.00007     0.       1 Fish_CCkRFs       0 MetroTh            0 NA                 0      49 NA
Metro.03    OprMetroThFHL_BDC_RFs                        55835.00008     0.       1 FHL_BDC_RFs       0 MetroTh            0 NA                 0      49 NA
Metro.04    OprMetroThStand_SWRFs                        55835.00009     0.       1 Stand_SWRFs       0 MetroTh            0 NA                 0      48 NA
```

Reservoir Reuse Plans

A Reservoir Reuse Plan tracks reusable water stored and released from a physical reservoir; allowing both one-time use and fully-consumable water to be stored in the same reservoir account.

- The Reservoir Reuse Plan is associated with the reservoir as water is stored.
- Type 27/28 operating rules release water from the associated reservoir and the Reservoir Reuse Plan.
- A Type 29 operating rule to "spill" is not used for a Reservoir Reuse Plan.

Augmentation Plan Representation – Well Augmentation Plans (Type 2 and 10)

StateMod calculates the depletion at a river associated with well pumping in the current time step and all future time steps based on the amount pumped, the efficiency of its use, and its associated depletion pattern (e.g. unit response function). If a well water right is tied to an Augmentation Plan (Type 2), any depletion associated with out-of-priority pumping (i.e. augmentation requirement) is stored in a Well Augmentation Plan in the current and all future time steps. The augmentation requirement is the difference between the well's depletion on the river and the accretions from any associated return flows. These augmentation requirements may be "offset" by a number of supplies including:

- In-priority depletions that accrue to the river in the current time step; accounted for automatically by StateMod
- In-priority depletions that accrue to the river from pumping in prior time steps.
- Accretions from decreed recharge areas or canal seepage
- Reusable effluent from a Reuse Plan
- Releases from a reservoir
- Augmentation Wells

A Special Augmentation Plan (Type 10) is used to account for depletions associated with a well or group of wells that are not required to be augmented. Examples include pumping in Designated Basins or pumping by wells decreed to be non-tributary (e.g. Coffin Wells). A Special Augmentation Plan can track these depletions, however does not generate an "augmentation requirement" and therefore does not have associated supplies. Refer to Section 7.30 in the StateMod Documentation (Version 13) for information on Augmentation Plans.

Augmentation Plans were researched, reviewed, and recommended for inclusion in future SPDSS modeling efforts in Task 7.2. Individual augmentation plans with similar supplies, and augmentation plans that are accounted for in multiple Water Districts were grouped. The final list of recommended Augmentation Plans is provided in Table 4 of SPDSS Task 7.2 memorandum (available on the CDSS website).

Table 4
Well Augmentation Plans in SPDSS Study Area

No.	Plan Name	Plan ID	Plan Wells*	Plan Acreage
1	CENTRAL REPL	0203334	857	54,415
2	CENTRAL WAS AUG	0203394	401	29,382
3	LOGAN WELL USERS AUG	6402539	307	28,176
4	BIJOU AUG PLAN	0103339	196	24,859
5	POUDRE PLAN	0303336	709	23,584
6	LOWER LOGAN WELL USERS A	6402536	129	12,841
7	LOWER PLATTE BEAVER AUG	0102535	95	12,816
8	SEDGWICK CTY WL USERS A	6402517	121	11,235
9	UPPER PLATTE BEAVER AUG	0102529	88	10,263
10	FT MORGAN CNL AUG PLAN	0102528	85	10,208
11	LOWER LATHAM RES CO AUG	0103332	89	9,073
12	RIVERSIDE AUG	0102522	88	6,299
13	ORPHAN WELLS OF WIGGINS AUG	0102557	37	5,189
14	HARMONY DITCH CO AUG	6402518	44	4,266
15	ROTHE AUG	0102513	17	4,232
16	NEW CACHE AUG	0103397	116	4,085
17	LSPWCD AUG	6402542	45	3,584
18	UNION DITCH AUG	0202539	46	3,130
19	PIONEER AUG PLAN	0102518	32	2,596
20	LOW LINE DITCH CO AUG	6402540	14	2,480
21	NORTH STERLING AUG	6403392	20	2,317
22	DINSDALE AUG	6402519	15	2,289
23	CONDON AUG	6402525	13	2,242
24	NATIONAL HOG FARMS AUG	0102624	5	2,216
25	WATER SUPPLY STRG AUG	0303399	70	1,931
		TOTALS*	3,639	273,708
26 to 125	SMALLER PLANS ASSOCIATED TO WELLS IN HYDROBASE	Various	201	25,240
		TOTALS*	3,840	298,948

Source: SPDSS 2001 GIS Irrigated Acreage Assessment (June 19, 2007) and HydroBase (V20060816).
Notes: Well use and replacements for 25 major plans discussed in Appendix A.
*Well counts included only those wells tied to land in 2001 Irrigated Acreage Assessment. Acreage and wells included in Plan IDs are not unique since multiple wells may be tied to the same lands in the GIS coverage and wells may be associated with multiple plans in HydroBase.
Refer to row number for the following notes:

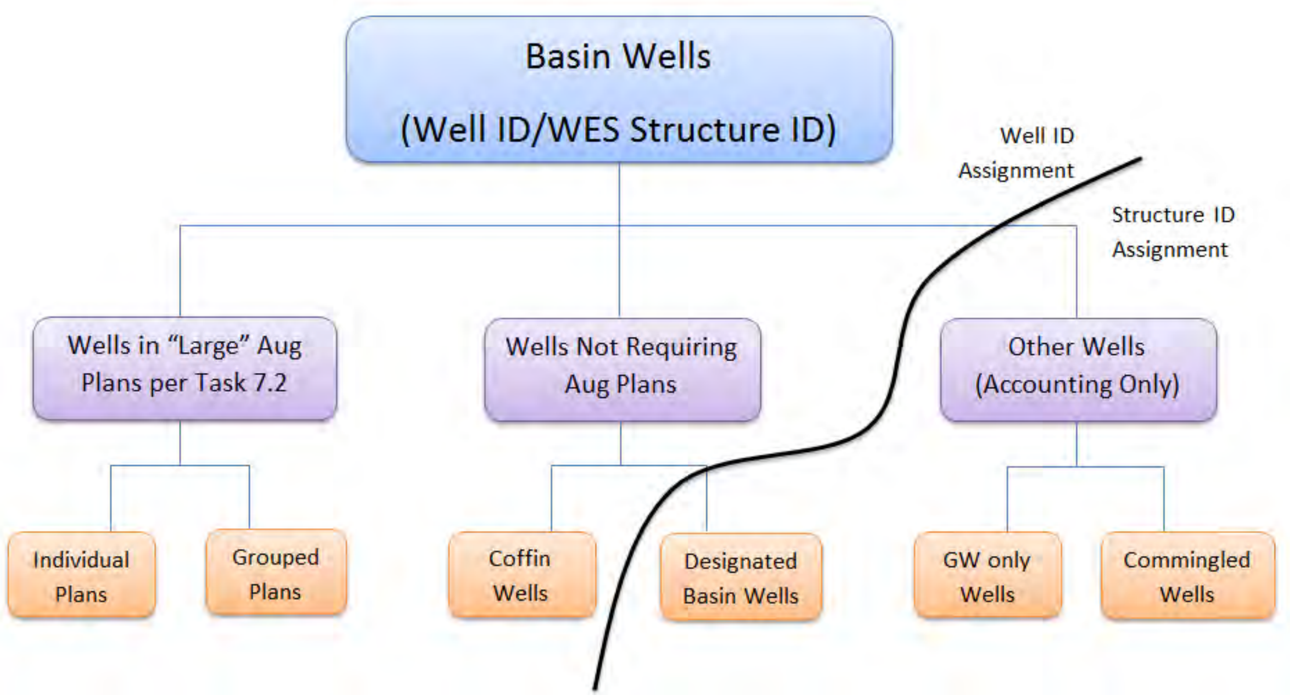
1. Includes Plan IDs 0103334, 0203334, 0303334, 0403334, and 0503334 since Central Repl. (i.e., Ground Water Management Subdistrict – GMS) wells assigned to different Plan IDs based on Water District where well is located (see Appendix A-1).
2. Includes Plan IDs 0103394, 0203394, 0303394, and 0403394 since Central WAS (i.e., Well Augmentation Subdistrict) wells assigned to different Plan IDs based on Water District where well is located (see Appendix A-2).
3. Includes Plan IDs 6402537, 6402539, 6402546, 6402547, 6502548, and 6402554 to account for Logan Well Users and other well users included in original Logan Well Users decree that subsequently split off to form their own plans, which commonly use the same augmentation sources (see Appendix A-3).
4. Includes Plan IDs 0103339 and 0102574 to account for Bijou Canal wells and five wells in Fort Morgan Farms augmentation plan that irrigate the same lands as those irrigated by Bijou Canal wells (see Appendix A-4).
5. Includes Plan IDs 0103336, 0203336, and 0303336 (see Appendix A-5).
12. Includes Plans IDs 0102522, 0102525, 0102536, 0102581, and 0102725 to account for well users under Riverside Canal that receive surface water deliveries from Riverside Canal and share the same augmentation sources (see Appendix A-12).

Note – It is important to discuss the recommended Augmentation Plans with the Water Commissioner to make sure the "large" augmentation plans are included.

Augmentation Plan "Demand"

1. Define the list of "large" Augmentation Plans, "grouped" Augmentation Plans, and Special Augmentation Plans.
    a. List User Accounting Plans in the PLN File with Type 2 or Type 10 designations and include on the network file.

2. Associate the wells in the model to each augmentation plan to define the "demand" of the Augmentation Plans.
    a. StateMod internally tracks the "demand" or augmentation requirement of an Augmentation Plan based on the wells associated with the Augmentation Plan. This association is input into the model using the Plan to Well (PLW) File.



Note – There is no current method to create the PLW File using DMIs; currently created using HydroBase Association Table, WER File, and MS Access.

Augmentation Plan "Supplies"

Augmentation supplies can come in the form of "lagged" accretions or "controlled" releases (e.g. changed shares via augmentation station, reservoir releases, and reusable effluent). In general, augmentation supplies should be prioritized in the operating rule file in the following order:

1. In-priority depletions that accrue to the river in the current time step; accounted for automatically by StateMod based on the individual well water right.

2. In-priority depletions that accrue to the river from pumping in prior time steps.
    a. Use a Type 43 operating rule in the OPR File using an "in-priority" date that generally corresponds to the Augmentation Plan decree or a common well right date.

3. Accretions from decreed recharge areas or canal seepage.
    a. Accretions from each recharge area and each canal are tracked using individual Recharge Plans (Type 8); include in PLN file and network file.

Canal Recharge Plans

    b. Diversions to recharge areas are simulated using Type 45 operating rules in the OPR File, and the Canal Recharge Plan is designated in this operating rule file if applicable.
    c. The Canal Recharge Plan accretes to the river based on the Return Flow Location, Percent, and Return Table ID in the Plan Return File (PRF).
    d. The Canal Recharge Plan "credits" the augmentation plan based on a Type 48 operating rule in the OPR File.

RA Recharge Plans

e. Define the Recharge Areas (RA) and their associated Augmentation Plans in the Plan Recharge (PLR) File, as a recharge area can be associated with more than one augmentation plan.

Plan Recharge (PLR) File

```
#
# Reservoir  Reservoir    Reservoir
# Plan ID    Right ID     Str ID            Owner Comments
#---------exb----------exb----------exb------exb----------------------e
0102522_PlR  0102522_R.1  0102522_R            1    Res Recharge to Aug Plan
0102528_PlR  0102528_R.1  0102528_R            1    Res Recharge to Aug Plan
0102529_PlR  0102529_R.1  0102529_R            1    Res Recharge to Aug Plan
0102535_PlR  0102535_R.1  0102535_R            1    Res Recharge to Aug Plan
0103334_PlR  0103339_R.1  0103334_R            1    Res Recharge to Aug Plan
0103339_PlR  0103339_R.1  0103339_R            1    Res Recharge to Aug Plan
0103570_PlR  0103570_R.1  0103570              1    Res Recharge to Aug Plan
#
```

f. The RA Recharge Plan accretes to the river based on the seepage rate defined in the Reservoir Station (RES) file, and the Return Flow Location, Percent, and Return Table ID in the Reservoir Return File (RRF).

Reservoir Recharge (RRF) File

```
# ID           Ret ID            Ret % Table          Comment (e.g.return type, Name, etc.)
#----------exb----------exb------exb----------exb------------------------------e
0102522_R      0100513            100.  100503        Res Rech
0102528_R      0100518            100.  100514        Res Rech
0102529_R      0100518            100.  100515        Res Rech
```

g. The RA Recharge Plan "credits" the augmentation plan based on a Type 48 operating rule in the OPR File.

h. Limit the amount diverted to recharge areas based on a Release Limit Plan (Type 12) and include the Limit Plan in the operating rule that diverts to each recharge area.

    i. A Release Limit Plan limits the amount of releases made from a reservoir based on monthly or annual limitations as defined by a Type 47 operating rule in the OPR file.

    ii. Include Release Limit Plans in the PLN file and in the network.

Operating Rule (OPR) File

```
#
# ID        Name                    NA                      Admin#   # Str  On/Off Dest Id      Dest Ac  Sou1 Id      Sou1 Ac  Sou2 Id      Sou2 Ac    Type Plan          Div Type    OprLoss    Limit
# ---------eb----------------------eb----------exxxxb----------eb------eb------e-b-----------eb------e-b-----------eb------e-b-----------eb------eb------exb-----------exb----------exb------eb------eb--
01025220.02 RIVERSIDE Carrier                          46751.45836      1        1 0102522_R          1 0100503_D.08      1 0100503_D       100     4  0102522_P1C Diversion      0.00     4.00
                                  0100503_D      25 Carrier
                                  01025180.07
01025220.03 RIVERSIDE Carrier                          50466.00000      1        1 0102522_R          1 0100503_D.10      1 0100503_D       100     45 0102522_P1C  Diversion      0.00     4.00
                                  0100503_D      25 Carrier
                                  01025180.07
01025220.04 RIVERSIDE Carrier                          50712.00000      1        1 0102522_R          1 0100503_D.11      1 0100503_D       100     45 0102522_P1C  Diversion      0.00     4.00
                                  0100503_D      25 Carrier
                                  01025180.07
01025220.05 RIVERSIDE Carrier                          50769.49378      1        1 0102522_R          1 0100503_D.12      1 0100503_D       100     45 0102522_P1C  Diversion      0.00     4.00
                                  0100503_D      25 Carrier
                                  01025180.07
01025220.06 RIVERSIDE Carrier                          51356.00000      1        1 0102522_R          1 0100503_D.13      1 0100503_D       100     45 0102522_P1C  Diversion      0.00     4.00
                                  0100503_D      25 Carrier
                                  01025180.07
#
01025180.07 RIVERSIDE Res Limit                            1.00000      0        1 NA                 1 0102522_RL        1 NA                0     47 NA           Diversion         0        1
  1995.  1995.  1995.  1995.  1995.  1995.  1995.  1995.  1995.  1995.  1995.  1995. 24000.
#
01025220.08 RIVERSIDE Canal Recharge                   55637.10000      0        1 0102522            1 0102522_P1C       0 NA                0     48 NA           Diversion      0.00     0.00
01025220.09 RIVERSIDE Res Recharge                     55637.10000      0        1 0102522            1 0102522_P1R       0 NA                0     48 NA           Diversion      0.00     0.00
01025220.10 RIVERSIDE Reservoir                        55637.20000      0        1 0102522            1 0103651           1 NA                0     49 NA           Diversion      0.00     0.00
#
```

4. Reusable Effluent based on recent diversion coding or basin knowledge; use Type 48 or Type 49 operating rules in the OPR file to "release" water from a Reuse Plan directly to an Augmentation Plan.
5. Releases from a reservoir directly to the augmentation plan based on decree, recent diversion coding, or basin knowledge; use Type 48 or Type 49 operating rules in the OPR file.
6. Augmentation or Recharge Wells
   a. Per SEO, use recent (2011) diversion coding to identify augmentation and recharge wells for inclusion with each augmentation plan.
   b. Augmentation and Recharge Well "structures" need to be included in the appropriate well and network files.
   c. Include any augmentation and recharge wells in the PLW file to ensure their depletions are included in the augmentation plan "demand".
   d. Use a Type 44 operating rule in the OPR file to pump recharge wells directly to the recharge areas.
   e. Use a Type 37 operating rule in the OPR file to pump augmentation wells directly to the augmentation plan.
7. Excess Accretions
   a. Use a Type 48 or 49 operating rules in the OPR file to associate excess credits from other RA and Canal Recharge Plans at a priority junior to other users of the plan based on decrees or recent diversion coding.

Additional Augmentation Plan Notes

- Include the Augmentation Plan in the model even if the sources are not included in the model (e.g. Central GMS or WAS Augmentation Plans).
- Note that StateMod does not limit the depletions if supplies are not sufficient to meet the augmentation demand, however it will track the depletions for accounting purposes. See the Plan Output File (XPL) file for more information.

SPDSS Surface Water Model

Calibration Workshop Materials

Information Included:

1. Diversions to Augmentation Representation in Natural Flow
2. Non-Gaged Natural Flow Locations
3. Calibration of Natural Flow
4. Natural Flow for Off-Channel Reservoir Systems
5. Calibration of Historical Simulation

Augmentation Diversion Representation in Natural Flow

Some Augmentation Plans rely on changed senior water rights as a supply, and these supplies are measured at augmentation stations located at different points along a ditch.

- Diversions to augmentation must be considered differently when creating natural flows because:
  - diversions are returned without being consumptively used,
  - diversions need to be removed from the supply used to meet irrigation or other demands, and
  - diversions return immediately back to the river (i.e. a different return pattern than irrigation returns)

- Augmentation stations may or may not be included in the total diversions (if located upstream of the measuring device) – ASK the Water Commissioner

- Location of augmentation station impacts where it returns (i.e. above a calling right) and the amount of ditch loss that should be applied to the augmentation diversions.

- Forward mode – use plan structures and operating rules – not an issue

- If augmentation is a minor amount, can ignore in both natural flow calculations and simulations

Representation Options:

1. Create two structures on the river; one main headgate structure with only the U:A diversions that returns immediately and one irrigation structure (_I) with the remaining diversions to irrigation and potentially recharge as well.
   - Downfall is the fake headgate, but could be used in forward mode with operating rules to represent augmentation station capacity

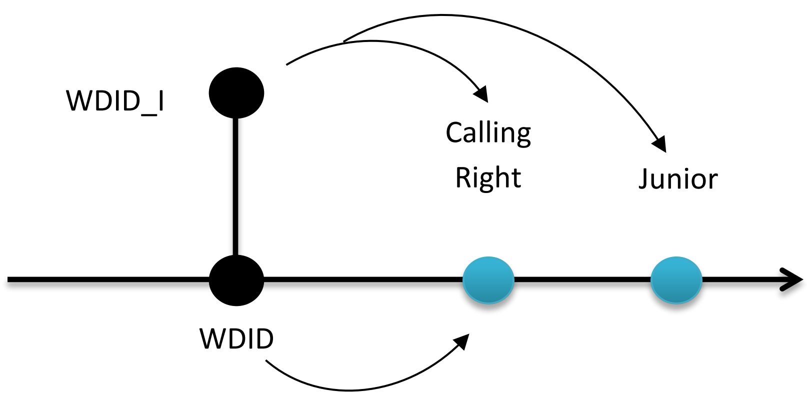
2. Create an entire off-channel system that includes the headgate structure, an irrigation structure, and an augmentation demand structure.

- Downfall is the added complexity and that we have a demand structure that isn't used during simulation.
- May make more sense if already have an off-channel reservoir system

Augmentation Station Representation when only diverts for augmentation station and irrigation demand (i.e. no "off-channel" system)

1. Understand the operation and location of the augmentation station on a specific ditch.
   a. Determine if the diversions to augmentation are included in DivTotal
   b. Determine if conveyance loss should be applied to diversions to augmentation
   c. Determine node(s) where the augmentation station will "return".

2. Use the main "headgate" WDID for diversions to augmentation, and include additional off-channel "demand" structures for other uses on the ditch (e.g. irrigation, carrier to municipal).



3. Historical diversions for the WDID reflect only diversions to augmentation (U:A) and return immediately (*_N.DDS) to the river based on the augmentation station location, generally to the calling right.
   a. If the augmentation station is down-ditch, include conveyance losses as appropriate in the *_N.DDS file. (DDS file used only for natural flow calculation)

4. Historical diversions for the irrigation demand (WDID_I) reflect only diversions to irrigation (U:1) and have lagged returns in the *_N.DDS to

multiple downstream structures based on the location of the irrigated land. (note that the WDID_I is the same in both the *_N.DDS and the *.DDS for simulation)

5. Historical diversions, if applicable, for the carrier demand (WDID_C) reflect only carried diversions (e.g. municipal supplies) and return immediately to the municipal demand.

6. Confirm that the sum of the diversions to augmentation, irrigation, and carrier equal DivTotal so water is not "created" on this system.

7. In "forward mode", operating rules, plan structures, and a separate simulation DDS files will simulate the augmentation station, irrigation and carried demands.

Non-gaged Natural Flow Locations

Natural flow gains between gages are modeled as entering the system at ungaged points, to better simulate the river's growth due to generalized groundwater contributions and unmodeled tributaries.

- See the Modeling Workshop No. 1 materials for more discussion on StateMod's automated approaches to distributing gains and the use of area/precipitation factors.

- Use GIS to identify smaller tributaries that are not explicitly modeled and represent that natural flow contribution at an ungaged node in the model.

- Natural flow must be estimated at ungaged headwater nodes (except for the "mock" off-channel tributary systems supplied by a carrier structure.

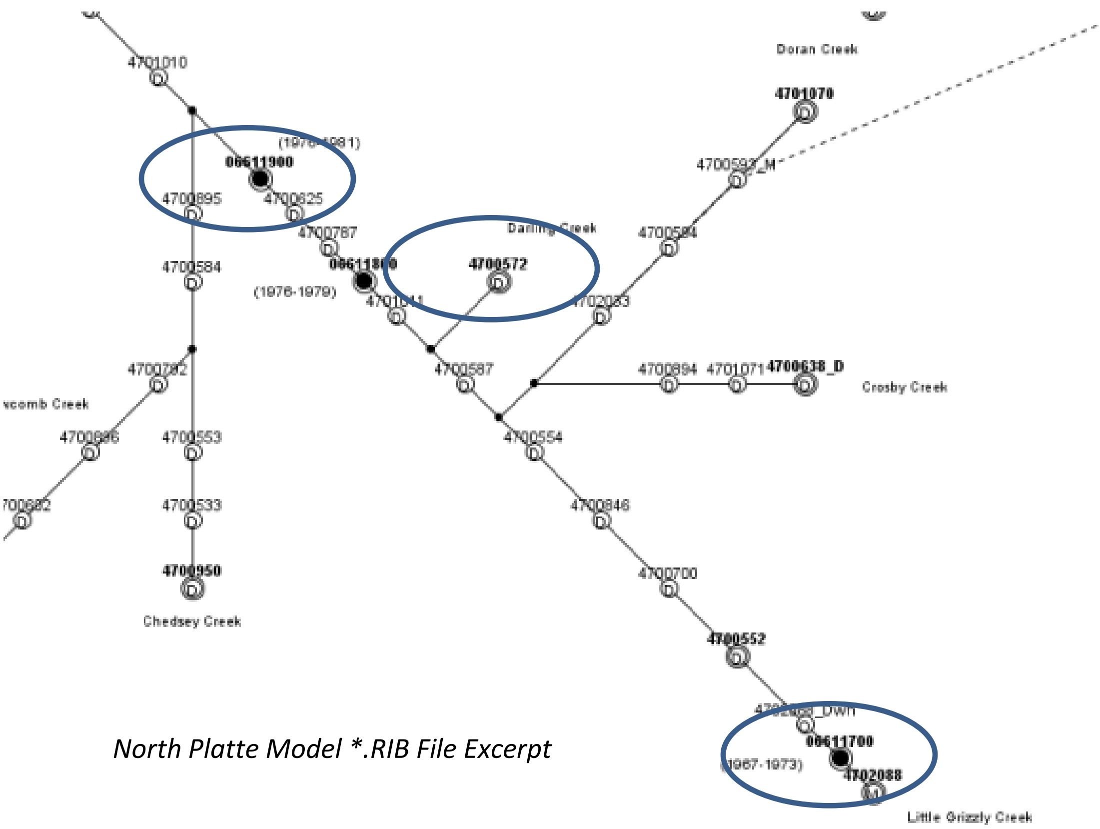
- During calibration, other ungaged nodes may be made into natural flow nodes to better simulate a water supply that would support historical operations.

The drainage area for gaged natural flow locations is the **total** drainage area contributing to the gaged location.

The drainage area for ungaged locations is the **incremental** drainage area upstream of the natural flow location and downstream of a gaged location.

Natural Flow Parameter File (*.rib)

Proration factors are calculated based on the area/precipitation factors in the network diagram and commands in StateDMI, and provided to StateMod in the Natural Flow Parameter File (*.rib).



*North Platte Model *.RIB File Excerpt*

For example:

- Natural Flow for **4701070** = 26.6% * (natural flow at downstream gage 06611800 minus natural flow at the upstream gage 06611700)
- Natural Flow for **4700552** = 31.3% *(natural flow at downstream gage 06611800 minus natural flow at the upstream gage 06611700) + the natural flow at the upstream gage 06611700

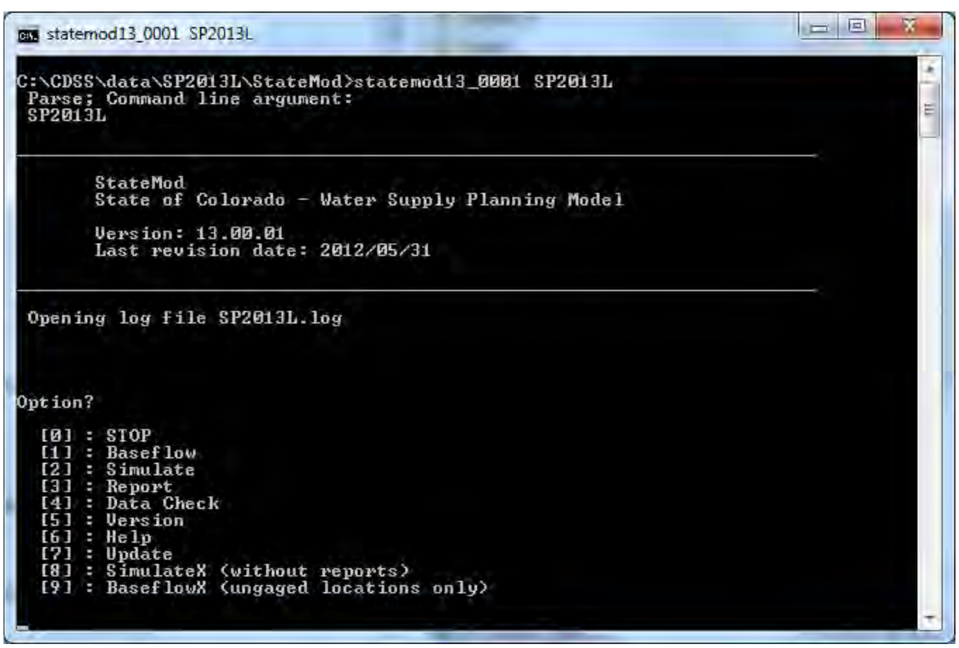
```
#>
#> FlowX                mbase    coefB1     FlowB1     coefB2     FlowB2     coefB3    F
#>---------exxxxxxxxb------eb------exb----------eb------exb----------eb------exb
#>             pf       nbase    coefG1    FlowG1     coefG2     FlowG2      coefG3
#>xxxxxxxxxxb------eb------eb------exb----------eb------exb----------eb------exb
#>
#>EndHeader
#>
4701070                        0
               0.266           2    1.000 06611800      -1.000 06611700
4700552                        1    1.000 06611700
               0.313           2    1.000 06611800      -1.000 06611700
4700624                        0
               0.008           2    1.000 06611300      -1.000 06611200
4700638_D                      0
               0.316           2    1.000 06611800      -1.000 06611700
```

Proration factors (pf) in the *.rib file should never be greater than 1.0 if developed using the Gain Approach. If neighboring gage approach, can be greater than 1.0.

StateMod Simulation of Natural Flow

Previous CDSS models used the Mixed Station Model (MSM) to fill missing natural flows; complete datasets (i.e. diversions, reservoir contents, streamflow) will be developed for the SPDSS models therefore MSM will not be needed.

With complete datasets, StateMod simulation option Baseflow will create natural flows at gaged locations and distribute to ungaged locations in a single simulation step.



Calibration of Natural Flow

Natural flow is estimated by the model by:

Natural Flow at Gaged Locations =

Gaged Flow + Diversions – Return Flows +/- Change in Storage

Natural Flow at Ungaged Locations =

Distribution of Gaged Natural Flow Based on the Pro-Rata Share of Area*Precipitation

or

Neighboring Gage Approach Based on the Pro-Rata Share of Area*Precipitation

"Negative" Natural Flows

The gain approach can result in estimates of negative natural flows. These occur when the gaged flow is less than the other parameter used in the natural flow calculation.

Gaged Flow + Diversions – Return Flows +/- Change in Storage

- StateMod automatically sets any natural flow estimated to be negative at a gaged location to zero prior to distributing gains to ungaged locations, essentially "creating" water in the system.
- A negative flow summary, including a count of the number of months with negative flow and the average and total amount of negative flow, is provided in the StateMod log file (*.log) when StateMod is run in the Baseflow Mode.

*North Platte Model *.LOG File Excerpt*

```
Virout; Negative Flows at GAGE Summary  ACFT/mon
  Note: Count is the # of months for a monthly model and
           the # of days for a daily model and
         Est is the average negative flow estimate
           on a monthly basis (af/mo) or a daily basis (af/day)
         Adj is the adjusted value printed to results
         Total is the total adjustment (abs(# * Est)
```

#	ID	Name	Count	Est af/mon	Adj af/mon	Total acft	River ID
1	06611200	BUFFALO CREEK NEAR HEBRO	5	-171.17	0.00	855.87	289
2	06611300	GRIZZLY CREEK NEAR HEBRO	8	-220.10	0.00	1760.77	295
3	06611700	LITTLE GRIZZLY CREEK NEA	0	0.00	0.00	0.00	191
4	06611800	LITTLE GRIZZLY CREEK ABO	0	0.00	0.00	0.00	206
5	06611900	LITTLE GRIZZLY CREEK ABO	0	0.00	0.00	0.00	209
6	06614800	MICHIGAN RIVER NEAR CAME	0	0.00	0.00	0.00	486
7	06615000	SOUTH FORK MICHIGAN RIVE	0	0.00	0.00	0.00	475
8	06616000	NORTH FORK MICHIGAN RIVE	0	0.00	0.00	0.00	498
9	06617500	ILLINOIS CREEK NEAR RAND	1	-2.80	0.00	2.80	415
10	06619400	CANADIAN RIVER NEAR LIND	0	0.00	0.00	0.00	101
11	06619450	CANADIAN RIVER NEAR BROW	0	0.00	0.00	0.00	120
12	06620000	NORTH PLATTE RIVER NEAR	2	-1720.07	0.00	3440.14	555
13	Line_BF	_FLO	0	0.00	0.00	0.00	1
14	Beav_BF	Beaver Creek BF _FLO	0	0.00	0.00	0.00	6
15	SFBig_BF	_FLO	0	0.00	0.00	0.00	14
16	Wheel_BF	Wheeler Creek BF _FLO	0	0.00	0.00	0.00	20
17	Camp_BF	_FLO	0	0.00	0.00	0.00	29
18	3mile_BF	Threemile Creek BF _FLO	0	0.00	0.00	0.00	27
	Total Ave		16	378.72	0.00	6059.59	

- As natural flows represent the flow as if "man wasn't there", negative natural flows are not "physically-based" and likely caused by data inconsistencies.
- Use the Baseflow Output (*.xbi) file to trouble shoot issues with negative flows – likely they are caused by bad "data points", often EOM reservoir contents.

*Yampa River Model *.XBI File Excerpt*

Naturalised Flow Information ACFT

Year	Mon	Day	River ID	Gauged Flow (1)	Import (-) (2)	Divert (+) (3)	Return (-) (4)	Well Dep (+) (5)	Delta Sto (+) (6)	Net Evp (+) (7)	Total Base Flow (8)	w/o (-) Base Flow (9)
1982	OCT	31	[illegible]	1702.	0.	118.	0.	0.	-769.	24.	[illegible]	[illegible]
1982	NOV	30	09238900	1160.	0.	83.	0.	0.	1359.	-2.	2600.	2600.
1982	DEC	31	09238900	547.	0.	84.	0.	0.	-731.	-23.	-123.	0.
1983	JAN	31	[illegible]	413.	0.	90.	0.	0.	533.	-25.	[illegible]	1010.
1983	FEB	28	09238900	359.	0.	76.	0.	0.	-50.	-7.	379.	379.
1983	MAR	31	09238900	422.	0.	165.	0.	0.	-825.	12.	-226.	0.
1983	APR	30	09238900	489.	0.	155.	0.	0.	187.	28.	858.	858.
1983	MAY	31	09238900	5256.	0.	163.	0.	0.	209.	55.	5683.	5683.
1983	JUN	30	09238900	28428.	0.	187.	0.	0.	-222.	78.	28471.	28471.
1983	JUL	31	09238900	16160.	0.	243.	0.	0.	0.	74.	16477.	16477.
1983	AUG	31	09238900	1201.	0.	247.	0.	0.	1576.	64.	3088.	3088.
1983	SEP	30	09238900	156.	0.	205.	0.	0.	-1268.	57.	-850.	0.

Recommended actions to check/correct negative natural flows include:

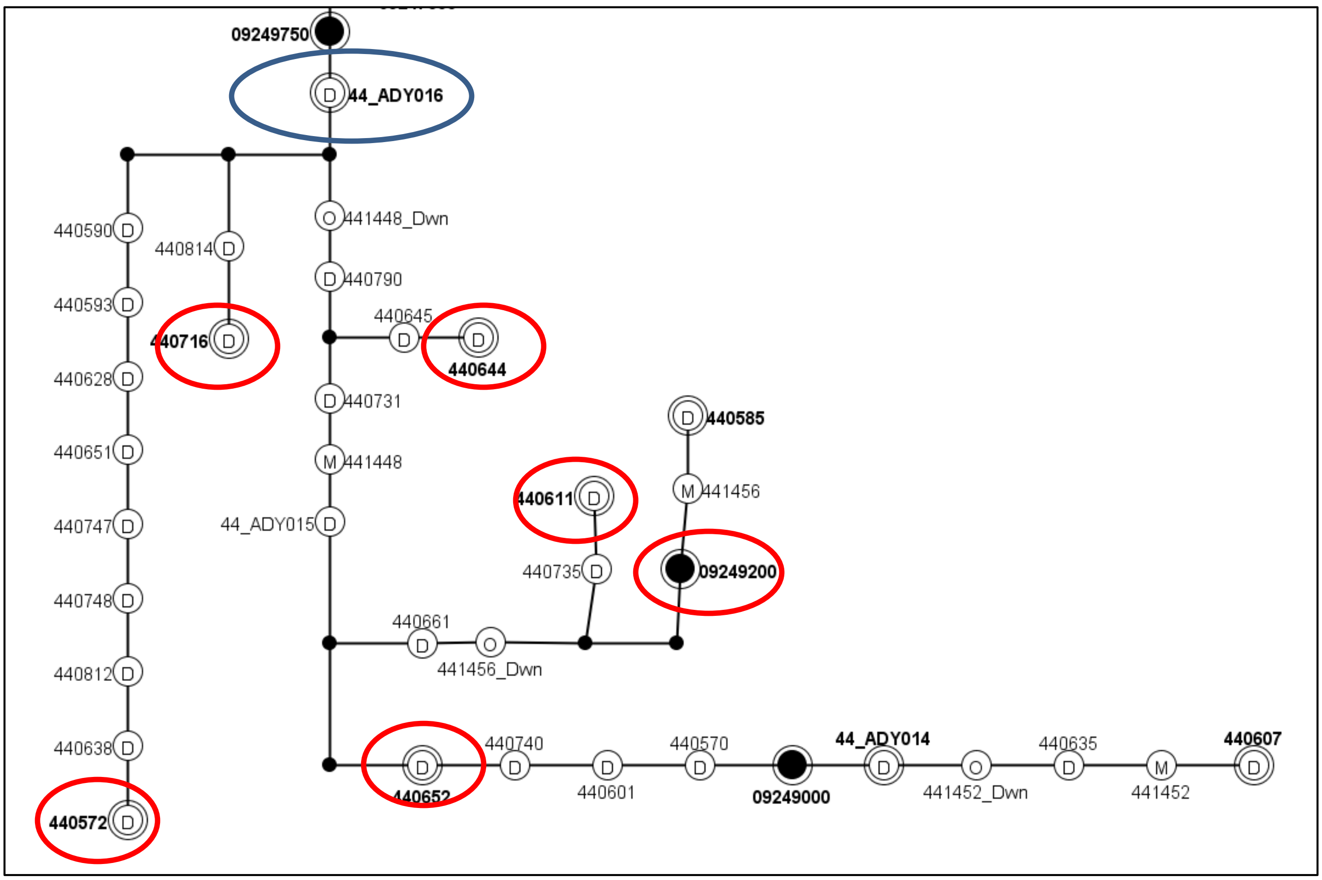
- Determine which gages have instances of negative flows using the Log file
- Query the Natural Flow Output file (*.xbi) for each gage with negative flow to determine the month and year (Column 8 does not equal 9)
- Use TSTool to graph the monthly diversions, reservoir content, and streamgage data to check for obvious data errors.

Upstream to Downstream Gains

Before man's influence, the stream gained as it moved downstream and a "losing" reach is not expected. If StateMod estimates that natural flow at a downstream gage is less than the sum of natural flow upstream, StateMod will consider that a "losing" reach. Note that is simulation, water will be delivered to a "losing" reach before distributed to senior uses. Check that natural flows increase from upstream to downstream.

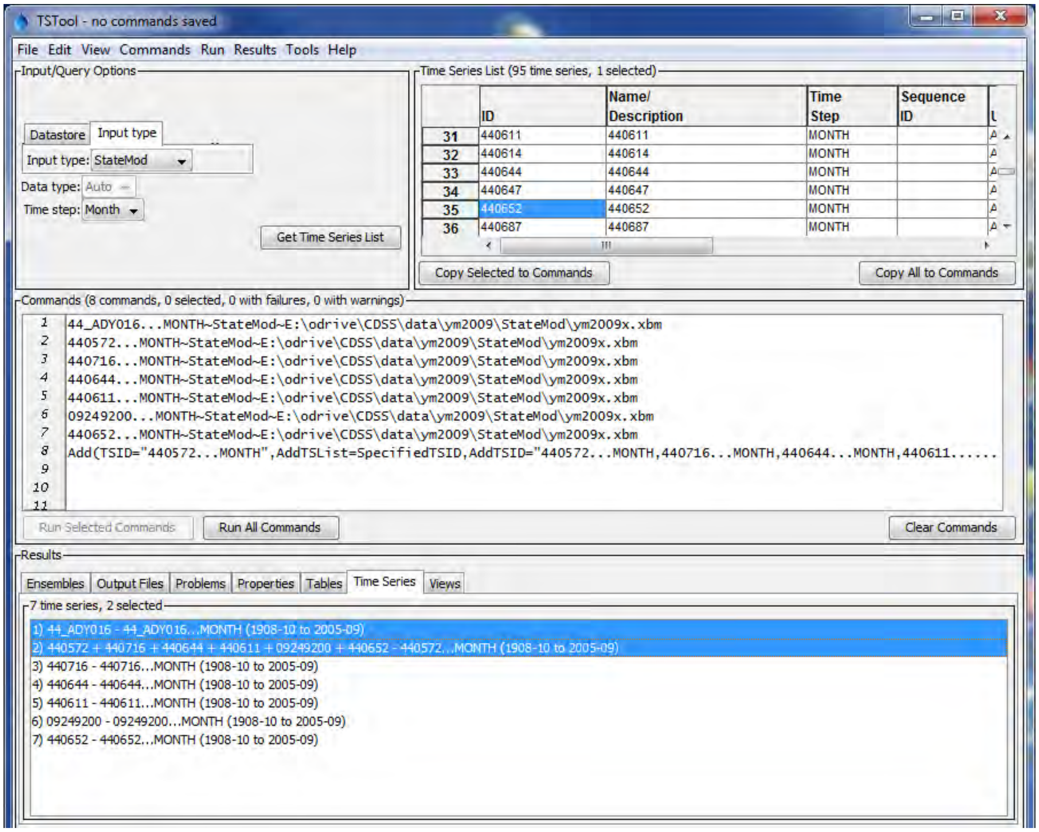
- Use TSTool to quickly graph and add natural flows in the *.xbm file above each gage to assure they are equal or greater to the natural flow estimated at the gage.

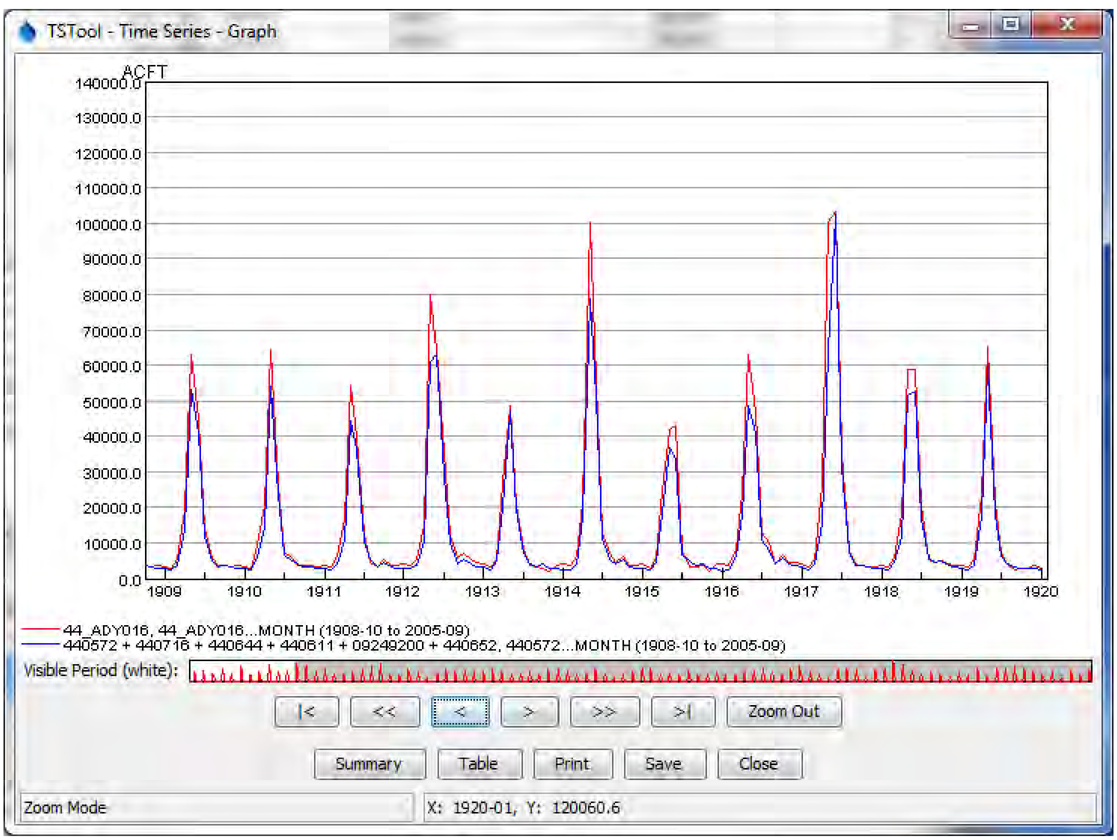
Yampa River Basin Example:



1) In TSTool, graphically compare the natural flow at gaged locations to ensure that natural flow at 44_ADY016 is greater than the natural flow for combined for upstream locations.
2) Add the total natural flow above the 44_ADY016 location and compare to the natural flow at the 44_ADY016 location.

44_ADY016 > 440572 + 440716 + 440644 + 440611 + 09249200 + 440652

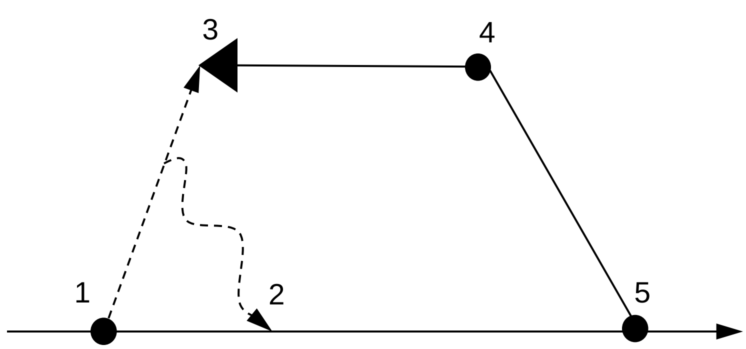

TSTool - no commands saved
File Edit View Commands Run Results Tools Help
Input/Query Options
Time Series List (95 time series, 1 selected)
Datastore
Input type
Input type: StateMod
Data type: Auto
Time step: Month
Get Time Series List
Copy Selected to Commands
Copy All to Commands
Commands (8 commands, 0 selected, 0 with failures, 0 with warnings)
44_ADY016...MONTH~StateMod~E:\odrive\CDSS\data\ym2009\StateMod\ym2009x.xbm
440572...MONTH~StateMod~E:\odrive\CDSS\data\ym2009\StateMod\ym2009x.xbm
440716...MONTH~StateMod~E:\odrive\CDSS\data\ym2009\StateMod\ym2009x.xbm
440644...MONTH~StateMod~E:\odrive\CDSS\data\ym2009\StateMod\ym2009x.xbm
440611...MONTH~StateMod~E:\odrive\CDSS\data\ym2009\StateMod\ym2009x.xbm
09249200...MONTH~StateMod~E:\odrive\CDSS\data\ym2009\StateMod\ym2009x.xbm
440652...MONTH~StateMod~E:\odrive\CDSS\data\ym2009\StateMod\ym2009x.xbm
Add(TSID="440572...MONTH",AddTSList=SpecifiedTSID,AddTSID="440572...MONTH,440716...MONTH,440644...MONTH,440611......
Run Selected Commands
Run All Commands
Clear Commands
Results
Ensembles Output Files Problems Properties Tables Time Series Views
7 time series, 2 selected
1) 44_ADY016 - 44_ADY016...MONTH (1908-10 to 2005-09)
2) 440572 + 440716 + 440644 + 440611 + 09249200 + 440652 - 440572...MONTH (1908-10 to 2005-09)
3) 440716 - 440716...MONTH (1908-10 to 2005-09)
4) 440644 - 440644...MONTH (1908-10 to 2005-09)
5) 440611 - 440611...MONTH (1908-10 to 2005-09)
6) 09249200 - 09249200...MONTH (1908-10 to 2005-09)
7) 440652 - 440652...MONTH (1908-10 to 2005-09)


TSTool - Time Series - Graph
ACFT
44_ADY016, 44_ADY016...MONTH (1908-10 to 2005-09)
440572 + 440716 + 440644 + 440611 + 09249200 + 440652, 440572...MONTH (1908-10 to 2005-09)
Visible Period (white):
Zoom Out
Summary
Table
Print
Save
Close
Zoom Mode
X: 1920-01, Y: 120060.6

Natural Flow for Off-Channel Reservoir Systems

Diversions to both off-channel reservoirs and irrigation demands are more common in the South Platte than in other basins. Therefore, it was necessary to develop a methodology to model them in both the StateCU and StateMod analyses.   This approach allows:

- Natural flows to be calculated correctly without special considerations of natural flow gage locations,
- Total historical diversion from the river remain at the river location,
- End-Of-Month (EOM) contents in the reservoir are represented by historical values (if a reservoir is part of the system),
- Direct diversions for irrigation plus releases from the reservoir for irrigation can be combined and applied to the irrigation demand,
- Return flows are accounted for at the correct locations and are operated either by variable efficiency (for irrigation structures) or by a constant efficiency (for carrier structures).



Simple Off-Channel Demand Schematic

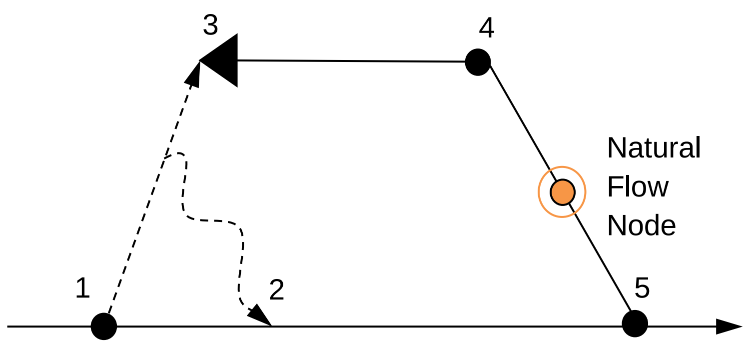
1. River Diversion (WDID_C)
2. Carrier Return Flow
3. Off Channel Reservoir
4. Off Channel Demand (WDID_I)
5. Demand Return Flow

It is important to correctly set up the off-channel reservoir systems in the model input files so that the off-channel reservoir systems can be simulated in both natural flow and “forward” modes. This representation was introduced in the Modeling Workshop No. 1; additional discussion herein pertains to representation in the natural flow mode and calibration of the off-channel reservoir systems.

Off-Channel Mass Balance

These reservoir systems, modeled off-channel on “fake” tributaries, represent a closed system in terms of a water balance. In other words, no natural flow should be created on the “fake” tributary and the total amount diverted should be accounted elsewhere in the reservoir system - at either the reservoir, off-channel demand, or as return flows.

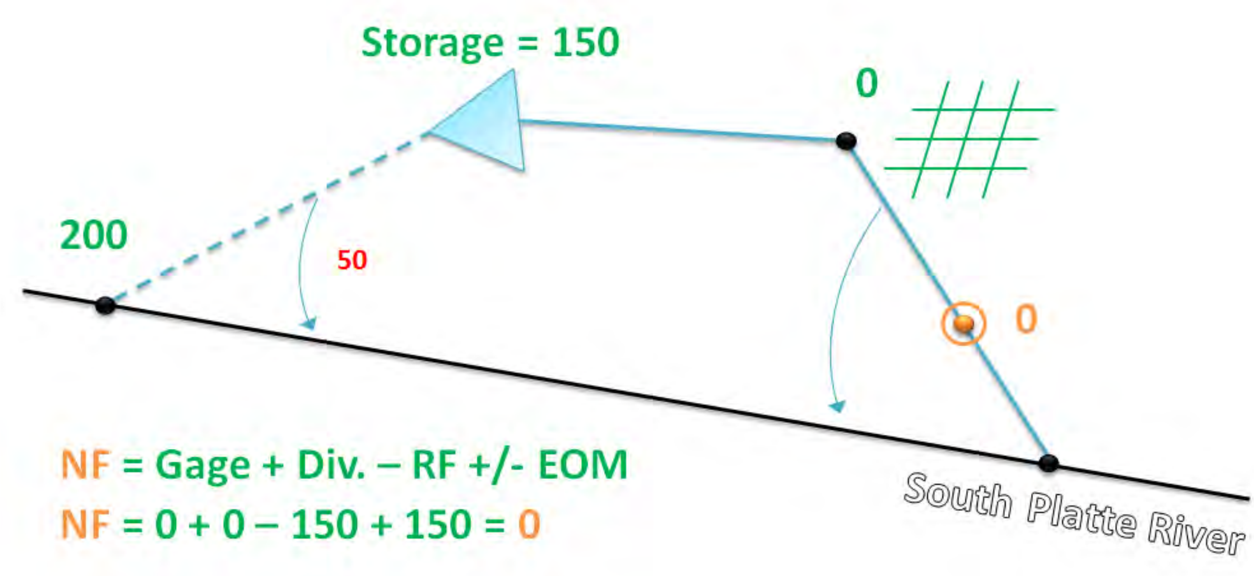
A natural flow node is added at the downstream end of the off-channel reservoir system so that any natural flow gains or losses can be isolated and analyzed.



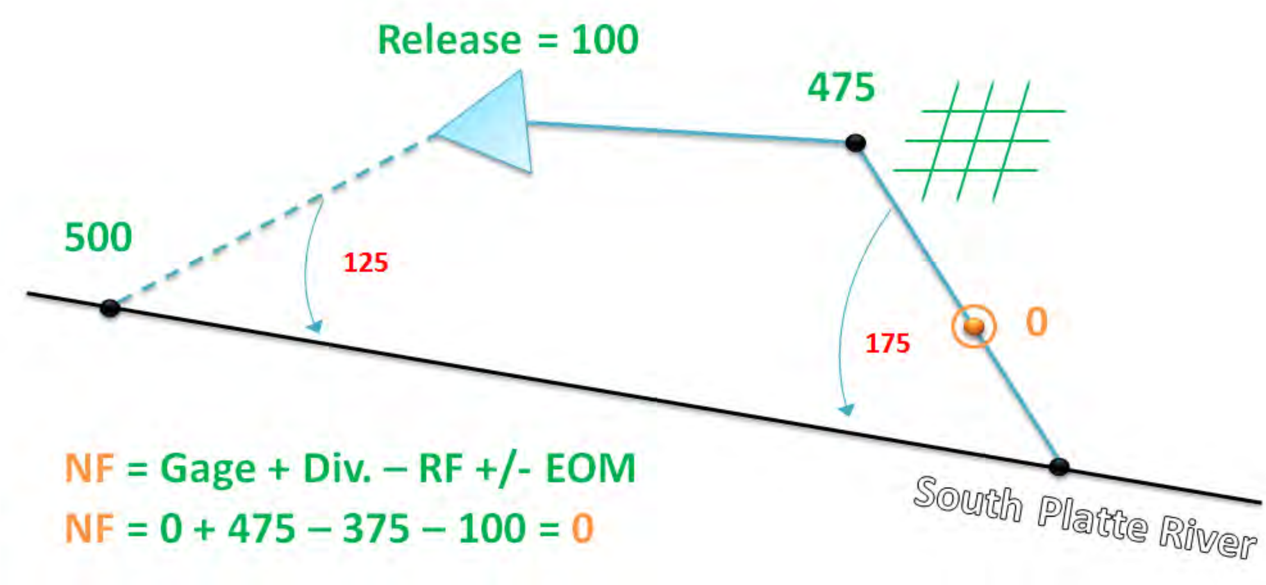
- The natural flow node is included in the model:
    - As a natural flow streamflow gage in the Network (NET and RIN) files
    - In the Streamflow Gage Station (RIS) file
    - With zero flow in the Historical Streamflow Gage (RIH) file

- Off-channel natural flow nodes must be removed prior to calibrating the mainstem, as any negative flows at this gage will automatically be set to zero.
- For reservoirs that release directly to the river for re-diversion at downstream headgates, natural flow on the tributary is expected.
- Mainstem structures should be used as return flow locations for canal and irrigation losses; not the natural flow node.

Mass Balance Example



- Headgate node historical diversions (DDH) equals 200 af
- Headgate node immediately returns 75% to the reservoir in the natural flow Direct Diversion Station (DDS) file, and lags 25% (equal to 50 af) to locations along the river
- Change in Reservoir EOM contents equals 150 af (evaporation is ignored in this example)
- Irrigation node historical diversions (DDH) equals 0 af.



- Headgate node historical diversions (DDH) equals 500 af.
- Headgate node immediately returns 75% to the reservoir in the natural flow Direct Diversion Station (_N.DDS) file, and lags 25% (equal to 125 af) to locations along the river.
    - Note that in simulation or "forward" mode 100% of the return
- Change in Reservoir EOM contents equals 100 af (evaporation is ignored in this example).
- Irrigation node historical diversions (DDH) equals the direct irrigation amount less conveyance loss (375 af) plus releases from the reservoir due to change in storage (100 af) for a total of 475 af.
- Irrigation node consumptive use is based on information in the Crop Irrigation Requirement (DDC) file and efficiency information in the Irrigation Practices (IPY) file.
- Irrigation node lags 100% of the return flow (175 af) to locations along the river based on information in the Direct Diversion Station (DDS) file.

Mass Balance Trouble-Shooting

Data inconsistencies, irrigation practices, and varying efficiencies can cause a mass “imbalance” for the off-channel system.

- If diversions to storage are less than change in storage, StateMod will estimate natural flow to “fill” the reservoir.
  - In the TSTool command file used to create the irrigation demand diversions, confirm that diversions to storage less conveyance loss are greater than the change in storage based on the EOM.
- If diversions to storage are greater than change in storage, these diversions are “pushed” to the irrigation demand in the TSTool command file so no natural flow is estimated for the off-channel system.
  - Review the diversions for the irrigation demand for outliers and winter values, likely created by diversions to storage that were not reflected by the reservoir EOM.
  - Determine if this water is being used for other off-channel demands (e.g. non-key storage, stock, recharge) and either include in the model or note during calibration.
- In many Water Districts, DivTotal is the most reliable value. Consider setting reservoir EOM content values to better agree with diversions to storage.
  - If EOM content values are adjusted, carry those values through the TSTool command files and the external spreadsheet used to estimate evaporation for the TSTool command files.
- Confirm that conveyance efficiency values used in the *_N.DDS, TSTool command files, IPY and the OPR file are consistent.

Calibration of Historical Simulation

Calibration is the process of simulating the river basin under historical conditions and adjusting parameters to achieve agreement between observed and simulated records of streamflow gages, reservoir storage, and diversions. CDSS models are generally calibrated in a two-step process.

First Step Calibration

In the first calibration run, the model is executed with relatively little freedom with respect to operating rules. Headgate demand is set to historical diversions, and historical reservoir EOM contents serve as operational targets. Operating rules simulate reservoir releases to satisfy demands, but if simulated reservoir content was higher than historical after all demand was satisfied, Release to Target operating rules caused the reservoir to release water to the river to achieve the historical EOM content.

The objective of the first calibration run is to refine natural flow hydrology and return flow locations before introducing uncertainties related to rule-based operations. Diversion shortages, that is, the inability of a water right to divert what it diverted historically, indicate possible problems with the way natural flows were represented or with the location assigned to return flows back to the river. Natural flow issues were also evidenced by poor calibration of the historical gages. Generally, the parameters that can be adjusted relate to the distribution of baseflows (i.e., A*P parameters or the method for distributing baseflows to ungaged locations), and locations of return flows.

Second Step Calibration

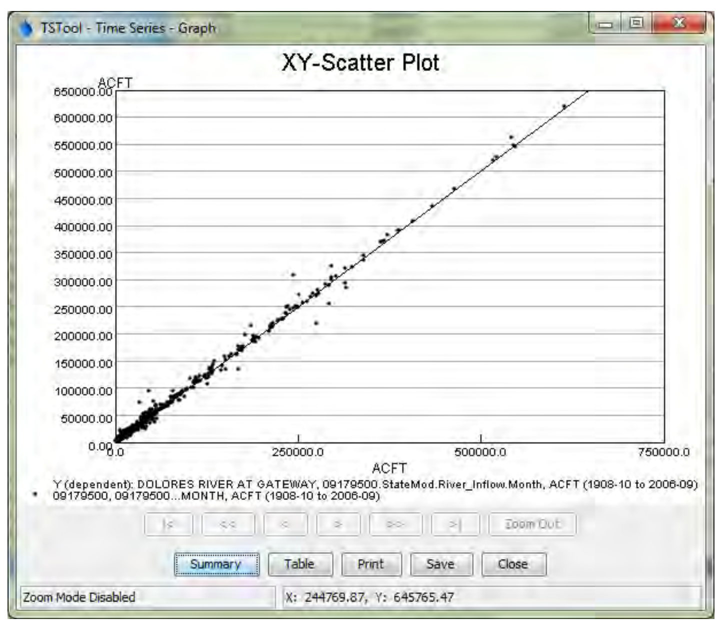
In the second calibration run, constraints on reservoir operations are relaxed. The Release to Target rules are no longer used and reservoir storage is now limited by water right and availability, and generally, reservoir releases are controlled by demands.

The objective of the second calibration step is to refine operational parameters. For example, poor calibration at a reservoir might indicate poor representation of administration or operating objectives. Calibration was evaluated by comparing simulated gage flows, reservoir contents, and diversions with historical observations of these parameters.

Simulated Values vs. Observed Records

1) **Run the Historical Scenario.** This simulates the system using the natural flow estimates, historical diversions as the demand, historical operations, and the reservoir targets are generally set to capacity as discussed in First Step Calibration above.

2) **Review the results of the Historical Simulation**. The results of the historical scenario are generally reviewed to determine if the natural flows are large enough to meet the historical diversions, and to determine if the simulated streamflows correlate with historical streamflows.
   a. Using TSTool, query for historical gaged streamflow (*.RIH file) and the simulated streamflow (River Outflow in the *.b43 StateMod Binary file) at all streamflow gages in the model (including off-channel reservoir system calibration nodes).
   b. Visually review the individual results of the simulated vs. historical streamflow by right-clicking on each time series result and selecting the **Graph-Line** option.
   c. To understand the correlation between the simulated vs. historical streamflow, right-click on each time series result and select the **Graph-XY-Scatter** option. Right-click on the scatter graph and select the Analysis Details option to view the R^2 value.



d. Using TSTool, query for historical diversions (*.DDH file) and the simulated diversions (*.b43 StateMod Binary file) at all diversion structures in the model. Note that simulated diversions may be recorded under the From River by Priority or From River by Other. Review the diversion output file (*.XDD) to understand how the total diversions can be calculated for structures that divert for more than one demand.
e. Visually review the individual results of the simulated vs. historical diversions by right-clicking on each time series result and selecting the **Graph-Line** option.
f. To understand the correlation between the simulated vs. historical streamflow, right-click on each time series result and select the **Graph-XY-Scatter** option. Right-click on the scatter graph and select the Analysis Details option to view the R^2 value.
g. Consider reviewing the sum of diversions by tributary to understand the shortages on a tributary, and consider adding the natural flow estimate to the graphs to determine if the calibration issue is more related to magnitude or timing.

SPDSS Surface Water Model

Workshop No. 4 – StateMod Revisions and Calibration Review

1. StateMod Revisions
    a. Documentation
    b. Model Connectivity
    c. Imports
    d. Changed Water Rights
    e. Multiple Instream Flow Rights
    f. Bookover Operations

2. Status of Natural Flow Calibration

3. Calibration of Historical Simulation

4. Basin-Specific Operational Discussion

StateMod Revisions

All SPDSS modeling should be performed using the StateMod Version 15.00.01 executable and the StateMod Version 15 Documentation; these were provided via email on November 1st, 2015. This version includes several enhancements and revisions critical to the SPDSS modeling effort. The following summarizes the primary enhancements and revisions; however the user should refer to the documentation for more information on these topics.

Documentation

- Sections 7 and 8 in Version 13 documentation, which included information on operations and FAQ, have been replaced by the Standard Modeling Procedures in Version 15 documentation.

- Additional notes have been added to alert the user of operations that may not be fully tested and require additional review if implemented.

7.0 Standard Modeling Procedures

This chapter provides technical notes on selected operations, guidance for frequently asked questions regarding the operation of StateMod, and standard and accepted StateMod modeling procedures for implementing the various operations. It is recommended the user follow these approaches, however if the approaches are adapted for more specific operations, it is the user's responsibility to test and verify the results. The following sections are available within this chapter:

- Examples of each operating rule type are now included in Section 4.13.51.

```
##########
#  Type 2   Reservoir to a Direct Flow or Reservoir or Carrier
#           Williams Fork Reservoir (ID 513709) release from GMR1 Pool (Account 4) to meet Farmers Irrigation Company (ID 952011) demand
#           carried through Silt Pump Canal (ID 390663 on second line)
#
5137090.30  Opr WFR-Silt Project                 39041.00002      1.       1 950011            1 513709            4 0
                                    390663
```

Model Connectivity

StateMod produces errors during Natural Flow (Baseflow) development if tributaries are modeled without confluence nodes (e.g. a tributary was connected to the model at a diversion node). It is important for the user to model each tributary (including "mock tributaries") using confluence nodes to ensure correct natural flow estimates.

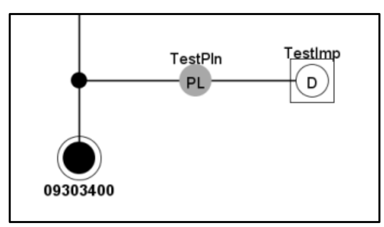
Imports

The import functionality during simulations was enhanced in StateMod Version 15; the functionality of imported water during natural flow mode remained the same as in previous versions. Refer to Section 7.13 for more information on import functionality.

- Special consideration of imported water in StateMod is recommended to make sure it is not reflected as natural flow or distributed as natural flow gains; it can be distributed to various users in the basin based on a specified order; and it can be tracked as a reusable supply as appropriate.
- In general, the imported water is brought into the system, stored in a plan structure, and then released from the plan structure to specific users.

River Network Setup

- A diversion structure, import plan, and accounting plan are all required to model imported water.
    - o The import plan *does not* need to be in the network; the model knows it is import plan because it has the same model ID as the import diversion structure (TestImp) in the plan file.



    - o If desired, check the "Is Import?" box for the import diversion structure. This will include a box around the diversion structure in the

network diagram, but it is used for visual representation only, and is not used by StateDMI when creating files or by StateMod.
    - The accounting plan must be included *directly downstream* of the import diversion structure that will serve as the import plan.
- In the plan file (*.pln), include the import diversion structure as a Type 7 Import Plan (must be same model identifier) and the accounting plan as a Type 11 Accounting Plan.

Example Plan (.pln) File*

```
#
# ID         Name                   RiverLoc       ON/Off iPtype    Peff    iPrf  iPfail   Psto1 Psource        IPAcc
#----------eb----------------------eb--------exb------eb-------eb------eb------eb------eb------exb----------eb------e
TestImp     TestImpPlan             TestImp             1        7     999     999       0     0.0 ImportPln          0
TestPln     TestAcctPlan            TestPln             1       11     999     999       0     0.0 ImportPln          0
```

- In the diversion station (*.dds) file, include the import diversion structure with the following parameters:
    - Set the capacity of the structure to be greater than the maximum import amount
    - Set the efficiency to be zero (i.e. 100 percent returns)
    - Set the return flow pattern and location to return the full amount in the same time step to the import plan structure.

Natural Flow Scenario

- The imported amount is reflected as a negative value under the import diversion structure ID in the historical diversion (*.ddh) file.
- After running the natural flow scenario, review the baseflow result information summary (*.xbi) file to ensure that the imported amount is reflected in the Import (Col 2) and accounted for in the natural flow calculations.

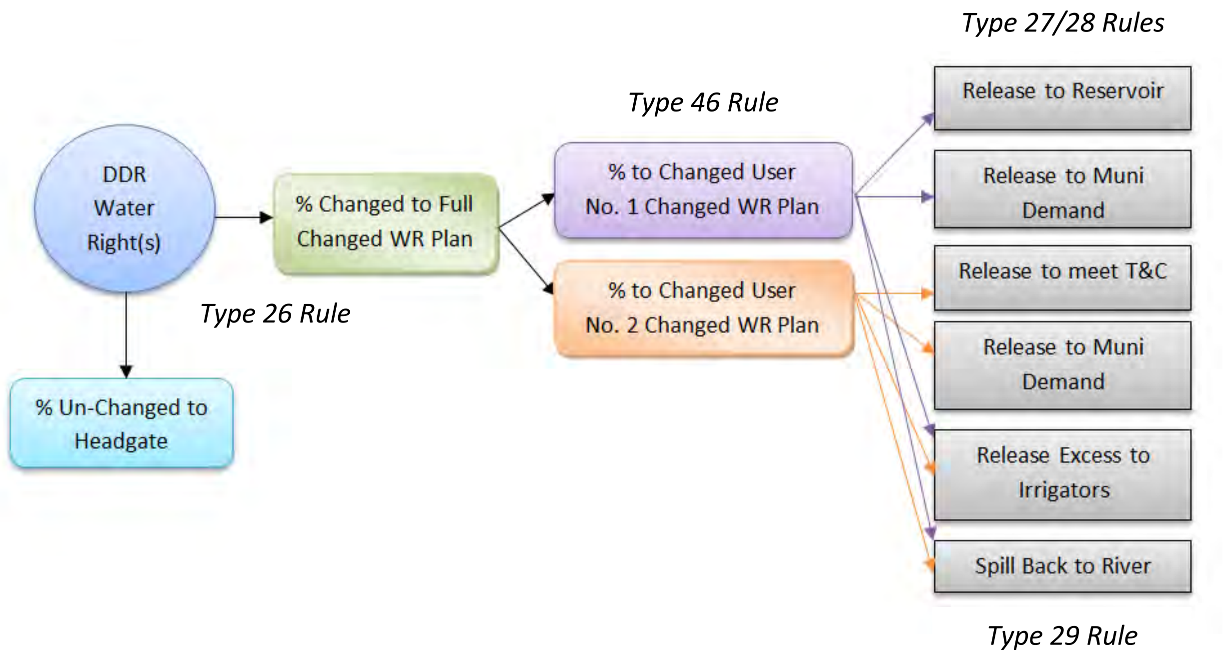
Simulation Scenario

- In the diversion demand (*.ddm) file, include the time series of the imported amount as a negative value under the import diversion structure ID.

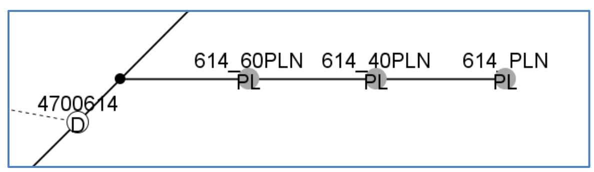
- In the operating rule (*.opr) file, include the following rules at a minimum to operate the import plan:
  - Type 35 rule with the source as the import diversion structure and the destination as the accounting plan structure. This rule is generally set as the most senior priority in the model.
  - Type 27 and/or 28 rules with the source as the import plan structure and the destination as any structures that are to receive imported supplies.
    - Note that if the import water that is carried to a specific diversion structure using these rules is a reusable supply, then include a reusable supply plan in the Type 27 or 28 rule. See the “How to Model Reusable Supplies” section for more information.
  - Type 29 with the source as the import plan structure and the destination as the next downstream node. Note that a destination node is required for any Type 29 plan spill rules with an accounting plan source.
- Review the plan summary (*.xpl) file and operating rule summary (*.xop) file for the portion of the imported water that was carried to meet each diversion demand and the portion, if any, that was unused and spilled back to the stream.

Changed Water Rights

The approach to simulating changed water rights was significantly enhanced in StateMod Version 15; additional plan types and operating rules were added to the model. The following discussion supersedes the changed water right information presented in SPDSS Modeling Workshop 2. Refer to Section 7.11 for more information on changed water rights operations.



1. As the changed water right plan operations are all accounted for at the source water right headgate (administrative) location, all the plans must be modeled off-channel on a "mock" tributary so they do not affect exchange potential or other operations on the mainstem.



2. Divert water associated with one more water rights into the Full Changed Water Right Plan.
   a. The Type 26 operating rule is specifically used to "temporarily store" water in a Changed Water Right Plan (Plan Type 13) and must include monthly and annual limitations. The priority of this operating rule is set to the same priority as the water right.
   b. If more than one water right is changed at the same source location, they can be put into the same overall plan *only if* all the water rights can be split to individual user plans using the same percentages and if the terms and conditions applied when the plans release the water to the end uses are the same.

    c. The full amount or only a portion can be put into the plan. StateMod does ensure shortages are shared between the portion that is put into the changed water rights plan and the portion that remains to meet the headgate demand.
    d. The water that remains at the headgate is limited by the source structures capacity, but the changed amount is *not* limited by the source structure's capacity. Capacity limitations are imposed when water is released from the changed water rights plan using a Type 27/ 28 rule.
    e. The Type 26 operating rule only operates only once per time step (i.e. does not re-operate).

3. Changed water in the Full Changed Water Right Plan is then split to multiple users.
    a. Type 46 operating rules are used to split water in the Changed Water Rights Plan to individual users' plans; a maximum of 10 split plans is allowed.
    b. Priorities of these operating rules are set just junior to the priority of the most junior water right in the Full Changed Water Rights Plan.

4. User Changed Water Right Plans release to meet individual demands using Type 27/28 rules.
    a. List User Changed Water Right Plans in the PLN file and include on the network file.
    b. Type 27/28 operating rules are used to "release" water in the users' plans to meet specific demands in a later priority relative to the users' other supplies.
    c. When a Changed Water Right Plan is the source for the Type 27/28 rule, the original Type 26 operating rule must be included in the Type 27/28 rule as an additional row. This signals StateMod to run the released water from the plan through the original source headgate so capacity can be reduced by the released amount.

d. Operating rules can include intervening structures with/without losses, designation of return flow obligations (Terms and Conditions Plan, see further discussion below), and designation of reusable supplies (Reuse Plan, see further discussion below).

SPDSS Modeling Workshop 2 summarizes the approach to modeling T&C Plans; this approach did not change and is therefore not reiterated here.

e. Releases can be limited by amounts simulated or specified in other operations using the OprLimit flag.
   i. OprLimit = 5 ties the release from the plan (or sub-plan if it has been split using a Type 46 operating rule) to the source water right diversion structure and allows the model to limit the release based on available capacity at the source structure. Include the Type 26 operating rule ID that diverted the water into the changed water right plan.
   ii. OprLimit = 7 limits the release from the changed water rights plan to the release limit plan. Include the Type 47 operating rule ID that defined the monthly and annual release limitations. If more than one release operating rule refers to the release limit plan, the total released from those rules will be limited to the release limit plan.
   iii. OprLimit = 8 limits the release from the changed water rights plan to the amount diverted and/or carried via another operating rule. Include the operating rule ID of the diversion or carrier operating rule; generally a Type 11 carrier rule. If more than one release operating rule refers to the carrier rule, each individual release rule will be limited by the amount carried (i.e. cumulative releases will *not* be limited).
   iv. OprLimit = 9 incorporates the limitations from all the limits above. Include the Type 26 operating rule ID, the Type 47 operating rule ID, and the carrier rule ID to apply all three limits.

5. Release unused supplies from the Users' Changed Water Rights Plans back to the ditch.
    a. "Release" water from the users plans back to the ditch demand, if applicable, using Type 27/28 operating rules and priorities junior to all other "releases".

6. Spill unused supplies from the Full Changed Water Rights Plan and Users' Plans back to the river.
    a. All plans must "spill" each time step; use Type 29 operating rules with a priority junior to all other operations to spill each plan.
    b. The Type 29 plan spill destination must be the source water right headgate.

7. Review the plan summary (*.xpl) file, the operating rule summary (*.xop) file, and the diversion structure summary (*.xdd) file for information on the amount of changed water stored in the plan and the amount of water diverted to meet the headgate demand.
    a. When a changed water right temporarily stores water in a plan, the available flow in the system and the water physically located at the source structure is reduced. This makes the water temporarily stored by this operating rule unavailable for any junior water rights to divert. Because the amount diverted is considered temporary, no diversions are reported in the diversion structure summary (*.xdd) file at the source structure or destination plan unless water is released from the plan. Note, the total amount diverted, including any that may have been released for use or spilled, is reported in the operating rule summary (*.xop) file and the plan summary (*.xpl) file.

Changed Water Rights Operations - Example Operating Rule (.opr) File*

```
# ID        Name                     NA                     Admin#   # Str  On/Off_Dest Id      _Dest Ac  Sou1 Id      Sou1 Ac  Sou2 Id      Sou2 Ac     Type ReusePlan    _Div Type     OprLoss     Limit   ioBeg   ioEnd
#---------eb--------------------------eb----------exxxxb---------eb------eb------e-b----------eb------e-b----------eb------e-b----------eb------eb------exb----------exb----------exb------eb------eb------eb------ex
#'Plan' structure operating rules
#
# Eureka Irrigation_Demand (614_60_I and 614_40_I) is split 60/40 due to supplemental reservoir water per rancher comments
#  1) Fill full plan (614_PLN) w/ 614 water right, 2) Split plan into 60/40 plan IDs (614_60PLN, 614_40PLN) 3) Meet demands (614_60_I, 614_40_I) 4) Spill back to 614
614_PLN.01  Eureka_Full_Plan                           1.00000      0.       1 614_PLN          1 4700614.01       50 NA                  0      26 NA          Diversion          0       0       0    9999
 4300.  4300.  4300.  4300.  4300.  4300.  4300.  4300.  4300.  4300.  4300.  4300.  48000.0
#
614_PLN.02  Split_Eureka_Full_Plan_60_40               1.00002      0.       1 614_60PLN       60 614_PLN           1 NA                  0      46 NA          Diversion          0       2       0    9999
                                                                               614_40PLN       40
#
# Releases from Seymour RS are released to the 60 plan, as only the 60% plan receives supplemental reservoir water
614_PLN.03  614_60PLN_to_614_60_I                      1.00003      1.       1 614_60_I         1 614_60PLN       100 NA                  0      27 NA          Diversion         -1       5       0    9999
                                    4700614       30        Carrier
                             614_PLN.01
614_PLN.04  614_40PLN_to_614_40_I                      1.00004      1.       1 614_40_I         1 614_40PLN       100 NA                  0      27 ReusePln    Diversion         -1       5       0    9999
                                    4700614       0        Carrier
                                    614_PLN.01
#
614_PLN.08  614_60PLN_Spill                            2.00000      0.       1 4700614          0 614_60PLN         0 NA                  0      29 NA          NA                 0       0       0    9999
614_PLN.09  614_40PLN_Spill                            2.00000      0.       1 4700614          0 614_40PLN         0 NA                  0      29 NA          NA                 0       0       0    9999
614_PLN.10  614_PLN_Spill                              2.00000      0.       1 4700614          0 614_PLN           0 NA                  0      29 NA          NA                 0       0       0    9999
614_PLN.11  614_PLN_Spill                              2.00000      0.       1 NA               0 ReusePln          0 NA                  0      29 NA          NA                 0       0       0    9999
```

Changed Water Rights Operations - Example Plan (.pln) File*

```
#
# ID        Name                     RiverLoc      ON/Off  iPtype    Peff   iPrf  iPfail   Psto1 Psource     IPAcc
#---------eb-----------------------eb----------eb------eb------eb------eb------eb------eb------exb----------eb------e
614_PLN     EurekaFullPlan           614_PLN            1      13       0      0       0       0 4700614         0
614_60PLN   Eureka60Plan             614_60PLN          1      13       0      0       0       0 4700614         0
614_40PLN   Eureka40Plan             614_40PLN          1      13       0      0       0       0 4700614         0
ReusePln    ReusePlan                ReusePln           1       4       0      0       0       0 4700614         0
```

Multiple Instream Flow Rights

The functionality associated with instream flow reaches and rights was enhanced in StateMod Version 15. StateMod is now able to simulate multiple water rights at a single instream flow reach/point and can release from a changed water rights plan to an instream flow right.

- For an instream flow reach with multiple rights, include the multiple instream flow rights in the instream flow rights (*.ifr) file using numeric suffixes (.01, .02, etc.). This numeric suffix approach is the same approach used in the diversion and reservoir rights files.
- For a plan releases to the instream flow, the instream flow must be downstream of the changed water rights plan. A Type 27 operating rule can be used to release from either an import plan or a changed water rights plan to meet the instream flow demand.

Bookover Operations

The functionality associated with bookover operations was enhanced in StateMod Version 15 to improve the reporting of these operations. In specific operational scenarios in which the full reservoir volume is redistributed among several different accounts (i.e. Vallecito and Lemon Reservoirs), re-operation of bookover operating rules resulted in bookover amounts that far exceeded the reservoir account capacities. The Type 6 operating rule was enhanced to allow the user control over when the operating rule re-operated. The user can include another operating rule ID in the Type 6 operating rule, which signals to StateMod to stop re-operating the Type 6 rule after it simulates the included operating rule. See Section 7.5.4 for more information on these operations.

Status of Natural Flow Calibration

- Discuss the status of any outstanding issues identified in the Natural Flow Review.

Calibration of Historical Simulation

Calibration is the process of simulating the river basin under historical conditions and adjusting parameters to achieve agreement between observed and simulated records of streamflow gages, reservoir storage, and diversions. CDSS models are generally calibrated in a two-step process.

First Step Calibration

In the first calibration run, the model is executed with relatively little freedom with respect to operating rules. Headgate demand is set to historical diversions, and historical reservoir EOM contents serve as operational targets. Operating rules simulate reservoir releases to satisfy demands, but if simulated reservoir content was higher than historical after all demand was satisfied, Release to Target operating rules caused the reservoir to release water to the river to achieve the historical EOM content.

The objective of the first calibration run is to refine natural flow hydrology and return flow locations before introducing uncertainties related to rule-based operations. Diversion shortages, that is, the inability of a water right to divert what it diverted historically, indicate possible problems with the way natural flows were represented or with the location assigned to return flows back to the river. Natural flow issues were also evidenced by poor calibration of the historical gages. Generally, the parameters that can be adjusted relate to the distribution of baseflows (i.e., A*P parameters or the method for distributing baseflows to ungaged locations), and locations of return flows.

Second Step Calibration

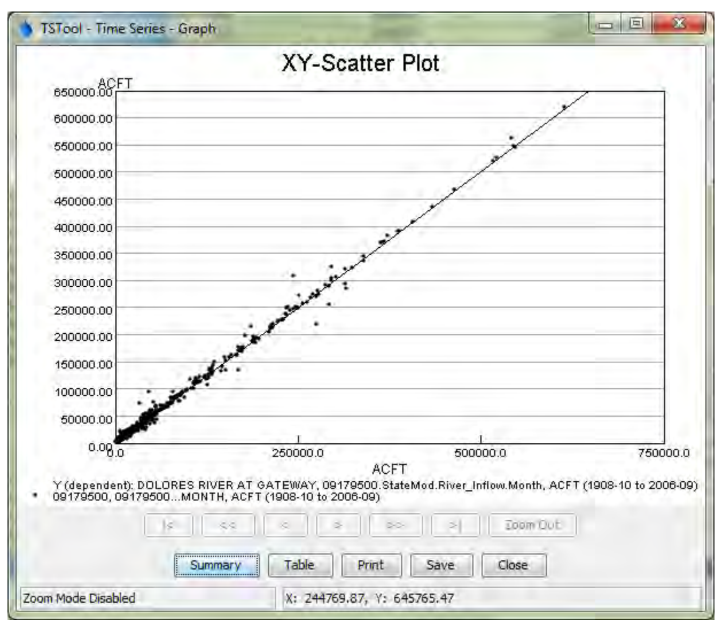
In the second calibration run, constraints on reservoir operations are relaxed. The Release to Target rules are no longer used and reservoir storage is now limited by water right and availability, and generally, reservoir releases are controlled by demands.

The objective of the second calibration step is to refine operational parameters. For example, poor calibration at a reservoir might indicate poor representation of administration or operating objectives. Calibration was evaluated by comparing simulated gage flows, reservoir contents, and diversions with historical observations of these parameters.

Simulated Values vs. Observed Records

1) **Run the Historical Scenario.** This simulates the system using the natural flow estimates, historical diversions as the demand, historical operations, and the reservoir targets are generally set to capacity as discussed in First Step Calibration above.

2) **Review the results of the Historical Simulation**. The results of the historical scenario are generally reviewed to determine if the natural flows are large enough to meet the historical diversions, and to determine if the simulated streamflows correlate with historical streamflows.
    a. Using TSTool, query for historical gaged streamflow (*.rih file) and the simulated streamflow (River Outflow in the *.b43 StateMod Binary file) at all streamflow gages in the model (including off-channel reservoir system calibration nodes).
    b. Visually review the individual results of the simulated vs. historical streamflow by right-clicking on each time series result and selecting the **Graph-Line** option.
    c. To understand the correlation between the simulated vs. historical streamflow, right-click on each time series result and select the **Graph-XY-Scatter** option. Right-click on the scatter



graph and select the Analysis Details option to view the R^2 value.

d. Using TSTool, query for historical diversions (*.DDH file) and the simulated diversions (*.b43 StateMod Binary file) at all diversion structures in the model. Note that simulated diversions may be recorded under the From River by Priority or From River by Other. Review the diversion output file (*.XDD) to understand how the total diversions can be calculated for structures that divert for more than one demand.
e. Visually review the individual results of the simulated vs. historical diversions by right-clicking on each time series result and selecting the **Graph-Line** option.
f. To understand the correlation between the simulated vs. historical streamflow, right-click on each time series result and select the **Graph-XY-Scatter** option. Right-click on the scatter graph and select the Analysis Details option to view the R^2 value.
g. Consider reviewing the sum of diversions by tributary to understand the shortages on a tributary, and consider adding the natural flow estimate to the graphs to determine if the calibration issue is more related to magnitude or timing.

Basin-Specific Operational Discussion

- Discuss any basin-specific operations modelers may be having difficulty representing in the models.