Addendum #1

Project Information	
Project Name:	Retiming Storage Investigation
Bid Number:	F24-01-005
Date:	March 6, 2024
Project Manager:	Kelen Dowdy

Addendum Questions	
Question #1	Who will be the decision makers
Answer	The decision makers in the evaluation are confidential but will include subject matter experts within the City.
Question #2	Should additional tasks/work items/budget we identify be included in the existing tasks provided in the RFP or grouped into new tasks for your evaluation purposes?
Answer	Additional tasks/work items/budget identified should be included within existing tasks as it applies and new tasks if needed. Additions should be clearly highlighted as additions and justification of need
Question #3	Are all the items listed on page 6 of the RFP currently publicly available? If so, where can they be located?
Answer	Not all of the items are publically available. All documents associated with system modeling are proprietary to the City. Master planning files can be found on
Question #4	Have potential reservoir site locations been identified on a preliminary basis or will the consultant need to conduct a "universe of opportunities" evaluation of storage?
Answer	The consultant will need to conduct an opportunites evaluation. However, the intent would be to leverage previous opportunity analysis and secondarily focus on optimization of Greeley owned
Question #5	Can the appendices of the IWRP be provided?
Answer	Appendix A, B and D can be provided (see attached)

To:	Kelen Dowdy	From:	Mary Presecan, Cortney Brand
Subject:	Water Resources Capital Improvement Plan - Draft	Date:	March 22, 2023

1.0 CAPITAL IMPROVEMENTS PLAN

The IWRP Capital Improvements Plan (CIP) was developed with consideration of the City's current and long-range population and projected water demands and represents water resource investments and projects needed to support implementation of the conclusions and recommendations of the IWRP. This CIP presents planning-level cost estimates for capital project scheduling and budgeting. Conditions will change with time and will impact the accuracy of this CIP. As projects approach implementation, it is important for the City to reevaluate the scope and need of each project to reflect updated growth, development, and water demands.

1.1 APPROACH TO CAPITAL IMPROVEMENTS PLAN DEVELOPMENT

A 10-year planning horizon was utilized for this CIP, starting in 2024 and continuing through 2033. This 10-year planning horizon does not capture the full implementation of recommendations identified in Greeley's IWRP. To the extent additional CIP projects may be required beyond 2033, those needs are addressed in the discussion about the identified capital improvement plan projects below.

This CIP represents Greeley Water Resources Department portion of project costs. Cost sharing opportunities with developers, funding partners, or other Departments within Greeley do exist for some of the projects included in this CIP. Those cost sharing opportunities are described in further detail in the project descriptions below.

Project cost estimates presented within this CIP are in 2023 dollars. Project costs associated with reoccurring projects assume an annual escalation rate of 3%. Project costs were developed based on input from the City, existing cost estimates from previous CIPs, and actual spending by the City.

Overall project sequencing is based input from City staff on the interdependencies between projects, and on progressive expansion of Greeley's water resources portfolio to meet or exceed the demand projections described in this IWRP.

The following key assumptions were made to develop this CIP:

- Land and/or easements will be required and ready for development of projects when needed.
- Cost associated with land acquisition / easements and right-of-ways are not included in this CIP.
- Estimated capital costs include costs associated with permitting, design, and construction management.

- Ancillary costs associated with capital projects such as pipeline connections, inlet and outlet structures, measurement, and controls were assumed to be included in the total project costs.
- Management of Greeley's water rights portfolio could include such things as maintenance of ditch and conveyance systems, regular measurement and recording of water deliveries, preparation of water accounting, land management for compliance with dry up or revegetation requirements. These on-going compliance requirements are considered regular operations and maintenance and are therefore not included in this CIP.
- Costs do not include "internal City costs" to complete projects. Internal City costs are defined as additional staff requirements associated with project development and implementation.

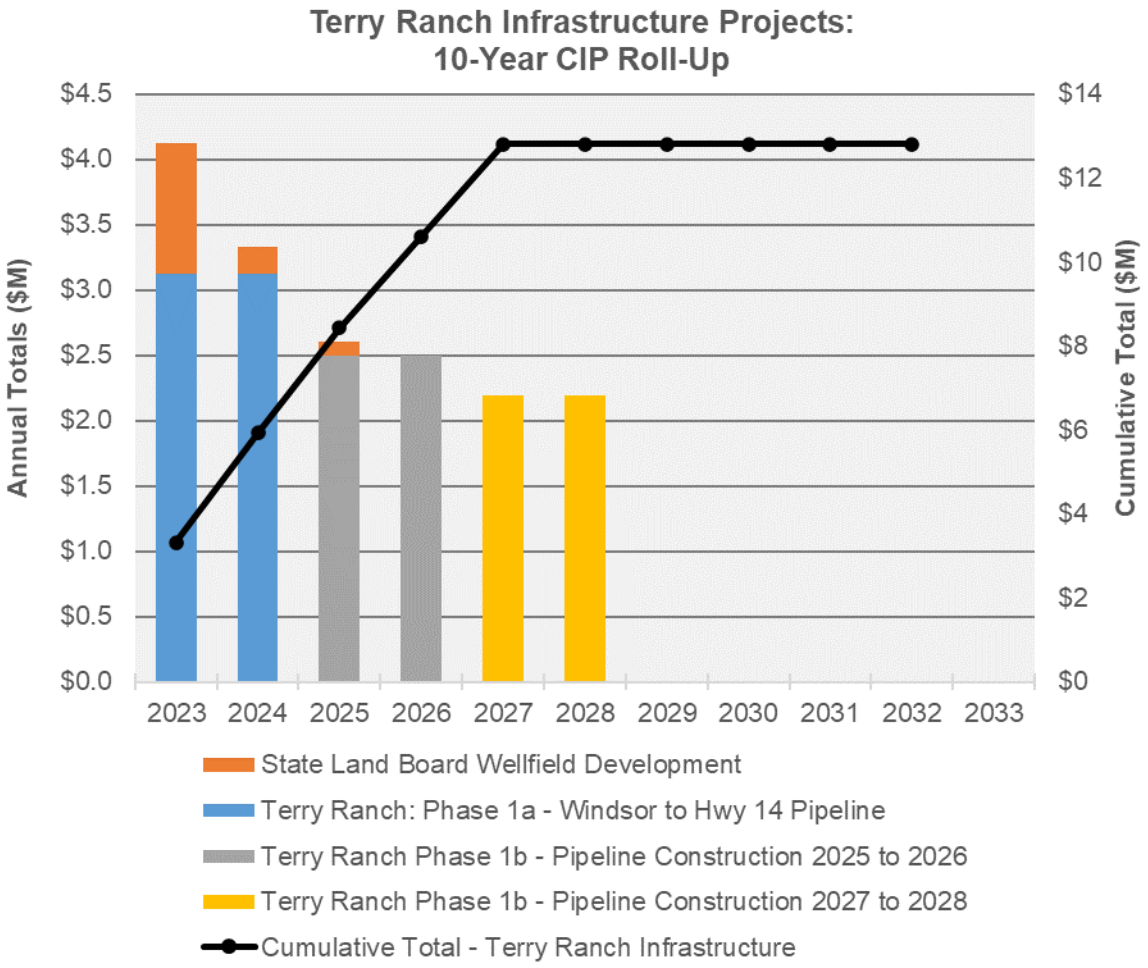
1.2 IDENTIFIED CAPITAL IMPROVEMENT PLAN PROJECTS

The following section provides a detailed description of the water resource projects identified through development of the IWRP and included in this CIP.

1.2.1 Terry Ranch Infrastructure

The annual and cumulative costs associated with the identified Terry Ranch Infrastructure projects to be completed between 2023 and 2033 are shown on Figure 1. The costs shown in this figure only reflect Greeley's portion of the project costs, and do not include the portion of project costs contributed by Wingfoot.

Figure 1.



1.2.1.1 Terry Ranch Infrastructure – Phase 1: Utilize 80/20 Match Funding

Phase 1a: Windsor to Highway 14 Pipeline

This project started in 2023 and will be completed within two years. It consists of constructing the first six miles of the Terry Ranch conveyance pipeline between Windsor and Highway 14. The total project cost for Phase 1 of the Terry Ranch Infrastructure is $31,250,000, Greeley's portion of the project costs is $6.25M.

Phase 1b: Continued High Priority Pipeline Construction

This project is anticipated to commence in 2025 and take four years to complete. It consists of installing the Terry Ranch conveyance pipeline from Highway 14 (termination point of Phase 1) to the north as far as the money available can develop. The total project cost for Phase 2 of the Terry Ranch Infrastructure is $46,875,000, Greeley's portion of the project costs are estimated to be $9.375M. It is also possible that

some funds allocated to Phase 1b could be used to equip the monitoring wells installed on the State Land Board parcels and to conduct additional testing.

1.2.1.2 Terry Ranch Infrastructure – Phase 2: Utilize 50/50 Match Funding

Phase 2 of Terry Ranch Infrastructure development is anticipated to commence outside of this 10-year CIP. The timing and composition of Phase 2 will be determined after Greeley completes the next update to its IWRP and the Terry Ranch Integration Study. Phase 2 could also be triggered by implementation of the Adaptive Plan. Funding for Phase 2 will require Greeley to match 50% of the funds contributed by Wingfoot.

1.2.1.3 State Land Board Wellfield Development

This project was initiated in 2023 and Greeley is in the process of requesting bids from drilling contractors. The project consists of installing and testing monitoring wells in the 16 State Land Board-owned sections interspersed with the Terry Ranch property. The primary purpose of this effort is to secure the rights to the groundwater in the Upper Laramie Aquifer underlying the State Land Board parcels and to jointly apply for a Water Court decree. The project is anticipated to be completed by the end of 2024. Greeley has budgeted $1.3M for this project, but the actual costs will not be known until bids are received and Greeley selects a contractor. It is likely that additional funds will be needed to supplement the existing budget. One potential source of additional funds to supplement the existing budget for the State Land Board Wellfield Development could be the money available from Wingfoot that is currently being shown as allocated to Terry Ranch Infrastructure Phases 2 and 3.

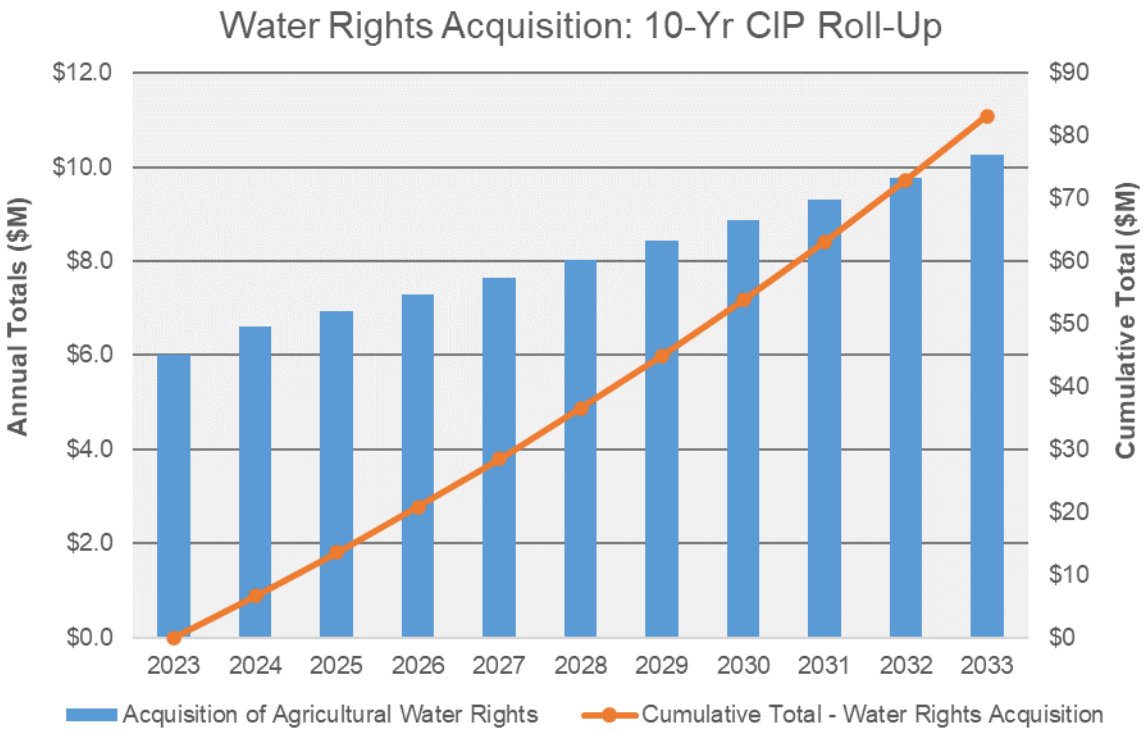
1.2.2 Water Rights Acquisition

The water rights acquisition costs included in this CIP assume that Greeley will continue an opportunistic and strategic approach to acquiring water rights. For planning purposes, this CIP assumes that Greeley will spend approximately $6.0M per year, with a 5% annual escalation. The annual and cumulative costs associated with Greeley's acquisition of agricultural water rights between 2023 and 2033 are shown on Figure 2.

Recent water right transactions suggest that non-potable supplies can range in cost from $8,000 to $30,000 per acre foot of consumptive use and potable supplies can range in price from $10,000 to $61,000 per acre-foot of consumptive use. Based on recent comparable sales, Greeley projects to acquire 150 to 750 acre-feet of consumptive use of unchanged agricultural water rights each year.

Water acquisition costs are highly variable based on several factors, including the water right's location and seniority, competition for water, and the historical practices of prior owners. Because of growing demand and the scarcity of supply, water prices are volatile and have been subject to significant increases in recent years. The acquisition costs included herein are meant to be used for high-level budgeting and should not be used to justify individual acquisitions or used as a criteria to decline potential future acquisitions. Water right acquisition prices are variable based on specifics of the acquisition, are likely to be higher in areas of increased competition (e.g., Upper Reach of the Cache la Poudre River), and will increase in the future as demand and scarcity continue to increase.

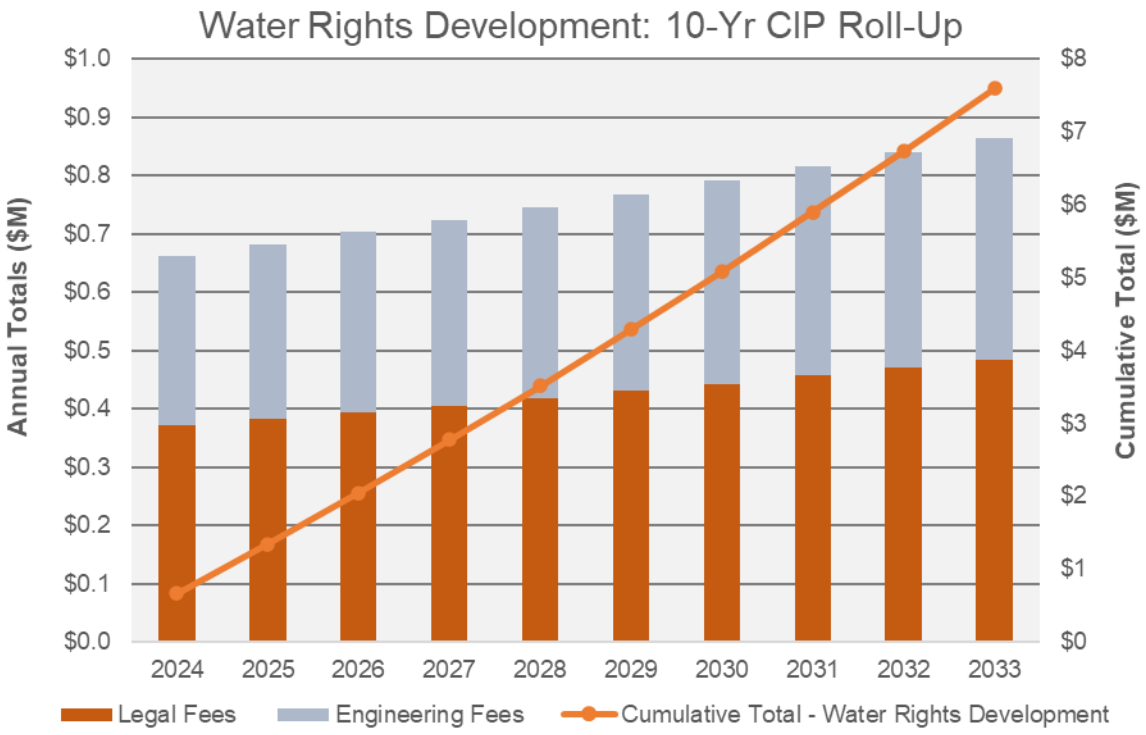
Figure 2



1.2.3 Water Rights Development

The Greeley IWRP CIP considered two categories of costs associated with water rights development: Legal Fees and Engineering Fees. The 10 year CIP roll-up for Water Rights Development costs considered in this CIP is presented in Figure 3. Once acquired, Greeley will have additional financial obligations associated with the operation and maintenance of those water rights. On-going operations and maintenance for water rights may include, but are not limited to: measuring and recording of water delivery and use, water accounting, upkeep of water conveyance and delivery infrastructure, or land management for compliance with dry up or revegetation provisions.

Figure 3



1.2.3.1 Water Rights Development – Legal Fees

The legal fees associated with water rights development included in the Greeley IWRP CIP represent the anticipated costs associated with hiring legal counsel to provide support through the acquisition and change of water rights for use by Greeley. The annual cost of $350,000 per year for legal services associated with water rights development is based on actual Greeley expenditures between 2018 and 2022. Annual costs associated with legal services for water rights development was projected to escalate 3% per year throughout the 10-year planning horizon of this CIP. It is assumed that Greeley will consistently work to protect existing water rights, and procure and change new water rights at a rate consistent with that of the last five years. However, it should be noted that water right development costs are highly variable as some water rights will be more complex or there will be a greater level of opposition given the ditch system's characteristics, location, or other water right owners.

1.2.3.2 Water Rights Development – Engineering Fees

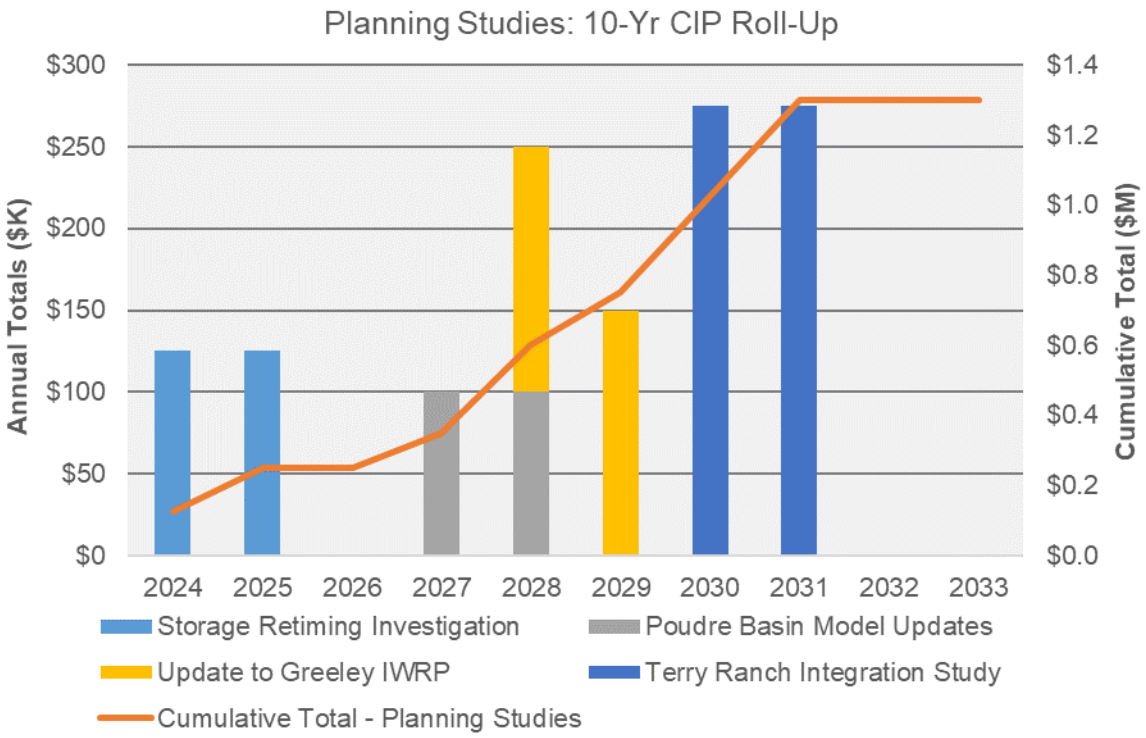
The engineering fees associated with water rights development included in the Greeley IWRP CIP represent the anticipated costs associated with hiring a technical consultant to provide support through the acquisition and change of water rights for use by Greeley. The annual cost of $275,000 per year for engineering services associated with water rights development is based on actual Greeley expenditures between 2018 and 2022. Annual costs associated with engineering for water rights development was

projected to escalate 3% per year throughout the 10-year planning horizon of this CIP. It is assumed that Greeley will consistently work to protect existing water rights, and procure and change new water rights at a rate consistent with that of the last five years. However, it should be noted that water right development costs are highly variable as some water rights will be more complex or there will be a greater level of opposition given the ditch system's characteristics, location, or other water right owners.

1.2.4 Planning Studies

Based on the IWRP outcomes and recommendations, and to support the key actions of the Adaptive Plan, four Planning Studies were identified by City staff as necessary within the term of this CIP. The costs included in this CIP for Planning Studies do not include “internal City costs” to complete projects. Internal City costs are defined as additional staff requirements associated with project development and implementation. Figure 4 presents the sequencing and estimated annual and cumulative costs associated with the Water Resources Planning Studies.

Figure 4



1.2.4.1 Storage Retiming Investigation

The purpose of the Storage Retiming Investigation is to evaluate opportunities to optimize Greeley’s water resources portfolio through storage retiming. This study may be used to assist Greeley in evaluating participation in NISP and to determine how the sustainability of Terry Ranch operations could be improved through storage retimining.

It is anticipated that the Storage Retiming Investigation will commence in 2024 and take 2 years to complete. The cost associated with this planning study is anticipated to be $250,000, this budget includes computer modeling which will be required to support the analysis.

1.2.4.2 Poudre Basin Model Updates

The Poudre Basin Model is a model which simulates water supply infrastructure and operations by municipal, industrial, and agricultural entities in the Poudre River Basin and the lower South Platte River basin. This model is used by water users throughout the Poudre River Basin to quantify the yields of agricultural and municipal water rights, and to provide preliminary estimates of Poudre River and Lower South Platte River streamflows. An update of the Poudre Basin Model is needed to reflect changes in water rights and river operations that have occurred since the last model update.

Given the multiple entities with rely upon the Poudre Basin Model and utilize the model to support water system operations and use, there is a high potential for cost share for this project. The total cost to update the Poudre Basin Model is expected to be $600,000. Assuming a three-way split of project costs between Fort Collins, Northern Water, and Greeley, Greeley's projected cost for this project is $200,000.

It is anticipated that this project will commence in 2027, after Fort Collins receives a Record of Decision (ROD) and before the Greeley IWRP Update and have a duration of two years.

1.2.4.3 Update to Greeley IWRP

While the IWRP showed Greeley's water supply system is resilient against warmer futures and increased demands, it is still vulnerable to significantly stressful future conditions. For these reasons, it is recommended that Greeley regularly update the IWRP to monitor drivers and changes that may impact Terry Ranch timing or other changes to the system.

It is anticipated that this project will commence in 2028, after the Poudre Basin Model update has started, and have a duration of two years. Results of the Greeley IWRP Update will be utilized for the Terry Ranch Integration Study.

1.2.4.4 Terry Ranch Integration Study

The purpose of the Terry Ranch Integration Study is to refine the triggers and timing of when water is needed from Terry Ranch, and when and how to develop and operate on-site infrastructure. The study could consist of the following elements:

- Refine the triggers for projecting when groundwater supplies will be needed from Terry Ranch;
- Develop an implementation plan for on-site infrastructure, including timing, phasing, and delivery method(s);
- Evaluate how to integrate Terry Ranch operations into overall water system operations, including well production and deliveries, water quality and treatment plant operations, and operations scheme for recharge activities and periods when water is not needed from Terry Ranch; and

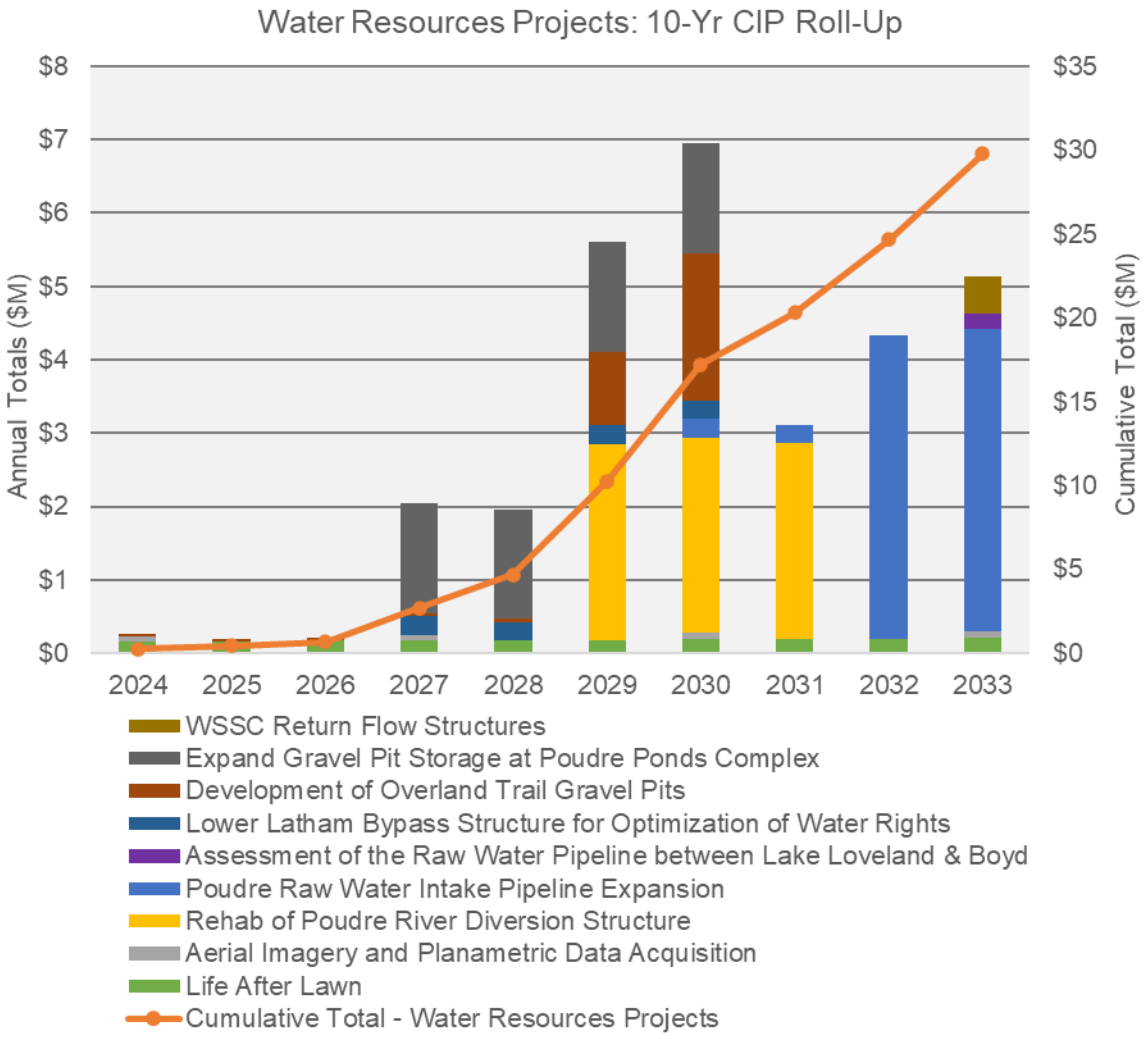
- Water system hydraulic modeling, if needed; and groundwater flow modeling to evaluate water-level impacts of various operations schemes.

It is anticipated that this study commence in approximately the 2030 timeframe after completion of the IWRP Update, and have a duration of two years.

1.2.5 Water Resources Projects

The following Water Resources Projects have been included in the IWRP CIP

Figure 5



1.2.5.1 Life After Lawn

The Life After Lawn Program allows residential and commercial water customers to receive a rebate for replacing healthy, well-watered turf grass with low-water landscaping. This program only applies to City of Greeley residents or water customers.

City of Greeley residents (homeowners and landlords) can receive $1.00/square foot to convert a minimum of 500 square feet of healthy, well-watered turf with native and/or water wise plantings. A maximum of $3,000 per household per year is eligible. Similarly, commercial properties can receive $1.00/square foot to convert a minimum of 5,000 square feet. A maximum of $30,000 per commercial property per year is eligible.

The estimated costs of the Life After Lawn program is $150,000 per year with an assumed 3% inflation rate.

1.2.5.2 Aerial Imagery and Planimetric Data Acquisition for Tri-Annual Update to Residential Water Budget

Every three years the City obtains aerial imagery and planimetric data for the purpose of analyzing the irrigable area component and updating the residential water budget. These data are necessary to accurately bill Greeley's Water and Sewer customers.

The cost to obtain updated aerial imagery and Planimetric data is approximately $200,000. It is anticipated that this cost will be split evenly between Water & Sewer, Stormwater, and IT. Therefore, for the purpose of the IWRP CIP, the cost for each Aerial Imagery and Planimetric Data Acquisition is assumed to be $68,000. These data will be acquired every three years starting in 2024.

1.2.5.3 Rehab of Poudre River Diversion Structure

Rehabilitation of the Poudre River Diversion Structure is needed due to the age of the infrastructure. Opportunities exist to make enhancements to the diversion structure (e.g., fish ladder and pass through for boaters) that will provide benefits for environmental and recreation uses. If these enhancements are included, Greeley anticipates the cost for rehabilitation of the Poudre River Diversion Structure to be $8,000,000. Cost sharing opportunities are anticipate given the regional benefit these enhancements could provide; however, at this time no specific coast sharing partner has been identified. For this reason, this CIP assumes that Greeley will assume all costs associated with this project along with the identified environmental and recreation enhancements. Greeley staff anticipates this project will commence in 2029 and have a duration of three years.

1.2.5.4 Poudre Raw Water Intake Pipeline Expansion - Between River Diversion and Bellvue Intake

The Poudre Raw Water Intake Pipeline between the river diversion and Bellvue water treatment plant (WTP) intake is limited to a capacity of 35 MGD. As demands increase, it is expected that the current capacity will restrict Greeley's ability to convey raw water to Bellvue WTP. The goal of this project is to

replace the existing pipeline with a pipeline capable of conveying 45 to 50 MGD to Bellvue WTP. Greeley staff anticipates this project will commence in 2030 and require a two year design phase (at a total cost of $500,000) and a three year construction phase (at a total cost of $8,250,000).

1.2.5.5 Assessment of the Raw Water Pipeline between Lake Loveland & Boyd

The purpose of this project is to perform a conditions assessment and evaluation of alternatives for the raw water pipeline between Lake Loveland and the Boyd WTP. Greeley staff anticipates this project will commence in 2033 and require one-year to complete. Any construction needs identified through this assessment would occur beyond the term of this CIP, and therefore are not included as project costs.

1.2.5.6 Lower Latham Bypass Structure for Optimization of Water Rights

The Lower Latham Ditch diverts off the South Platte River between the confluences with the Big Thompson River and the Cache la Poudre River. Multiple entities, including Greeley, require the ability to bypass water around the Lower Latham Ditch river diversion to satisfy downstream obligations or take delivery of upstream water rights at a downstream location. The purpose of this project is to rehabilitate the Lower Latham Bypass structure for the purpose of optimizing use of water rights. Greeley anticipates the cost associated with this project to be $3,000,000. Because of the number of entities that rely upon and would benefit from rehabilitation of the Lower Latham Bypass, there is a high likelihood of cost sharing for this project. For this CIP, based on direction by Greeley staff, we have assumed that Greeley will contribute one-third of the project costs, $1,000,000. Greeley staff anticipates this project will commence in 2027 and require four years to complete.

1.2.5.7 Development of Overland Trail Gravel Pits

The Overland Trail Gravel Pit project is a partnership with the Tri-Districts. The project costs associated with this project represent payment by Greeley to the Tri-Districts for past debt incurred by Tri-Districts for the development of infrastructure. Once all past debt is paid off, and upon final payment to Tri-District, the Overland Trail gravel pits will be conveyed to Greeley. Once payment is complete in 2023, this project will result in approximately 2,350 acre-feet of storage for Greeley.

1.2.5.8 Expansion of Gravel Pit Storage at the Poudre Ponds Complex (Martin Marietta storage)

To facilitate the management of water rights and increase water supply reliability, Greeley plans to expand gravel pit storage at the Poudre Ponds Complex by purchasing the gravel pits owned and actively mined by Martin Marietta. The Martin Marietta pits are located on the south side of the Cache la Poudre River, west of 35th Avenue. Once acquired, the Martin Marietta ponds will be integrated into the larger Poudre Pond Complex which is owned and managed by Greeley.

Acquisition and incorporation of the Martin Marietta gravel pits into the Poudre Ponds Complex is expected to begin in 2027 and be complete by 2031, the same year the Terry Ranch Integration Study is expected to be complete. Cost of the expansion is expected to by $6,000,000. Ancillary costs associated

with gravel pit reservoir development such as pipeline connections, inlet and outlet structures, measurement, and controls were assumed to be included in the total project costs.

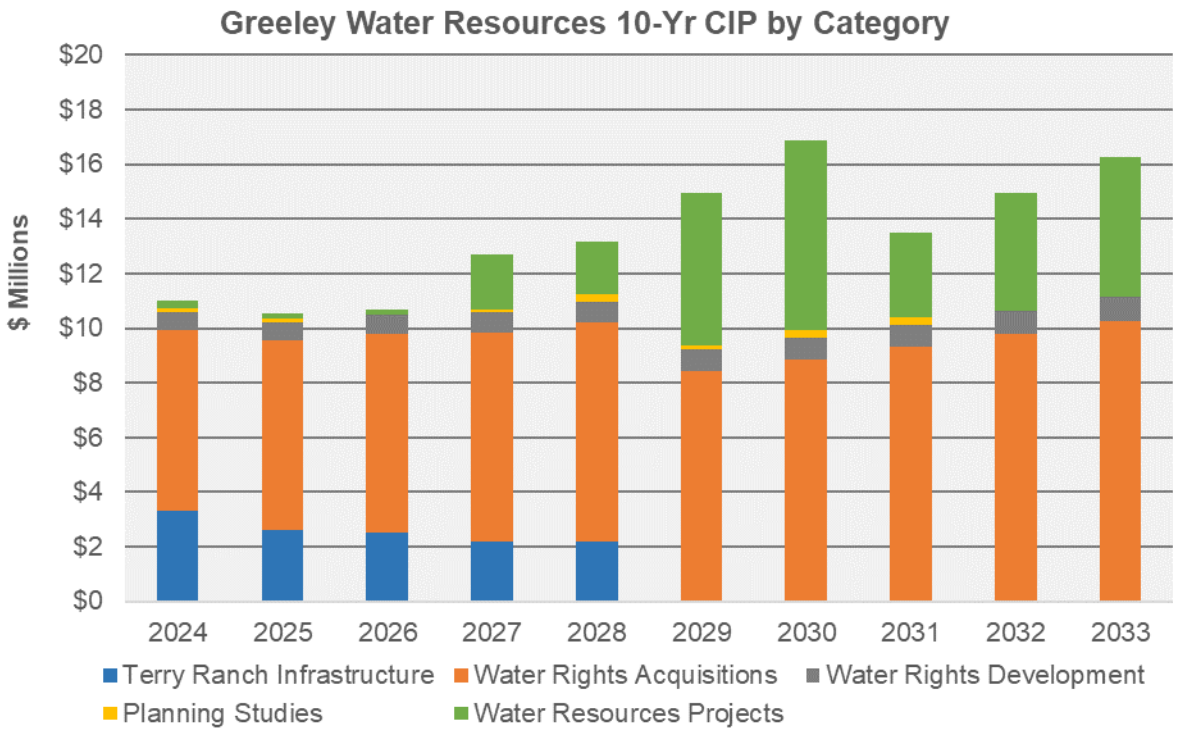
1.2.5.9 WSSC Return Flow Structures

It is anticipated that Greeley, and other municipal users, will need to construct new return flow structures to facilitate the use of changed WSSC shares for municipal use. Construction of the WSSC return flow structures is not anticipated to start until 2023. Greeley staff anticipate the cost to be $2,500,000. Cost sharing opportunities are anticipate given the number of number of municipal water users who are shareholders in the WSSC system; however, at this time no specific coast sharing partner has been identified. For this reason, this CIP assumes that Greeley will assume all costs associated with this project

1.3 GREELEY 10-YEAR WATER RESOURCES CIP

This CIP establishes a basis for capital planning necessary to implement the findings and recommendations of this IWRP, and to address challenges and meet future demand needs. Figure 6 illustrate the 10 year Water Resources CIP by project category. Figure 7 illustrates the annual and cumulative capital requirements associated with all water resource projects included herein through the 2033 planning horizon.

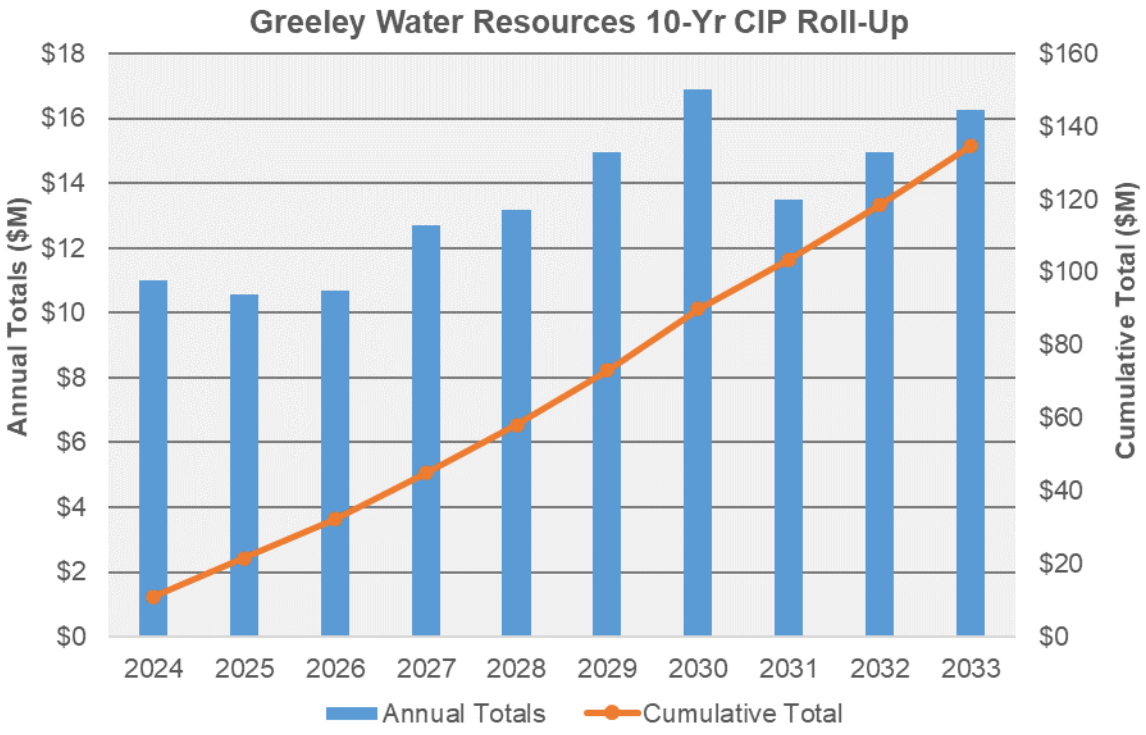
Figure 6



The annual and cumulative capital requirements associated with all water resource projects included herein through the 2033 planning horizon, as illustrated on Figure 7. The total capital requirement for the recommended IWRP CIP between 2024 and 2033 is $124,449,849 as shown in Table 1. Detailed annual capital requirements for each project and category of projects is provided in Appendix A.

Delays to the projects in this CIP may delay other projects and potentially result in Greeley not being able to meet demands. For this reason, this CIP should be reviewed and updated annually.

Figure 7



INTEGRATED WATER RESOURCE PLAN

Capital Improvements Plan

Table 1

Project Name	Start Year	Duration	Annual Project Cost	Total Project Cost	***Greeley (Water Resources Dept)***	*Developer / Funding Partner / Greeley non-WR Contribution*	***Greeley - Water Resources Dept Total 2024 to 2033***
Terry Ranch Infrastructure Projects							
Terry Ranch: Phase 1 - Windsor to Hwy 14 Pipeline	2023	2 yrs		$31,250,000	***$6,250,000***	*$25,000,000*	***$3,125,000***
Terry Ranch Phase 1b - Pipeline Construction 2025 to 2026	2025	2 yrs		$25,000,000	***$5,000,000***	*$20,000,000*	***$5,000,000***
Terry Ranch Phase 1b - Pipeline Construction 2027 to 2028	2027	2 yrs		$21,875,000	***$4,375,000***	*$17,500,000*	***$4,375,000***
Terry Ranch Phase 2 Development	2034				***TBD***		
State Land Board Wellfield Development	2023	3 yrs		$1,500,000	***$1,300,000***	*$200,000*	***$300,000***
Sub-Total for Terry Ranch Infrastructure Projects							***$12,800,000***
Water Right Acquisition							
Acquisition of Agricultural Water Rights	2023	Every year	$6,000,000 per year w/ 5% escalation		***$6,000,000 per year w/ 5% escalation***		***$83,202,759***
Sub-Total for Water Rights Acquisitions							***$83,202,759***
Water Rights Development							
Water Rights Development - Legal Fees	2023		$350,000 per year w/ 3% escalation		***$350,000 per year w/ 3% escalation***		***$4,256,710***
Water Rights Development - Engineering Fees	2023		$275,000 per year w/ 3% escalation		***$275,000 per year w/ 3% escalation***		***$3,344,558***
Sub-Total for Water Rights Development							***$7,601,268***

INTEGRATED WATER RESOURCE PLAN

Capital Improvements Plan

Project Name	Start Year	Duration	Annual Project Cost	Total Project Cost	***Greeley (Water Resources Dept)***	*Developer / Funding Partner / Greeley non-WR Contribution*	***Greeley - Water Resources Dept Total 2024 to 2033***
Planning Studies							
Storage Retiming Investigation	2024	2 yrs		$250,000	***$250,000***		***$250,000***
Poudre Basin Model Updates	2027	2 yrs		$600,000	***$200,000***	*$400,000*	***$200,000***
Update to Greeley IWRP	2028	2 yrs		$300,000	***$300,000***		***$300,000***
Terry Ranch Integration Study	2030	2 yrs		$550,000	***$550,000***		***$550,000***
Sub-Total for Planning Studies							***$1,300,000***
Water Resources Projects							
Life After Lawn	2023	Every year	$150,000 per year w/ 3% escalation		***$150,000 per year w/ 3% escalation***		***$1,824,304***
Aerial Imagery and Planimetric Data Acquisition for Update to Residential Water Budget	2024	Every 3 years (2024, 2027, 2030, 2033)	$200,000 per update w/ 3% escalation		***$68,000 per update w/ 3% escalation***	*$132,000 per update w/ 3% escalation*	***$327,099***
Rehab of Poudre River Diversion Structure	2029	3 yrs		$8,000,000	***$8,000,000***	*Partnership Opportunities Should Be Evaluated*	***$8,000,000***
Poudre Raw Water Intake Pipeline Expansion - Between River Diversion and Bellvue Intake	2030	5 yrs total 2 yrs design and 3 yrs construction		$8,750,000	***$8,750,000***		***$8,750,000***
Assessment of the Raw Water Pipeline between Lake Loveland & Boyd	2033	1 yr		$200,000	***$200,000***		***$200,000***
Lower Latham Bypass Structure for Optimization of Water Rights	2027	4 yrs		$3,000,000	***$1,000,000***	*$2,000,000*	***$1,000,000***

INTEGRATED WATER RESOURCE PLAN

Capital Improvements Plan

Project Name	**Start Year**	**Duration**	Annual Project Cost	Total Project Cost	***Greeley (Water Resources Dept)***	*Developer / Funding Partner / Greeley non-WR Contribution*	***Greeley - Water Resources Dept Total 2024 to 2033***
Development of Overland Trail Gravel Pits	2023	7 yrs		$3,210,000	***$3,210,000***		***$3,175,000***
Expansion of Gravel Pit Storage at the Poudre Ponds Complex (Martin Marietta storage)	2027	4 yrs		$6,000,000	***$6,000,000***		***$6,000,000***
WSSC Return Flow Structures	2033	5 yrs		$2,500,000	***$2,500,000***	*Partnership Opportunities Should Be Evaluated*	***$500,000***
Sub-Total for Water Resources Projects							***$29,776,403***
TOTAL FOR ALL PROJECTS							***$134,680,431***

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MEMORANDUM

To: Kelen Dowdy, Greeley Water and Neil Stewart, STANTEC

From: Doug Jeavons

Re: Water Demand Projections for Greeley Integrated Water Resource Plan

Date: November 18, 2022

Introduction

BBC was retained by Greeley Water and STANTEC in April 2022 to develop updated water demand projections for Greeley's Integrated Water Resource Plan (IWRP). This memorandum documents the development of the demand projections and the corresponding future water use forecasts.

Greeley Water Demand Model

BBC originally developed the Greeley Water demand model (the model) from 2014 through 2017 and the model was initially used during the Milton Seaman Water Supply Project permitting effort. The model was reviewed by the U.S. Army Corps of Engineers and U.S. EPA at that time and was documented in detail in BBC's January 2018 report "City of Greeley Population and Water Demand Projections" (2018 demand report).

The model was further refined during Greeley's Revised Alternative Screening (RAS) process in the Spring of 2019. The demand projections for the IWRP used the 2019 RAS version of the demand model, with a few modifications. More specifically, the approach to projecting demands by Greeley's large industrial customers (e.g., JBS Swift, Kodak, Leprino Foods, etc.) was changed from projecting a specific number of large industrial customers at different points in the future to maintaining future large industrial demand forecasts at a constant level per capita as Greeley's population grows. The share of future growth in outdoor water use served with non-potable supplies was also modified for the IWRP projections, as described in more detail later in this memorandum.

The model produces projections of annual indoor and outdoor water use by customer category (e.g., single family residential, multifamily residential, commercial, etc.) through 2070. The model only includes Greeley's "retail" customers and does not include water use by Greeley's wholesale customers who provide their own water resources (e.g., City of Evans, Town of Milliken, Town of Evans and Town of Johnstown).

The model's forecasts can be modified to produce alternative scenarios using a number of built in "levers" or "dials" as described later in this memorandum.

Greeley Population Growth Scenarios

One of the most important determinants of future water use in Greeley is future population growth within the service area. As part of this IWRP, BBC developed updated population projections for Greeley under three different scenarios.

New information since 2018. During the past four years, the following changes have occurred that are relevant for the updated Greeley population forecast:

- In 2019, BBC developed a method for the Technical Update to the Colorado Water Plan to derive alternative county-level population forecasts based on the State Demography Office's (SDO's) single set of published forecasts. The SDO reviewed and approved the BBC approach and it was implemented for the Technical Update and the next version of the Water Plan. The revised Greeley population scenarios reflect varied levels of population growth in Weld County developed for the Technical Update.

- 2020 Census data became available. These data indicate that Greeley's share of Weld County population growth has continued to slowly but steadily decline. Between 2000 and 2010, 22.2 percent of new Weld County residents lived in Greeley. That share declined to 20.6 percent of new Weld County residents between 2010 and 2020.

- The SDO projections of future Colorado population, and Weld County population in particular, have decreased considerably since 2018. In late 2017/early 2018, the SDO forecasts anticipated a 2050 statewide population of nearly 8.5 million and a Weld County population of 734,343 residents. The most recent (late 2021) SDO projections anticipate a 2050 statewide population of under 7.6 million and a Weld County population of 619,627 residents – a reduction of a little more than 15 percent.

Based on these changes in the past few years, BBC:

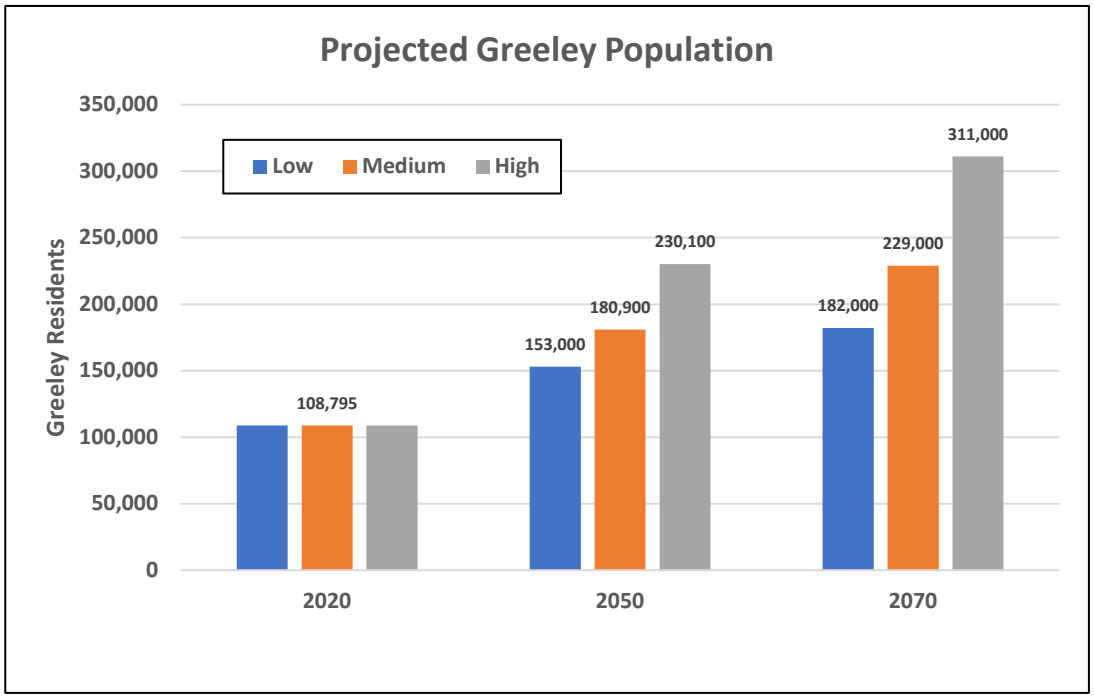
- Revised the forecasts to reflect the new, lower SDO population projections for Weld County.

- Updated the assumptions regarding Greeley's share of Weld County growth to 20% under the low case, 25% under the middle case and 30% under the high case. We believe that Greeley is better positioned than most communities in Weld County to accommodate future growth (particularly from a land and water resource perspective), which was the basis for using a higher middle case capture rate (25%) than the actual experience over the past two decades (21 to 22%).

- Used the lowest Weld County population growth scenario from the Technical Update (Weak Economy) to help drive the low case forecast, and the highest Weld County population growth scenario from the Technical Update (Adaptive Innovation) for the high case forecast.

Population growth scenarios. The updated scenarios for future Greeley population are illustrated in Figure 1. By 2070, Greeley's population is projected to be between 182,000 people under the low growth scenario and 311,000 people under the high growth scenario. The resulting average annual population growth rates through 2070 are 1.0 percent (low scenario), 1.5 percent (medium scenario) and 2.1 percent (high scenario).

Figure 1. Updated City of Greeley Population Projections



Projected buildout population. BBC also examined the potential timing of "buildout" in Greeley's Long Range Economic Growth Area (LREGA) and the potential city population at buildout.

The LREGA consists of almost 59,000 acres, of which about 30,700 acres are within Greeley's current city limits. At present, about 18,000 acres within the city limits (and the LREGA) are developed.

Greeley's ultimate population at buildout of the LREGA will depend on the density of residential development. Current residential density averages about 7.1 units per acre (including both single family and multifamily dwellings) and residential land use makes up about 29 percent of all developed acres in Greeley.[1] Recent residential development in Greeley appears to be denser than the historic average, and the buildout analysis assumed that the overall average density of

[1] Imagine Greeley Comprehensive Plan. Adopted February 6, 2018.

new residential development will increase by about 30 percent by 2070, to approximately 9.2 units per acre.[2]

While density (and the size of the LREGA) determines the ultimate projected buildout population in Greeley, the timing of when buildout is reached depends on the population growth rate. As shown in Table 1, with the assumed increase in residential density, Greeley's population at buildout is projected to be about 421,000 people. Based on the updated population growth scenarios described previously, buildout could be reached between the year 2097 (high growth scenario) and the year 2232 (low growth scenario).

Table 1. Potential Greeley LREGA Buildout Population and Timing

	Buildout	Buildout Year by Population Growth Scenario		
Density Scenario	**Population**	**Low**	**Medium**	**High**
At Current Residential Density (7.1 units per acre)	348,051	2182	2119	2079
With 30% Increase in New Residential Density (9.2 units per acre)	**420,985**	**2232**	**2150**	**2097**
With 50% Increase in New Residential Density (10.6 units per acre)	469,607	2265	2170	2109

Comparison with previous BBC population projections. The updated population projections are somewhat lower than the projections described in the 2018 demand report, and have a wider spread between the low and high growth scenarios. In the 2018 report, Greeley's 2070 population was projected to be between 229,600 residents (low scenario) and 325,100 residents (high scenario), with a middle growth forecast of 277,400 residents.

Greeley's potential buildout population has been addressed in at least three previous reports. In BBC's final report for the 2019 RAS process, BBC estimated Greeley's potential population at buildout could be about 340,000 "assuming the same average density for future development as exists today." The Greeley Non-Potable Water Master Plan (NPMP) produced by CDM Smith in March 2021 provided a buildout population projection of 425,271 (p. 3-13). The Water Transmission and Distribution Master Plan (WTDMP) also produced by CDM Smith in 2021 cited two slightly different buildout population estimates of 428,148 (p. 2-6) and 425,271 (p. 2-25). In general, all of these previously produced estimates of buildout population are consistent with the updated projections shown in Table 1, given different assumptions about future density.

[2] Similar to increases in residential density documented by Colorado Springs Utilities from analysis of 2015-2020 residential development compared to historical averages.

IWRP Water Demand Scenarios

BBC's developed 2030, 2050 and 2070 water demand projections for four scenarios for the IWRP:

- Median Scenario,
- High Bookend Scenario,
- Low Bookend Scenario, and
- Median Scenario with Max Conservation.

The four scenarios differ in terms of four important parameters – the population growth scenario, the extent to which irrigation increases in response to hotter and drier future conditions, the extent of future conservation (incorporated in the demand model in terms of higher water rates), and the proportion of new housing units that are multifamily apartments and condominiums (with lower outdoor water use per unit than single family homes). Table 2 summarizes the different settings for the four water demand scenarios.

Table 2. IWRP Demand Scenario Settings

Planning Scenario Name	Population Scenario	Climate Increase in Irrigation Rate[1]	Conservation (Price Increases)[2]	Multifamily Share of New Housing Units
High Bookend	High Growth	37%	Level 2 (2%/yr)	40%
Median Scenario	Medium Growth	25%	Level 1 (1%/yr)	40%
Low Bookend	Low Growth	12%	Level 3 (3%/yr)	50%
Median with Max Conservation	Medium Growth	25%	Level 3 (3%/yr)	40%

Notes: [1]Projected increases in irrigation application per square foot in response to hotter climate. Developed during 2019 RAS process based on climate projections from High Country Hydrology.

[2]Assumed rates of annual water rate increases beyond inflation through 2035. After 2035, all scenarios assume 1% per year rate increases beyond inflation. Higher rates drive conservation in the demand model.

Non-potable assumptions. The model produces separate forecasts for potable use (indoor and outdoor) and non-potable use for irrigation purposes only. During the development of the IWRP demand forecasts, the assumptions regarding the proportion of new outdoor water use that would be served with non-potable supplies, and the ultimate capacity of the non-potable system, were revised for greater consistency with the 2021 NPMP. Table 3, on the following page, shows the historical shares of outdoor water use served with non-potable supplies by customer category (from the 2018 demand report), the aggressive future non-potable shares

developed during the 2019 RAS process, and the revised non-potable shares adopted for the IWRP. Under all IWRP scenarios, the ultimate capacity of the non-potable system was assumed to be limited to 7,100 acre-feet per year (AFY).

Table 3. Assumed Shares of New Outdoor Use Served with Non-potable Supplies[1]

Customers	Master Plan	2019 RAS	Historic
SFR	12.00%	30.00%	2.95%
MFR	12.00%	30.00%	1.03%
Comm	16.00%	40.00%	15.34%
CoG	80.00%	90.00%	70.64%
Schools	60.00%	75.00%	45.94%
UNC Comm	16.00%	40.00%	7.04%

Notes: [1]Non-potable system capacity assumed to be limited to 7,100 AFY.

IWRP demand forecast results. Table 4 on the following page shows projected annual potable use, non-potable use and total water requirements in 2030, 2050 and 2070 under the four IWRP demand scenarios described earlier. Potable use is reported as it would be measured at the customers' meters. Total water requirements (TWR) include 5 percent "losses" (non-revenue water) in the distribution system and 2 percent losses in the treatment process.

There is an increasing span across the IWRP demand scenarios as we look farther into the future. Projected TWR in 2030 under the High Bookend scenario are about 30 percent greater than under the Low Bookend scenario. By 2070, projected TWR under the High Bookend Scenario are almost double the projected TWR under the Low Bookend scenario. Although differences in conservation assumptions and the assumed irrigation response to climate changes are important aspects of the scenarios – most of the difference in projected water demands is due to the large spread among the population growth scenarios.

Table 4. IWRP Scenario Demand Forecasts

Demand Type/ Scenario Name	Acre-feet per Year 2030	2050	2070
Potable Water Use[1]			
Median Scenario	28,600	37,500	45,100
High Bookend Scenario	30,700	46,000	62,900
Low Bookend Scenario	23,800	27,300	30,600
Median with Max Conservation	25,900	33,000	39,700
Non-potable Water Use			
Median Scenario	3,700	5,700	7,100
High Bookend Scenario	4,300	7,100	7,100
Low Bookend Scenario	3,000	4,000	4,800
Median with Max Conservation	3,500	5,300	7,100
Total Water Use[2]			
Median Scenario	34,400	45,900	55,600
High Bookend Scenario	37,300	56,500	74,600
Low Bookend Scenario	28,600	33,300	37,700
Median with Max Conservation	31,300	40,800	49,700

Notes: [1]Potable use as it would be measured at customers' meters.

[2]Total water use includes potable and non-potable use as well as 5 percent distribution losses and 2% treatment losses on water provided through the potable system.

Table 5 provides further information regarding the IWRP demand scenarios, focusing on changes in projected water use intensity between the scenarios in 2070 – measured in terms of gallons per capita per day. All of the scenarios reflect continuing increases in water use efficiency, with systemwide water use measured in gallons per capita per day projected to decrease from current conditions by between 3 percent (Median scenario) and 18 percent (Low Bookend scenario).

Table 5. 2070 Demand Projection Details

Scenario	Population	Total Annual Water Requirements (AFY)	Use in Gallons per Capita per Day	
			Systemwide	Residential
Current	109,000	27,000	210	110
2070 Projections				
Median	229,000	55,600	204	110
High Bookend	311,000	74,600	201	107
Low Bookend	182,500	37,700	173	87
Median with Max Conservation	229,000	49,700	182	93

Notes: [1]Potable use as it would be measured at customers' meters.

[2]Total water use includes potable and non-potable use as well as 5 percent distribution losses and 2% treatment losses on water provided through the potable system.

Potential water demand at buildout. Based on the range of projected water use efficiency in 2070 shown in Table 5 (systemwide gallons per capita per day) and the projected buildout population of around 421,000 people shown earlier in Table 1, Greeley's ultimate total water requirements at buildout could be between 81,600 AFY and 96,200 AFY.

Comparison to Previous Greeley Water Demand Forecasts

As mentioned earlier in this memorandum, the Greeley demand model was used to produce forecasts of future water demands in 2017-2018 and, with some modifications to the model, in the Spring of 2019.

In the initial set of demand projections using the model in 2017-2018, uncertainty in the future demand forecasts was examined using Monte Carlo simulations to establish the potential range of future demands in 2070. The median forecast of Greeley's total 2070 water requirements was about 78,000 AFY – nearly 40 percent higher than the IWRP Median scenario. More than one-half of this difference (21 percent) is due to the lower 2070 population forecasts developed for this IWRP. The low forecast in 2017-2018 (90 percent exceedance probability from the Monte Carlo analysis) was about 62,600 AFY and the high forecast (10 percent exceedance probability from the Monte Carlo analysis) was about 94,500 AFY.

The revised demand forecasts developed for the 2019 RAS process were considerably lower than the 2017-2018 projections. The median RAS projection of TWR in 2070 was 62,300 AFY – about 12 percent higher than the IWRP Median scenario. The low RAS projection of TWR in 2017 was 51,500 AFY, higher than the Low Bookend scenario for the IWRP, but lower than the Median scenario. The high RAS projection of TWR in 2070 was 69,200 AFY, lower than the High Bookend scenario for the IWRP.

In sum, the updated water demand projections for the IWRP are closer to the demand forecasts developed during the 2019 RAS process than to the original demand projections in 2017-2018 for the Milton Seaman Water Supply Project. The IWRP scenarios appear to encompass an appropriately wide range of potential future water needs, with a broader range of possible future water requirements in 2070 than projected during the RAS process in 2019.

Appendices

Detailed printouts of the demand model results for each of the four IWRP scenarios – in 2030, 2050 and 2070 – are attached on the following pages.

Median Scenario: 2030, 2050 and 2070

Greeley Deterministic Demand Model

Projection Year	**2030**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Avg.**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New	
		21,831		**132,830**		93,253		**2.668**		**60%**		
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		132,830		2.668		30,731		11%				
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		39,577		**0.54**		51,254						

Equation Results

	30,731
	21,151
	72,558

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj Consumption)					
		30,731		**57**			**86%**					
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj Consumption)					
		30,731		96			**91%**					
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj Consumption)					
		21,151		**52**			**96%**					
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj Consumption)					
		21,151		23			**100%**					
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj Consumption)					
		7,256		**102**			**83%**					
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj Consumption)					
		7,256		94			**91%**					
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		132,830		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		132,830		8,581								
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj Consumption)					
		132,830		**177**			**89%**					
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj Consumption)					
		132,830		1,361			**90%**					
				114.3								

Results (Thousands of Gallons/Yr)

-Simulation-	-2015-	-Delta-
1,498,333	1,272,894	225,440
2,693,569	1,997,350	696,219
1,056,880	757,429	299,451
492,631	312,131	180,500
617,558	538,586	78,972
622,449	464,150	158,299
30,803	23,322	7,481
1,124,154	769,421	354,733
20,909	17,228	3,681
162,297	120,735	41,562

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	14.6%	*2.5%*
2025	120,813	*7,344*	2.69	*0.05*	0.56	*0.025*	20.4%	*5.0%*
2030	132,830	*10,547*	2.67	*0.06*	0.54	*0.025*	26.5%	*7.5%*
2035	144,848	*13,867*	2.65	*0.08*	0.53	*0.025*	33.0%	*10.0%*
2040	156,865	*17,188*	2.63	*0.09*	0.52	*0.025*	39.8%	*12.5%*
2045	168,883	*20,508*	2.61	*0.11*	0.52	*0.025*	46.9%	*15.0%*
2050	**180,900**	*23,828*	2.60	*0.12*	0.52	*0.025*	54.4%	*17.5%*
2055	192,918	*27,188*	2.58	*0.14*	0.52	*0.025*	62.3%	*20.0%*
2060	204,935	*30,547*	2.56	*0.15*	0.52	*0.025*	70.6%	*22.5%*
2065	216,953	*33,906*	2.60	*0.15*	0.52	*0.025*	79.3%	*25.0%*
2070	**228,970**	*37,266*	2.60	*0.15*	0.52	*0.025*	88.4%	*27.5%*
2075	240,988	*40,625*	2.60	*0.15*	0.52	*0.025*	98.0%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Rev Alt	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)	*(Price Elasticity Adj Consumption)					Existing parks	1.00	
	49,562	**78%**		38,893	46,178	-7,285	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	181,323			181,323	164,953	16,370			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		1,945,428	1,676,087	269,341	5970.3		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**10,523,575**	**8,214,515**	2,309,060			
			Systemwide GPCD	*217*	*224*	-7			
			Residential GPCD	*118*	*118*	0			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**1,196,811**	**754,935**	441,877	3,673	7,100	Non-potable system capacity (weather dependent)
Potable Use				**9,326,764**	**7,459,580**	1,867,184	28,623		
							32,296		
Distribution Losses/Unaccounted for Water		**5%**		**490,882**					
Treatment Losses		**2%**		**200,360**					
Potable Water Requirements at Treatment Plant Inflow				**10,018,006**					
Non-Potable Water Requirements at Point of Use				**1,196,811**					

Potable Requirements in Acre-feet	**30,744**
Non-Potable Requirements in Acre-feet	**3,673**
Total Requirements in Acre-feet	**34,417**

Greeley Deterministic Demand Model

Projection Year	**2050**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Avg.**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New		
		21,831		**180,900**		93,253		**2.596**		**60%**		**42,088**
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		180,900		2.596		42,088		11%				**30,631**
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		87,647		**0.52**		51,254						**96,458**

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj Consumption)					
		42,088		**57**			**74%**					
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj Consumption)					
		42,088		104			**83%**					
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj Consumption)					
		30,631		**52**			**92%**					
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj Consumption)					
		30,631		25			**100%**					
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj Consumption)					
		9,646		**102**			**70%**					
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj Consumption)					
		9,646		102			**83%**					
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		180,900		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		180,900		9,291								
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj Consumption)					
		180,900		**177**			**79%**					
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj Consumption)					
		180,900		1,474			**81%**					
				114.3								

Results (Thousands of Gallons/Yr)

	-Simulation-	-2015-	-Delta-
	1,776,734	1,272,894	503,840
	3,654,251	1,997,350	1,656,901
	1,473,382	757,429	715,953
	772,428	312,131	460,297
	690,422	538,586	151,837
	818,371	464,150	354,221
	41,950	23,322	18,628
	1,665,018	769,421	895,597
	25,439	17,228	8,211
	215,961	120,735	95,225

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	14.6%	*2.5%*
2025	120,813	*7,344*	2.69	*0.05*	0.56	*0.025*	20.4%	*5.0%*
2030	132,830	*10,547*	2.67	*0.06*	0.54	*0.025*	26.5%	*7.5%*
2035	144,848	*13,867*	2.65	*0.08*	0.53	*0.025*	33.0%	*10.0%*
2040	156,865	*17,188*	2.63	*0.09*	0.52	*0.025*	39.8%	*12.5%*
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2060	204,935	*30,547*	2.56	*0.15*	0.52	*0.025*	70.6%	*22.5%*
2065	216,953	*33,906*	2.60	*0.15*	0.52	*0.025*	79.3%	*25.0%*
2070	**228,970**	*37,266*	2.60	*0.15*	0.52	*0.025*	88.4%	*27.5%*
2075	240,988	*40,625*	2.60	*0.15*	0.52	*0.025*	98.0%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Rev Alt	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)		*(Price Elasticity Adj Consumption)				Existing parks	1.00	
	49,562		**62%**	30,936	46,178	-15,242	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	196,316			196,316	164,953	31,363			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		2,649,461	1,676,087	973,374	8130.898		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**14,049,018**	**8,214,515**	5,834,504			
			Systemwide GPCD	*213*	*224*	-11			
			Residential GPCD	*116*	*118*	-2			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**1,844,305**	**754,935**	1,089,370	5,660	7,100	Non-potable system capacity (weather dependent)
Potable Use				**12,204,714**	**7,459,580**	4,745,133	37,455		
							43,115		
Distribution Losses/Unaccounted for Water		**5%**		**642,353**					
Treatment Losses		**2%**		**262,185**					
Potable Water Requirements at Treatment Plant Inflow				**13,109,252**					
Non-Potable Water Requirements at Point of Use				**1,844,305**					
Potable Requirements in Acre-feet				**40,231**					
Non-Potable Requirements in Acre-feet				**5,660**					
Total Requirements in Acre-feet				**45,891**					

Greeley Deterministic Demand Model

Projection Year	**2070**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Avg.**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New		
		21,831		**228,970**		93,253		**2.6**		**60%**		
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		228,970		2.6		53,150		11%				
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		135,717		**0.52**		51,254						

Equation Results

	53,150
	38,756
	121,250

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj	Consumption)				
		53,150		**57**			**64%**					
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj	Consumption)				
		53,150		109			**76%**					
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj	Consumption)				
		38,756		**52**			**89%**					
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj	Consumption)				
		38,756		26			**100%**					
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj	Consumption)				
		12,125		**102**			**59%**					
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj	Consumption)				
		12,125		106			**76%**					
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		228,970		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		228,970		9,677								
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj	Consumption)				
		228,970		**177**			**71%**					
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj	Consumption)				
		228,970		1,535			**73%**					
				114.3								

Results (Thousands of Gallons/Yr)

-Simulation-	-2015-	-Delta-
1,942,671	1,272,894	669,778
4,397,584	1,997,350	2,400,234
1,794,496	757,429	1,037,068
1,017,923	312,131	705,792
729,873	538,586	191,287
978,755	464,150	514,605
53,098	23,322	29,775
2,200,050	769,421	1,430,629
28,766	17,228	11,538
256,933	120,735	136,197

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	14.6%	*2.5%*
2025	120,813	*7,344*	2.69	*0.05*	0.56	*0.025*	20.4%	*5.0%*
2030	132,830	*10,547*	2.67	*0.06*	0.54	*0.025*	26.5%	*7.5%*
2035	144,848	*13,867*	2.65	*0.08*	0.53	*0.025*	33.0%	*10.0%*
2040	156,865	*17,188*	2.63	*0.09*	0.52	*0.025*	39.8%	*12.5%*
2045	168,883	*20,508*	2.61	*0.11*	0.52	*0.025*	46.9%	*15.0%*
2050	**180,900**	*23,828*	2.60	*0.12*	0.52	*0.025*	54.4%	*17.5%*
2055	192,918	*27,188*	2.58	*0.14*	0.52	*0.025*	62.3%	*20.0%*
2060	204,935	*30,547*	2.56	*0.15*	0.52	*0.025*	70.6%	*22.5%*
2065	216,953	*33,906*	2.60	*0.15*	0.52	*0.025*	79.3%	*25.0%*
2070	**228,970**	*37,266*	2.60	*0.15*	0.52	*0.025*	88.4%	*27.5%*
2075	240,988	*40,625*	2.60	*0.15*	0.52	*0.025*	98.0%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Rev Alt	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)	*(Price Elasticity Adj Consumption)					Existing parks	1.00	
	49,562	**50%**		24,606	46,178	-21,571	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	204,476			204,476	164,953	39,523			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		3,353,495	1,676,087	1,677,407	10291.5		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**17,021,074**	**8,214,515**	8,806,559			
			Systemwide GPCD	*204*	*224*	-20			
			Residential GPCD	*110*	*118*	-9			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**2,313,542**	**754,935**	1,558,608	7,100	7,100	Non-potable system capacity (weather dependent)
Potable Use				**14,707,532**	**7,459,580**	7,247,952	45,136		
							52,236		
Distribution Losses/Unaccounted for Water		**5%**		**774,081**					
Treatment Losses		**2%**		**315,951**					
Potable Water Requirements at Treatment Plant Inflow				**15,797,564**					
Non-Potable Water Requirements at Point of Use				**2,313,542**					
Potable Requirements in Acre-feet				**48,481**					
Non-Potable Requirements in Acre-feet				**7,100**					
Total Requirements in Acre-feet				**55,581**					

High Bookend Scenario: 2030, 2050 and 2070

Greeley Deterministic Demand Model

Projection Year	**2030**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Avg.**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New		
		21,831		**149,230**		93,253		**2.668**		**60%**		
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		149,230		2.668		34,420		11%				
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		55,977		**0.54**		51,254						

Equation Results

	34,420
	23,880
	81,387

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj Consumption)					
		34,420		**57**			**77%**					
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj Consumption)					
		34,420		99			**85%**					
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj Consumption)					
		23,880		**52**			**93%**					
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj Consumption)					
		23,880		24			**100%**					
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj Consumption)					
		8,139		**102**			**73%**					
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj Consumption)					
		8,139		97			**85%**					
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		149,230		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		149,230		8,852								
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj Consumption)					
		149,230		**177**			**82%**					
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj Consumption)					
		149,230		1,404			**83%**					
				114.3								

Results (Thousands of Gallons/Yr)

-Simulation-	-2015-	-Delta-
1,505,103	1,272,894	232,209
2,910,350	1,997,350	913,000
1,159,583	757,429	402,154
573,737	312,131	261,606
607,633	538,586	69,048
672,728	464,150	208,577
34,606	23,322	11,284
1,305,269	769,421	535,848
21,575	17,228	4,347
174,079	120,735	53,343

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	20.3%	*2.5%*
2025	129,013	*7,344*	2.69	*0.05*	0.56	*0.025*	32.9%	*5.0%*
2030	149,230	*10,547*	2.67	*0.06*	0.54	*0.025*	46.7%	*7.5%*
2035	169,448	*13,867*	2.65	*0.08*	0.53	*0.025*	62.0%	*10.0%*
2040	189,665	*17,188*	2.63	*0.09*	0.52	*0.025*	70.2%	*12.5%*
2045	209,883	*20,508*	2.61	*0.11*	0.52	*0.025*	78.9%	*15.0%*
2050	**230,100**	*23,828*	2.60	*0.12*	0.52	*0.025*	88.0%	*17.5%*
2055	250,318	*27,188*	2.58	*0.14*	0.52	*0.025*	97.6%	*20.0%*
2060	270,535	*30,547*	2.56	*0.15*	0.52	*0.025*	107.7%	*22.5%*
2065	290,753	*33,906*	2.60	*0.15*	0.52	*0.025*	118.3%	*25.0%*
2070	**310,970**	*37,266*	2.60	*0.15*	0.52	*0.025*	129.4%	*27.5%*
2075	331,188	*40,625*	2.60	*0.15*	0.52	*0.025*	141.1%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Rev Alt	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)	*(Price Elasticity Adj Consumption)					Existing parks	1.00	
	49,562	**66%**		32,693	46,178	-13,485	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	187,041			187,041	164,953	22,088			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		2,185,623	1,676,087	509,535	6707.429		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**11,408,366**	**8,214,515**	3,193,851			
			Systemwide GPCD	*209*	*224*	-14			
			Residential GPCD	*113*	*118*	-5			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**1,393,478**	**754,935**	638,543	4,276	7,100	Non-potable system capacity (weather dependent)
Potable Use				**10,014,888**	**7,459,580**	2,555,308	30,735		
							35,011		
Distribution Losses/Unaccounted for Water		**5%**		**527,099**					
Treatment Losses		**2%**		**215,143**					
Potable Water Requirements at Treatment Plant Inflow				**10,757,130**					
Non-Potable Water Requirements at Point of Use				**1,393,478**					
Potable Requirements in Acre-feet				**33,012**					
Non-Potable Requirements in Acre-feet				**4,276**					
Total Requirements in Acre-feet				**37,289**					

Greeley Deterministic Demand Model

Projection Year	**2050**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Avg.**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New		
		21,831		**230,100**		93,253		**2.596**		**60%**		**53,460**
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		230,100		2.596		53,460		11%				**39,046**
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		136,847		**0.52**		51,254						**121,833**

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj Consumption)					
		53,460		**57**			**64%**					
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj Consumption)					
		53,460		111			**76%**					
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj Consumption)					
		39,046		**52**			**89%**					
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj Consumption)					
		39,046		27			**100%**					
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj Consumption)					
		12,183		**102**			**59%**					
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj Consumption)					
		12,183		109			**76%**					
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		230,100		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		230,100		9,887								
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj Consumption)					
		230,100		**177**			**71%**					
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj Consumption)					
		230,100		1,569			**73%**					
				114.3								

Equation Results

Results (Thousands of Gallons/Yr)

	-Simulation-	-2015-	-Delta-
Single Family Residential -- Indoor	1,951,940	1,272,894	679,046
Single Family Residential -- Outdoor	4,517,548	1,997,350	2,520,198
Multifamily Residential -- Indoor	1,807,808	757,429	1,050,379
Multifamily Residential -- Outdoor	1,047,843	312,131	735,712
Commercial -- Indoor	732,272	538,586	193,687
Commercial -- Outdoor	1,004,426	464,150	540,276
City of Greeley -- Indoor	53,360	23,322	30,037
City of Greeley -- Outdoor	2,259,391	769,421	1,489,970
School District - Indoor	28,889	17,228	11,662
School District -- Outdoor	263,674	120,735	142,939

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	20.3%	*2.5%*
2025	129,013	*7,344*	2.69	*0.05*	0.56	*0.025*	32.9%	*5.0%*
2030	149,230	*10,547*	2.67	*0.06*	0.54	*0.025*	46.7%	*7.5%*
2035	169,448	*13,867*	2.65	*0.08*	0.53	*0.025*	62.0%	*10.0%*
2040	189,665	*17,188*	2.63	*0.09*	0.52	*0.025*	70.2%	*12.5%*
2045	209,883	*20,508*	2.61	*0.11*	0.52	*0.025*	78.9%	*15.0%*
2050	**230,100**	*23,828*	2.60	*0.12*	0.52	*0.025*	88.0%	*17.5%*
2055	250,318	*27,188*	2.58	*0.14*	0.52	*0.025*	97.6%	*20.0%*
2060	270,535	*30,547*	2.56	*0.15*	0.52	*0.025*	107.7%	*22.5%*
2065	290,753	*33,906*	2.60	*0.15*	0.52	*0.025*	118.3%	*25.0%*
2070	**310,970**	*37,266*	2.60	*0.15*	0.52	*0.025*	129.4%	*27.5%*
2075	331,188	*40,625*	2.60	*0.15*	0.52	*0.025*	141.1%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Rev Alt	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)		*(Price Elasticity Adj Consumption)				Existing parks	1.00	
	49,562		**50%**	24,541	46,178	-21,636	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	208,921			208,921	164,953	43,968			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		3,370,045	1,676,087	1,693,957	10342.29		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**17,309,006**	**8,214,515**	9,094,491			
			Systemwide GPCD	*206*	*224*	-18			
			Residential GPCD	*111*	*118*	-7			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**2,313,542**	**754,935**	1,558,608	7,100	7,100	Non-potable system capacity (weather dependent)
Potable Use				**14,995,464**	**7,459,580**	7,535,884	46,019		
							53,119		
Distribution Losses/Unaccounted for Water		**5%**		**789,235**					
Treatment Losses		**2%**		**322,137**					
Potable Water Requirements at Treatment Plant Inflow				**16,106,835**					
Non-Potable Water Requirements at Point of Use				**2,313,542**					
Potable Requirements in Acre-feet				**49,430**					
Non-Potable Requirements in Acre-feet				**7,100**					
Total Requirements in Acre-feet				**56,530**					

Greeley Deterministic Demand Model

Projection Year	**2070**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Avg.**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New	
		21,831		**310,970**		93,253		**2.6**		**60%**	**72,073**
										6%	
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)			
		310,970		2.6		72,073		11%			**52,759**
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)					
		217,717		**0.52**		51,254					**163,541**

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj		Consumption)			
		72,073		**57**			**56%**				2,278,495	1,272,894	1,005,601
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj		Consumption)			
		72,073		119			**70%**				5,954,006	1,997,350	3,956,656
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj		Consumption)			
		52,759		**52**			**86%**				2,351,399	757,429	1,593,970
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj		Consumption)			
		52,759		29			**100%**				1,512,815	312,131	1,200,683
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj		Consumption)			
		16,354		**102**			**49%**				826,656	538,586	288,070
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj		Consumption)			
		16,354		116			**69%**				1,315,976	464,150	851,825
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		310,970		**232**							72,113	23,322	48,791
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		310,970		10,565							3,269,581	769,421	2,500,160
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj		Consumption)			
		310,970		**177**			**63%**				34,880	17,228	17,652
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj		Consumption)			
		310,970		1,676			**66%**				343,605	120,735	222,870
				114.3								

Equation Results

Results (Thousands of Gallons/Yr)

-Simulation-	-2015-	-Delta-

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	20.3%	*2.5%*
2025	129,013	*7,344*	2.69	*0.05*	0.56	*0.025*	32.9%	*5.0%*
2030	149,230	*10,547*	2.67	*0.06*	0.54	*0.025*	46.7%	*7.5%*
2035	169,448	*13,867*	2.65	*0.08*	0.53	*0.025*	62.0%	*10.0%*
2040	189,665	*17,188*	2.63	*0.09*	0.52	*0.025*	70.2%	*12.5%*
2045	209,883	*20,508*	2.61	*0.11*	0.52	*0.025*	78.9%	*15.0%*
2050	**230,100**	*23,828*	2.60	*0.12*	0.52	*0.025*	88.0%	*17.5%*
2055	250,318	*27,188*	2.58	*0.14*	0.52	*0.025*	97.6%	*20.0%*
2060	270,535	*30,547*	2.56	*0.15*	0.52	*0.025*	107.7%	*22.5%*
2065	290,753	*33,906*	2.60	*0.15*	0.52	*0.025*	118.3%	*25.0%*
2070	**310,970**	*37,266*	2.60	*0.15*	0.52	*0.025*	129.4%	*27.5%*
2075	331,188	*40,625*	2.60	*0.15*	0.52	*0.025*	141.1%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Rev Alt	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)		*(Price Elasticity Adj Consumption)				Existing parks	1.00	
	49,562		**39%**	19,520	46,178	-26,657	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	223,231			223,231	164,953	58,278			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		4,554,467	1,676,087	2,878,379	13977.14		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**22,795,091**	**8,214,515**	14,580,577			
			Systemwide GPCD	*201*	*224*	-23			
			Residential GPCD	*107*	*118*	-12			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**2,313,542**	**754,935**	1,558,608	7,100	7,100	Non-potable system capacity (weather dependent)
Potable Use				**20,481,549**	**7,459,580**	13,021,969	62,856		
							69,956		
Distribution Losses/Unaccounted for Water		**5%**		**1,077,976**					
Treatment Losses		**2%**		**439,990**					
Potable Water Requirements at Treatment Plant Inflow				**21,999,516**					
Non-Potable Water Requirements at Point of Use				**2,313,542**					

Potable Requirements in Acre-feet	**67,514**
Non-Potable Requirements in Acre-feet	**7,100**
Total Requirements in Acre-feet	**74,614**

Low Bookend Scenario: 2030, 2050 and 2070

Greeley Deterministic Demand Model

Projection Year	**2030**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Low**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New		
		21,831		**123,530**		93,253		**2.668**		**50%**		
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		123,530		2.668		27,505		11%				
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		30,277		**0.54**		51,254						

Equation Results

	27,505
	20,863
	67,552

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj Consumption)					
		27,505		**57**			**69%**					
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj Consumption)					
		27,505		93			**80%**					
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj Consumption)					
		20,863		**52**			**91%**					
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj Consumption)					
		20,863		23			**100%**					
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj Consumption)					
		6,755		**102**			**64%**					
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj Consumption)					
		6,755		91			**79%**					
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		123,530		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		123,530		8,311								
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj Consumption)					
		123,530		**177**			**75%**					
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj Consumption)					
		123,530		1,319			**77%**					
				114.3								

Results (Thousands of Gallons/Yr)

	-Simulation-	-2015-	-Delta-
	1,077,863	1,272,894	-195,031
	2,041,432	1,997,350	44,082
	984,429	757,429	227,000
	470,600	312,131	158,468
	441,900	538,586	-96,685
	489,528	464,150	25,378
	28,646	23,322	5,324
	1,010,920	769,421	241,499
	16,396	17,228	-832
	125,164	120,735	4,429

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	26.4%	*2.5%*
2025	116,163	*7,344*	2.69	*0.05*	0.56	*0.025*	46.5%	*5.0%*
2030	123,530	*10,547*	2.67	*0.06*	0.54	*0.025*	69.8%	*7.5%*
2035	130,898	*13,867*	2.65	*0.08*	0.53	*0.025*	96.9%	*10.0%*
2040	138,265	*17,188*	2.63	*0.09*	0.52	*0.025*	106.9%	*12.5%*
2045	145,633	*20,508*	2.61	*0.11*	0.52	*0.025*	117.5%	*15.0%*
2050	**153,000**	*23,828*	2.60	*0.12*	0.52	*0.025*	128.6%	*17.5%*
2055	160,368	*27,188*	2.58	*0.14*	0.52	*0.025*	140.2%	*20.0%*
2060	167,735	*30,547*	2.56	*0.15*	0.52	*0.025*	152.5%	*22.5%*
2065	175,103	*33,906*	2.60	*0.15*	0.52	*0.025*	165.3%	*25.0%*
2070	182,470	*37,266*	2.60	*0.15*	0.52	*0.025*	178.9%	*27.5%*
2075	189,838	*40,625*	2.60	*0.15*	0.52	*0.025*	193.1%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Rev Alt	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)	*(Price Elasticity Adj Consumption)					Existing parks	1.00	
	49,562	**55%**		27,425	46,178	-18,753	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	175,605			175,605	164,953	10,652			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		1,809,220	1,676,087	133,133	5552.293		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**8,737,477**	**8,214,515**	522,963			
			Systemwide GPCD	*194*	*224*	-30			
			Residential GPCD	*101*	*118*	-17			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**980,862**	**754,935**	225,928	3,010	7,100	Non-potable system capacity (weather dependent)
Potable Use				**7,756,615**	**7,459,580**	297,035	23,804		
							26,814		
Distribution Losses/Unaccounted for Water		**5%**		**408,243**					
Treatment Losses		**2%**		**166,630**					
Potable Water Requirements at Treatment Plant Inflow				**8,331,488**					
Non-Potable Water Requirements at Point of Use				**980,862**					
Potable Requirements in Acre-feet				**25,568**					
Non-Potable Requirements in Acre-feet				**3,010**					
Total Requirements in Acre-feet				**28,579**					

Greeley Deterministic Demand Model

Projection Year	**2050**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Low**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New		
		21,831		**153,000**		93,253		**2.596**		**50%**		
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		153,000		2.596		33,339		11%				
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		59,747		**0.52**		51,254						

Equation Results

33,339
28,414
82,068

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj Consumption)					
		33,339		**57**			**56%**					
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj Consumption)					
		33,339		98			**70%**					
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj Consumption)					
		28,414		**52**			**86%**					
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj Consumption)					
		28,414		24			**100%**					
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj Consumption)					
		8,207		**102**			**49%**					
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj Consumption)					
		8,207		96			**69%**					
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		153,000		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		153,000		8,694								
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj Consumption)					
		153,000		**177**			**63%**					
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj Consumption)					
		153,000		1,379			**66%**					
				114.3								

Results (Thousands of Gallons/Yr)

-Simulation-	-2015-	-Delta-
1,051,731	1,272,894	-221,162
2,264,733	1,997,350	267,383
1,266,200	757,429	508,771
670,514	312,131	358,383
413,568	538,586	-125,017
543,025	464,150	78,875
35,480	23,322	12,158
1,314,534	769,421	545,113
17,139	17,228	-88
138,980	120,735	18,245

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	26.4%	*2.5%*
2025	116,163	*7,344*	2.69	*0.05*	0.56	*0.025*	46.5%	*5.0%*
2030	123,530	*10,547*	2.67	*0.06*	0.54	*0.025*	69.8%	*7.5%*
2035	130,898	*13,867*	2.65	*0.08*	0.53	*0.025*	96.9%	*10.0%*
2040	138,265	*17,188*	2.63	*0.09*	0.52	*0.025*	106.9%	*12.5%*
2045	145,633	*20,508*	2.61	*0.11*	0.52	*0.025*	117.5%	*15.0%*
2050	**153,000**	*23,828*	2.60	*0.12*	0.52	*0.025*	128.6%	*17.5%*
2055	160,368	*27,188*	2.58	*0.14*	0.52	*0.025*	140.2%	*20.0%*
2060	167,735	*30,547*	2.56	*0.15*	0.52	*0.025*	152.5%	*22.5%*
2065	175,103	*33,906*	2.60	*0.15*	0.52	*0.025*	165.3%	*25.0%*
2070	182,470	*37,266*	2.60	*0.15*	0.52	*0.025*	178.9%	*27.5%*
2075	189,838	*40,625*	2.60	*0.15*	0.52	*0.025*	193.1%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Rev Alt	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)		*(Price Elasticity Adj Consumption)				Existing parks	1.00	
	49,562		**39%**	19,416	46,178	-26,762	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	183,712			183,712	164,953	18,759			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		2,240,838	1,676,087	564,751	6876.879		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**10,198,220**	**8,214,515**	1,983,705			
			Systemwide GPCD	*183*	*224*	-41			
			Residential GPCD	*94*	*118*	-24			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**1,292,685**	**754,935**	537,750	3,967	7,100	Non-potable system capacity (weather dependent)
Potable Use				**8,905,535**	**7,459,580**	1,445,955	27,330		
							31,297		
Distribution Losses/Unaccounted for Water		**5%**		**468,712**					
Treatment Losses		**2%**		**191,311**					
Potable Water Requirements at Treatment Plant Inflow				**9,565,558**					
Non-Potable Water Requirements at Point of Use				**1,292,685**					
Potable Requirements in Acre-feet				**29,356**					
Non-Potable Requirements in Acre-feet				**3,967**					
Total Requirements in Acre-feet				**33,323**					

Greeley Deterministic Demand Model

Projection Year	**2070**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Low**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New		
		21,831		**182,470**		93,253		**2.6**		**50%**		
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		182,470		2.6		38,988		11%				
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		89,217		**0.52**		51,254						

Equation Results

	38,988
	34,624
	97,267

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj	Consumption)				
		38,988		**57**			**48%**					
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj	Consumption)				
		38,988		99			**64%**					
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj	Consumption)				
		34,624		**52**			**82%**					
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj	Consumption)				
		34,624		24			**100%**					
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj	Consumption)				
		9,727		**102**			**41%**					
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj	Consumption)				
		9,727		97			**63%**					
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		182,470		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		182,470		8,789								
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj	Consumption)				
		182,470		**177**			**56%**					
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj	Consumption)				
		182,470		1,394			**59%**					
				114.3								

Results (Thousands of Gallons/Yr)

-Simulation-	-2015-	-Delta-
1,064,938	1,272,894	-207,956
2,449,707	1,997,350	452,357
1,485,250	757,429	727,821
825,987	312,131	513,856
412,219	538,586	-126,367
594,334	464,150	130,184
42,315	23,322	18,992
1,588,109	769,421	818,688
18,261	17,228	1,033
151,216	120,735	30,480

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	26.4%	*2.5%*
2025	116,163	*7,344*	2.69	*0.05*	0.56	*0.025*	46.5%	*5.0%*
2030	123,530	*10,547*	2.67	*0.06*	0.54	*0.025*	69.8%	*7.5%*
2035	130,898	*13,867*	2.65	*0.08*	0.53	*0.025*	96.9%	*10.0%*
2040	138,265	*17,188*	2.63	*0.09*	0.52	*0.025*	106.9%	*12.5%*
2045	145,633	*20,508*	2.61	*0.11*	0.52	*0.025*	117.5%	*15.0%*
2050	**153,000**	*23,828*	2.60	*0.12*	0.52	*0.025*	128.6%	*17.5%*
2055	160,368	*27,188*	2.58	*0.14*	0.52	*0.025*	140.2%	*20.0%*
2060	167,735	*30,547*	2.56	*0.15*	0.52	*0.025*	152.5%	*22.5%*
2065	175,103	*33,906*	2.60	*0.15*	0.52	*0.025*	165.3%	*25.0%*
2070	182,470	*37,266*	2.60	*0.15*	0.52	*0.025*	178.9%	*27.5%*
2075	189,838	*40,625*	2.60	*0.15*	0.52	*0.025*	193.1%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	**Low**	**High**
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Rev Alt	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)		*(Price Elasticity Adj Consumption)				Existing parks	1.00	
	49,562		**31%**	15,443	46,178	-30,734	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	185,721			185,721	164,953	20,768			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		2,672,456	1,676,087	996,368	8201.465		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**11,544,305**	**8,214,515**	3,329,790			
			Systemwide GPCD	*173*	*224*	-50			
			Residential GPCD	*87*	*118*	-31			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**1,568,271**	**754,935**	813,336	4,813	7,100	Non-potable system capacity (weather dependent)
Potable Use				**9,976,034**	**7,459,580**	2,516,454	30,615		
							35,428		
Distribution Losses/Unaccounted for Water		**5%**		**525,054**					
Treatment Losses		**2%**		**214,308**					
Potable Water Requirements at Treatment Plant Inflow				**10,715,396**					
Non-Potable Water Requirements at Point of Use				**1,568,271**					

Potable Requirements in Acre-feet	**32,884**
Non-Potable Requirements in Acre-feet	**4,813**
Total Requirements in Acre-feet	**37,697**

Median Scenario with Max Conservation: 2030, 2050 and 2070

Greeley Deterministic Demand Model

Projection Year	**2030**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Avg.**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New		
		21,831		**132,830**		93,253		**2.668**		**60%**		
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		132,830		2.668		30,731		11%				
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		39,577		**0.54**		51,254						

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)	*(	Price Elasticity Adj Consumption)						
		30,731		**57**		**69%**						
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)	*(	Price Elasticity Adj Consumption)						
		30,731		96		**80%**						
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)	*(	Price Elasticity Adj Consumption)						
		21,151		**52**		**91%**						
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)	*(	Price Elasticity Adj Consumption)						
		21,151		23		**100%**						
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)	*(	Price Elasticity Adj Consumption)						
		7,256		**102**		**64%**						
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)	*(	Price Elasticity Adj Consumption)						
		7,256		94		**79%**						
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		132,830		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		132,830		8,581								
				335								
School District - Indoor		Population	*	WU(SD_I)	*(	Price Elasticity Adj Consumption)						
		132,830		**177**		**75%**						
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)	*(	Price Elasticity Adj Consumption)						
		132,830		1,361		**77%**						
				114.3								

Equation Results

	30,731
	21,151
	72,558

Results (Thousands of Gallons/Yr)

	-Simulation-	-2015-	-Delta-
	1,204,294	1,272,894	-68,600
	2,355,153	1,997,350	357,803
	998,019	757,429	240,590
	492,631	312,131	180,500
	474,650	538,586	-63,936
	542,928	464,150	78,777
	30,803	23,322	7,481
	1,124,154	769,421	354,733
	17,630	17,228	402
	138,970	120,735	18,234

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	26.4%	*2.5%*
2025	120,813	*7,344*	2.69	*0.05*	0.56	*0.025*	46.5%	*5.0%*
2030	132,830	*10,547*	2.67	*0.06*	0.54	*0.025*	69.8%	*7.5%*
2035	144,848	*13,867*	2.65	*0.08*	0.53	*0.025*	96.9%	*10.0%*
2040	156,865	*17,188*	2.63	*0.09*	0.52	*0.025*	106.9%	*12.5%*
2045	168,883	*20,508*	2.61	*0.11*	0.52	*0.025*	117.5%	*15.0%*
2050	**180,900**	*23,828*	2.60	*0.12*	0.52	*0.025*	128.6%	*17.5%*
2055	192,918	*27,188*	2.58	*0.14*	0.52	*0.025*	140.2%	*20.0%*
2060	204,935	*30,547*	2.56	*0.15*	0.52	*0.025*	152.5%	*22.5%*
2065	216,953	*33,906*	2.60	*0.15*	0.52	*0.025*	165.3%	*25.0%*
2070	**228,970**	*37,266*	2.60	*0.15*	0.52	*0.025*	178.9%	*27.5%*
2075	240,988	*40,625*	2.60	*0.15*	0.52	*0.025*	193.1%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Alternative	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)		*(Price Elasticity Adj Consumption)				Existing parks	1.00	
	49,562		**55%**	27,425	46,178	-18,753	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	181,323			181,323	164,953	16,370			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		1,945,428	1,676,087	269,341	5970.3		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**9,571,754**	**8,214,515**	1,357,239			
			Systemwide GPCD	*197*	*224*	-26			
			Residential GPCD	*104*	*118*	-14			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**1,129,481**	**754,935**	374,547	3,466	7,100	Non-potable system capacity (weather dependent)
Potable Use				**8,442,273**	**7,459,580**	982,693	25,908		
							29,375		
Distribution Losses/Unaccounted for Water		**5%**		**444,330**					
Treatment Losses		**2%**		**181,359**					
Potable Water Requirements at Treatment Plant Inflow				**9,067,962**					
Non-Potable Water Requirements at Point of Use				**1,129,481**					
Potable Requirements in Acre-feet				**27,829**					
Non-Potable Requirements in Acre-feet				**3,466**					
Total Requirements in Acre-feet				**31,295**					

Greeley Deterministic Demand Model

Projection Year	**2050**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Avg.**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New		
		21,831		**180,900**		93,253		**2.596**		**60%**		
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		180,900		2.596		42,088		11%				
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		87,647		**0.52**		51,254						

Equation Results

	42,088
	30,631
	96,458

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj	Consumption)				
		42,088		**57**			**56%**					
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj	Consumption)				
		42,088		104			**70%**					
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj	Consumption)				
		30,631		**52**			**86%**					
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj	Consumption)				
		30,631		25			**100%**					
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj	Consumption)				
		9,646		**102**			**49%**					
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj	Consumption)				
		9,646		102			**69%**					
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		180,900		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		180,900		9,291								
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj	Consumption)				
		180,900		**177**			**63%**					
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj	Consumption)				
		180,900		1,474			**66%**					
				114.3								

Results (Thousands of Gallons/Yr)

	-Simulation-	-2015-	-Delta-
	1,327,764	1,272,894	54,870
	3,055,293	1,997,350	1,057,943
	1,365,001	757,429	607,572
	772,428	312,131	460,297
	486,081	538,586	-52,504
	682,026	464,150	217,876
	41,950	23,322	18,628
	1,665,018	769,421	895,597
	20,265	17,228	3,037
	175,598	120,735	54,863

Time Variant Parameters

	Population		HH Size		Jobs/Resident		Inflation Adjusted Rate Change vs 2012	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
2020	**108,795**	*4,141*	2.70	*0.03*	0.59	*0.025*	26.4%	*2.5%*
2025	120,813	*7,344*	2.69	*0.05*	0.56	*0.025*	46.5%	*5.0%*
2030	132,830	*10,547*	2.67	*0.06*	0.54	*0.025*	69.8%	*7.5%*
2035	144,848	*13,867*	2.65	*0.08*	0.53	*0.025*	96.9%	*10.0%*
2040	156,865	*17,188*	2.63	*0.09*	0.52	*0.025*	106.9%	*12.5%*
2045	168,883	*20,508*	2.61	*0.11*	0.52	*0.025*	117.5%	*15.0%*
2050	**180,900**	*23,828*	2.60	*0.12*	0.52	*0.025*	128.6%	*17.5%*
2055	192,918	*27,188*	2.58	*0.14*	0.52	*0.025*	140.2%	*20.0%*
2060	204,935	*30,547*	2.56	*0.15*	0.52	*0.025*	152.5%	*22.5%*
2065	216,953	*33,906*	2.60	*0.15*	0.52	*0.025*	165.3%	*25.0%*
2070	**228,970**	*37,266*	2.60	*0.15*	0.52	*0.025*	178.9%	*27.5%*
2075	240,988	*40,625*	2.60	*0.15*	0.52	*0.025*	193.1%	*30.0%*

Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

Change in Irrigation due to Climate Change

	Change Scenario		
	Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
2025	107%	104%	109%
2030	110%	106%	113%
2035	113%	109%	118%
2040	117%	111%	122%
2045	118%	111%	124%
2050	119%	111%	127%
2055	120%	112%	129%
2060	121%	112%	131%
2065	123%	112%	133%
2070	124%	113%	135%
2075	125%	113%	137%

Shares of New Outdoor Use Served by Non-Pot by Category

	Alternative	Historic
SFR	12.00%	2.95%
MFR	12.00%	1.03%
Comm	16.00%	15.34%
CoG	80.00%	70.64%
Schools	60.00%	45.94%
UNC Comm	16.00%	7.04%

Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)		*(Price Elasticity Adj Consumption)				Existing parks	1.00	
	49,562		**39%**	19,416	46,178	-26,762	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	196,316			196,316	164,953	31,363			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		2,649,461	1,676,087	973,374	8130.898		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**12,494,968**	**8,214,515**	4,280,453			
			Systemwide GPCD	*189*	*224*	-35			
			Residential GPCD	*99*	*118*	-19			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**1,726,397**	**754,935**	971,463	5,298	7,100	Non-potable system capacity (weather dependent)
Potable Use				**10,768,571**	**7,459,580**	3,308,990	33,048		
							38,346		
Distribution Losses/Unaccounted for Water		**5%**		**566,767**					
Treatment Losses		**2%**		**231,333**					
Potable Water Requirements at Treatment Plant Inflow				**11,566,671**					
Non-Potable Water Requirements at Point of Use				**1,726,397**					
Potable Requirements in Acre-feet				**35,497**					
Non-Potable Requirements in Acre-feet				**5,298**					
Total Requirements in Acre-feet				**40,795**					

Greeley Deterministic Demand Model

Projection Year	**2070**	
Weather	**1**	**Avg.** (1=Avg., 2=Dry, 3=Wet)
Climate Change	**Avg.**	**(Low, Avg., High)**

Equations to Develop Specific Terms:

SFR	=	SFR(2010)	+	((Population	-	Pop(2010))	/	HH Size)	x	%SFR_New		
		21,831		**228,970**		93,253		**2.6**		**60%**		
										6%		
MFR	=	Population	/	HH Size	-	SFR	x	(Vacancy rate + 1)				
		228,970		2.6		53,150		11%				
Jobs	=	Pop. Growth	*	Jobs/Resident	+	Jobs(2010)						
		135,717		**0.52**		51,254						

Equation Results

	53,150
	38,756
	121,250

Future Water Use Equations (Future Demand is Sum of these Equations):

Single Family Residential -- Indoor	=	SFR	*	WU(SFR_I)		*(	Price Elasticity Adj	Consumption)				
		53,150		**57**				**48%**				
				1.76								
Single Family Residential -- Outdoor	=	SFR	*	WU(SFR_O)		*(	Price Elasticity Adj	Consumption)				
		53,150		109				**64%**				
				3.05								
Multifamily Residential -- Indoor		MFR	*	WU(MFR_I)		*(	Price Elasticity Adj	Consumption)				
		38,756		**52**				**82%**				
				2.26								
Multifamily Residential -- Outdoor		MFR	*	WU(MFR_O)		*(	Price Elasticity Adj	Consumption)				
		38,756		26				**100%**				
				1.13								
Commercial -- Indoor		Jobs/10	*	WU(COMM_I)		*(	Price Elasticity Adj	Consumption)				
		12,125		**102**				**41%**				
				8.58								
Commercial -- Outdoor		Jobs/10	*	WU(COMM_O)		*(	Price Elasticity Adj	Consumption)				
		12,125		106				**63%**				
				3.50								
City of Greeley -- Indoor		Population	*	WU(COG_I)								
		228,970		**232**								
				91.3								
City of Greeley -- Outdoor		Population	*	WU(COG_O)								
		228,970		9,677								
				335								
School District - Indoor		Population	*	WU(SD_I)		*(	Price Elasticity Adj	Consumption)				
		228,970		**177**				**56%**				
				3.56								
School District -- Outdoor		Population	*	WU(SD_O)		*(	Price Elasticity Adj	Consumption)				
		228,970		1,535				**59%**				
				114.3								

Results (Thousands of Gallons/Yr)

-Simulation-	-2015-	-Delta-
1,451,770	1,272,894	178,877
3,676,788	1,997,350	1,679,438
1,662,495	757,429	905,066
1,017,923	312,131	705,792
513,856	538,586	-24,730
815,690	464,150	351,540
53,098	23,322	29,775
2,200,050	769,421	1,430,629
22,915	17,228	5,687
208,913	120,735	88,177

Time Variant Parameters

Year	Population Mean	Population SD	HH Size Mean	HH Size SD	Jobs/Resident Mean	Jobs/Resident SD	Inflation Adjusted Rate Change vs 2012 Mean	Inflation Adjusted Rate Change vs 2012 SD
2015	**100,572**	***0***	**2.74**	***0.00***	**0.59**	***0.000***	**9.0%**	***0.0%***
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Weather variant outdoor use intensities (use only "average" year in Monte Carlo simulations

		SFR	MFR	Comm	COG	Schools	UNC
1	Avg.	**88**	**21**	**86**	**7,807**	**1,239**	**164,953**
2	Dry	**109**	**26**	**107**	**9,758**	**1,548**	**206,191**
3	Wet	**63**	**15**	**62**	**5,621**	**892**	**118,766**

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	Change Scenario Avg.	Low	High
2015	100%	100%	100%
2020	103%	102%	104%
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2035	113%	109%	118%
2040	117%	111%	122%
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2055	120%	112%	129%
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Schools	60.00%	45.94%
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Greeley Park Watering Efficiency (Use/acre relative to historic)

UNC Commercial -- Indoor	WU(UNC_I)		*(Price Elasticity Adj Consumption)				Existing parks	1.00	
	49,562		**31%**	15,443	46,178	-30,734	New parks	0.80	
	1,681								
UNC Commercial -- Outdoor	WU (UNC_O)								
	204,476			204,476	164,953	39,523			
	12,117								
Large Industrial Customers		WU/resident							
		14.646		3,353,495	1,676,087	1,677,407	10291.5		
		122,342							
Other Water Use	Avg. Annual								
(Greeley-Loveland, Sharkstooth Pipeline,	**38,348**			38,348					
Mountain View Meadows)	6,708								
Total Retail Water Use				**15,235,259**	**8,214,515**	7,020,745			
			Systemwide GPCD	*182*	*224*	-41			
			Residential GPCD	*93*	*118*	-25			
							AF		
Estimated Non-Potable Use	Based on 2006-13 avg. NP share of use by customer category. Capped at 4,800 AFY)			**2,301,142**	**754,935**	1,546,207	7,062	7,100	Non-potable system capacity (weather dependent)
Potable Use				**12,934,118**	**7,459,580**	5,474,538	39,693		
							46,755		
Distribution Losses/Unaccounted for Water		**5%**		**680,743**					
Treatment Losses		**2%**		**277,854**					
Potable Water Requirements at Treatment Plant Inflow				**13,892,715**					
Non-Potable Water Requirements at Point of Use				**2,301,142**					
Potable Requirements in Acre-feet				**42,635**					
Non-Potable Requirements in Acre-feet				**7,062**					
Total Requirements in Acre-feet				**49,697**					

Integrated Water Resources Plan

City of Greeley
Water and Sewer Department

Agenda

- Background objectives
- How the plan was developed
- What is Greeley’s plan for water supplies

Project Team

Greeley Team Project Manager

Kelen Dowdy

Greeley Technical Team

Dena Egenhoff
Water Conservation Manager

Erik Dial
Deputy Director of Utility Finance and Customer Service

Leah Hubbard
Water Resource Operations Manager

Daniel Biwer
Environmental & Water Resources Attorney

Greeley Management Team

Sean Chambers
Water & Sewer Director

Ty Bereskie
Deputy Director of Water Resources

Adam Prior
Chief Engineer

Consultant Team Project Manager

Neil Stewart (Stantec)

Consultant Team

Mary Presecan (LRE Water)
South Platte River Basin Expert

Cortney Brand (LRE Water)
Terry Ranch Groundwater Expert

Michelle Johnson (Martin & Wood)
Greeley Water Rights Expert

Adam Jokers (West Water Research)
Greeley Issues

Paul Weiss (Williams & Weiss)
Water Supply Modeling Expert

IWRP Vision Statement

“An actionable and adaptive master plan for Greeley’s water resources that uses modern, defensible methods to develop a roadmap ensuring a reliable water supply for our community through an uncertain future.”

Introduction and Background

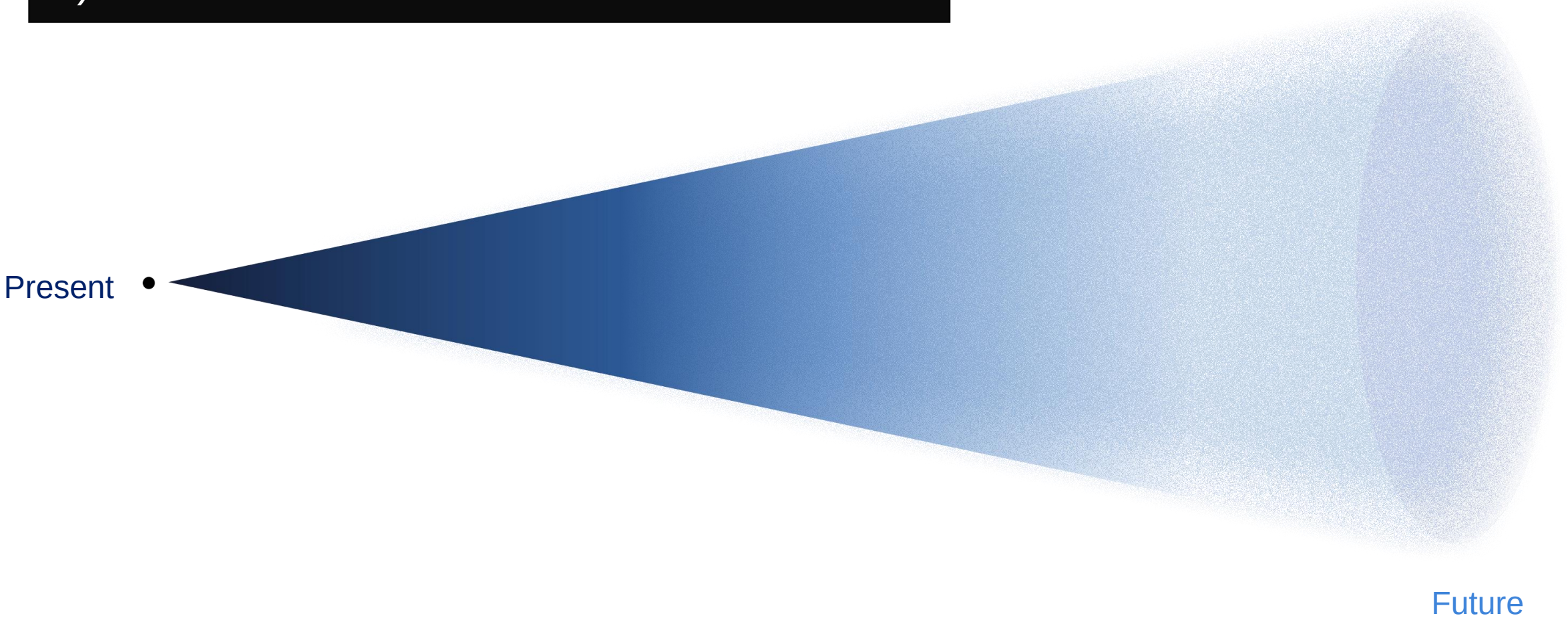
What is an integrated water resources plan – or IWRP?

What are Greeley's IWRP objectives?

How will Greeley use its IWRP?

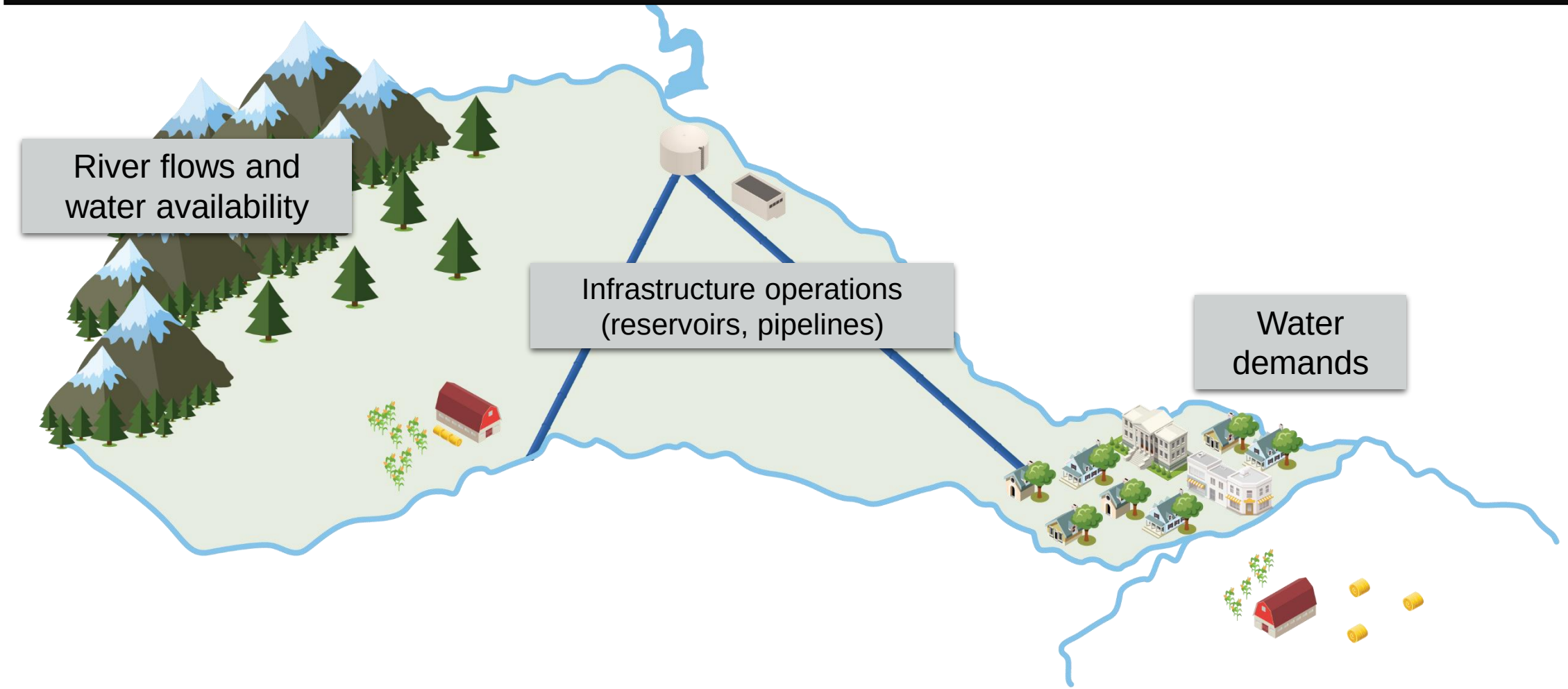
What is an IWRP?

1) Accounts for the uncertain future conditions



What is an IWRP?

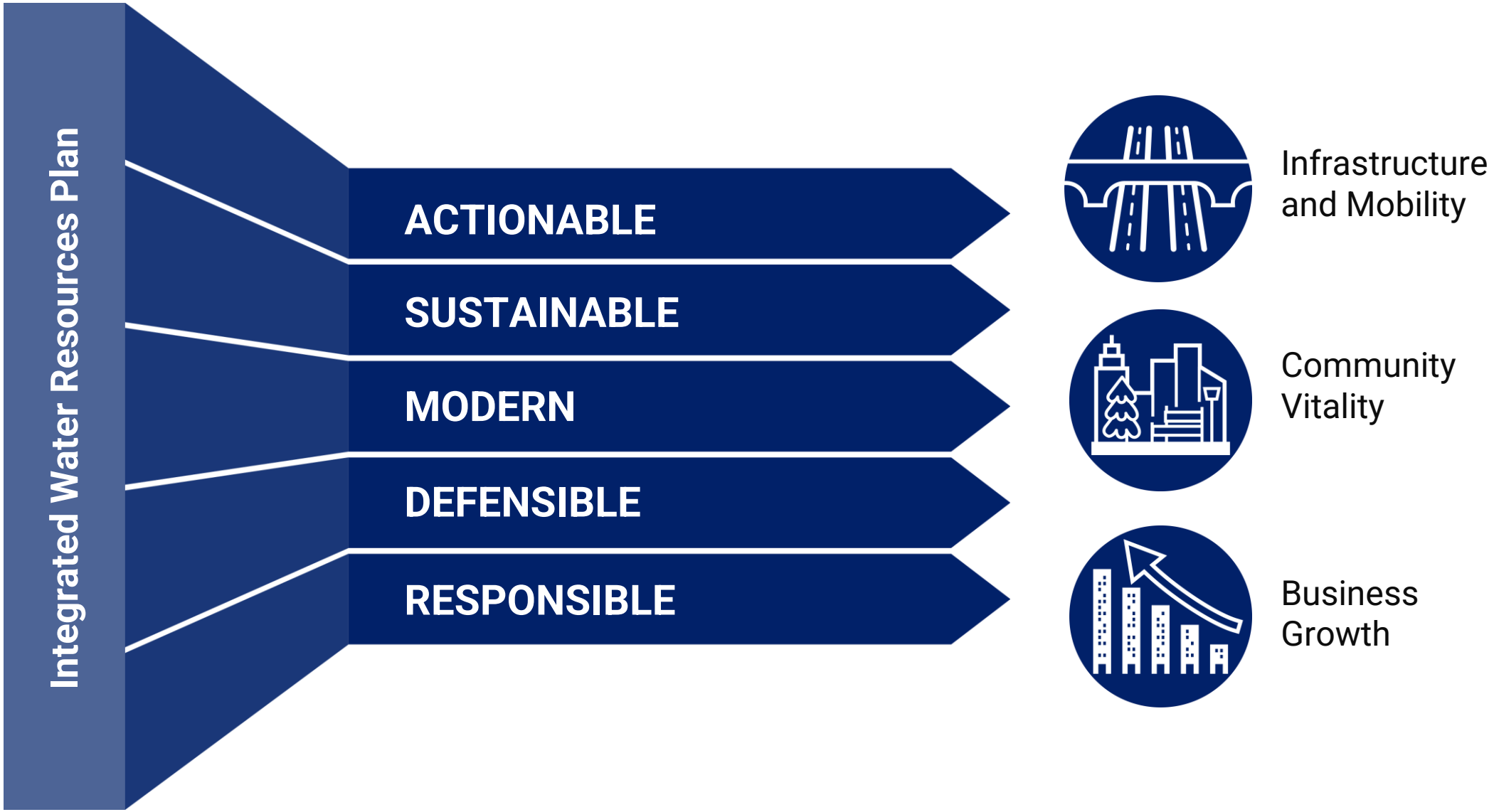
2) Holistic, long-term evaluation of Greeley's water supply system that integrates:



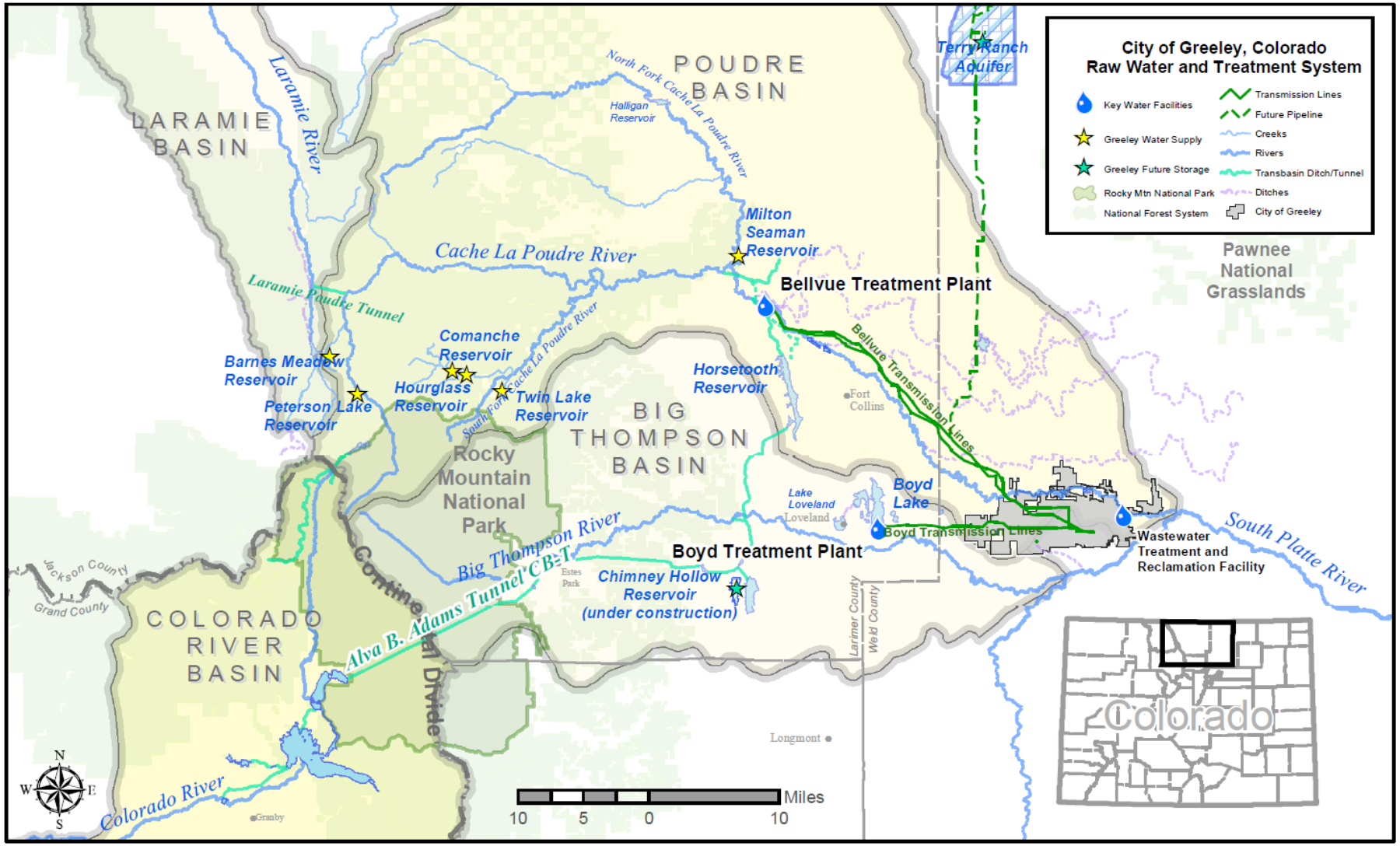
What is an IWRP?

3) Evaluates how changes to future conditions impact the water supply system

What are Greeley's IWRP objectives?



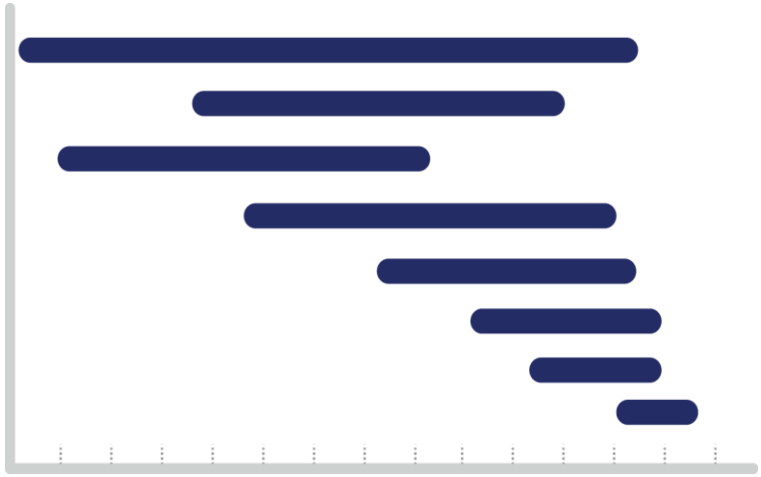
Greeley's Current Water Supply System



How will Greeley use its IWRP?

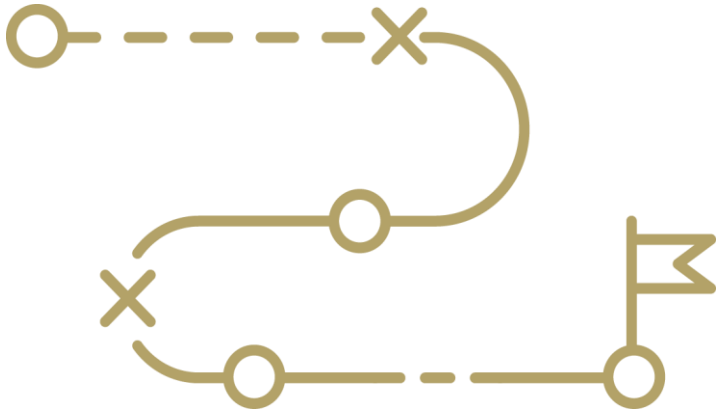
1

Detailed 10-year plan for the water supply system



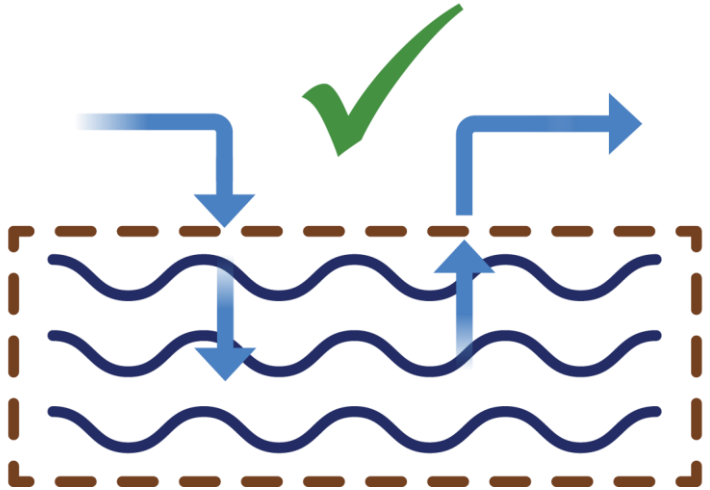
2

Process to trigger implementation of the Terry Ranch Project



3

Establish long-term Terry Ranch use and if that use is sustainable



What will Terry Ranch implementation look like?

1. Continue completing high-priority pipeline
2. Construct treatment facility and remaining pipeline
3. Install initial wells with extraction capabilities
4. Upgrade existing wells with injection capabilities
5. Install additional wells as needed

Terry Ranch Integrated

Understanding Uncertainty

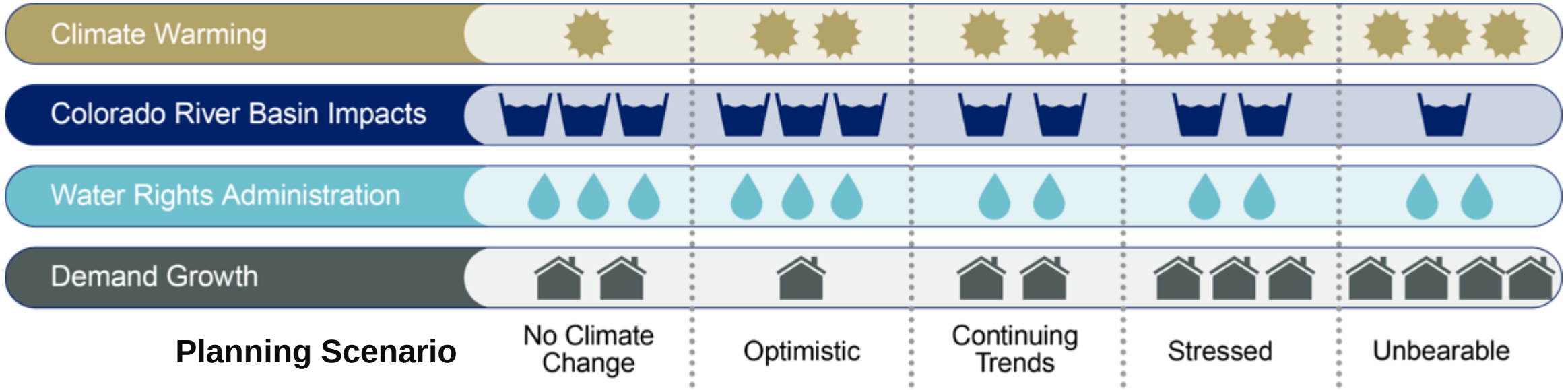
What futures did the IWRP plan for?

How could climate change affect Greeley's water supplies?

What could Greeley's future water demands be?

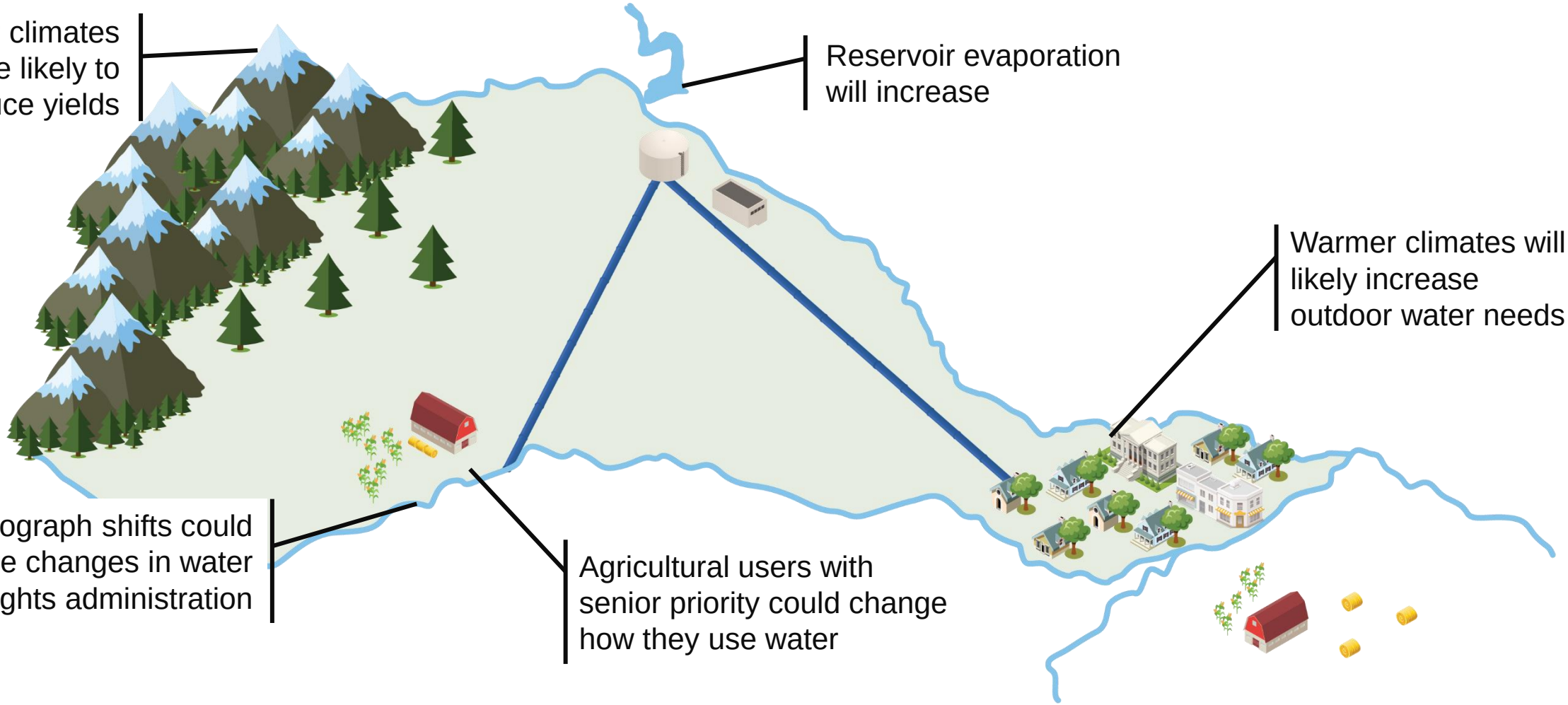
What futures did the IWRP plan for?

- “Planning Scenarios” were defined to vary important future water supply conditions



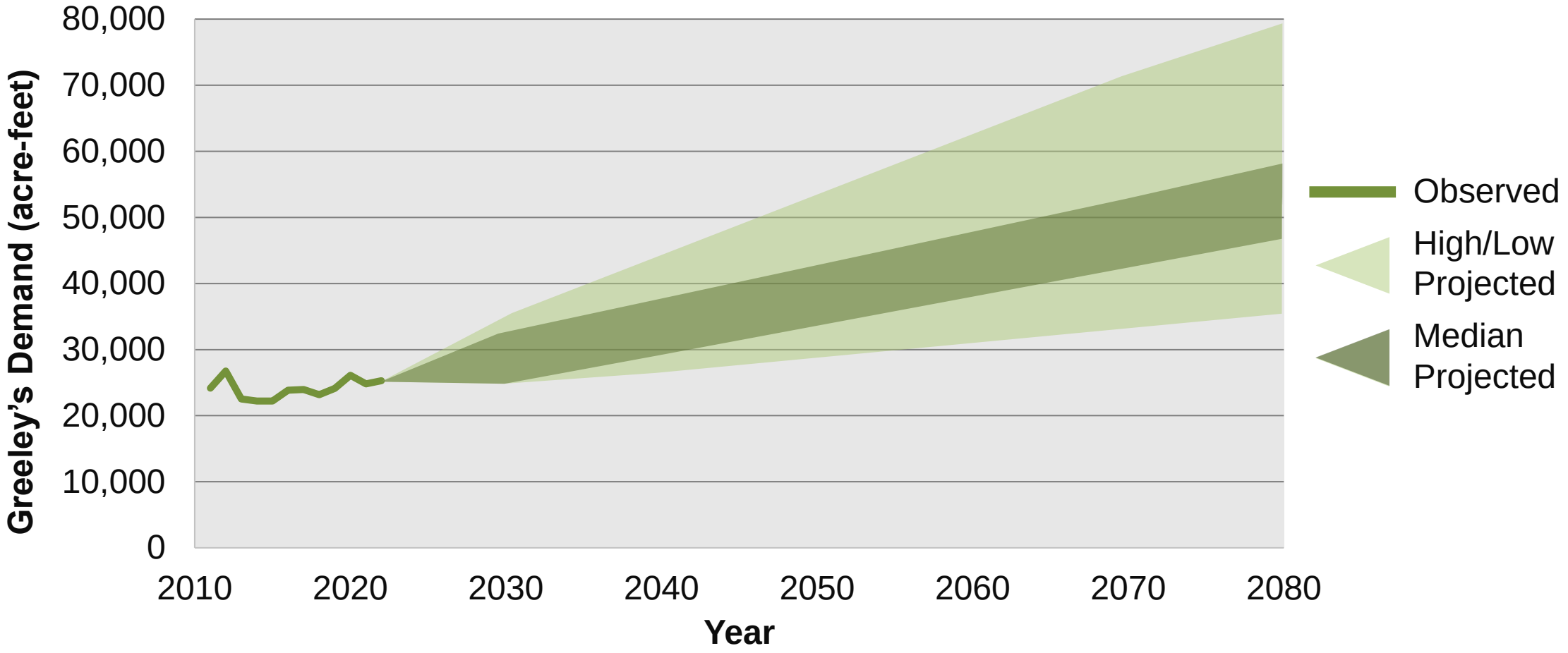
How could climate change impact Greeley's water supplies?

The IWRP reflects the following climate change impacts to Greeley:



What could Greeley's future water demands be?

- Unclear when demand growth will resume
- Future demands highly variable



Developing Greeley's IWRP

How vulnerable is the current water supply system?

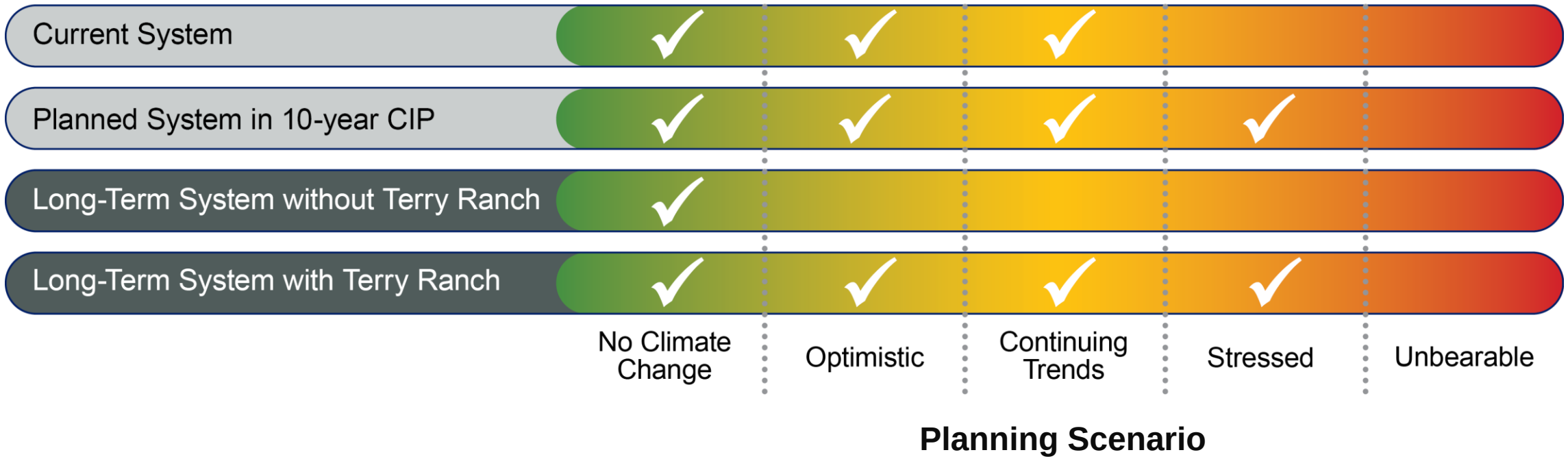
How could Greeley use the Terry Ranch Project?

What are the triggers for needing Terry Ranch?

When does the Terry Ranch Project need to be developed?

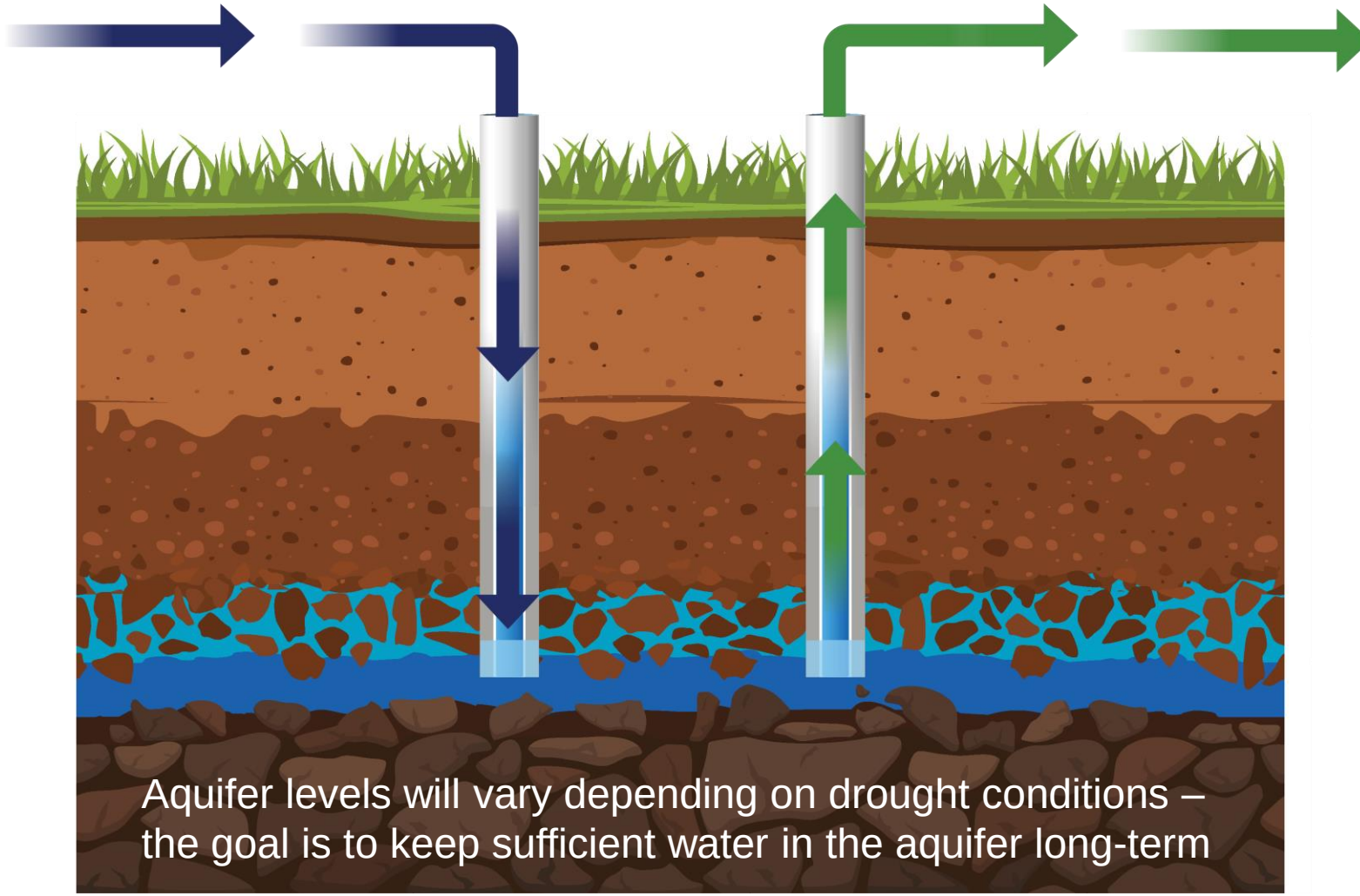
How vulnerable is the water supply system?

Greeley's Water Supply System able to meet performance criteria for each Planning Scenario



How can Greeley use the Terry Ranch Project?

When available, treated surface water is injected into the aquifer

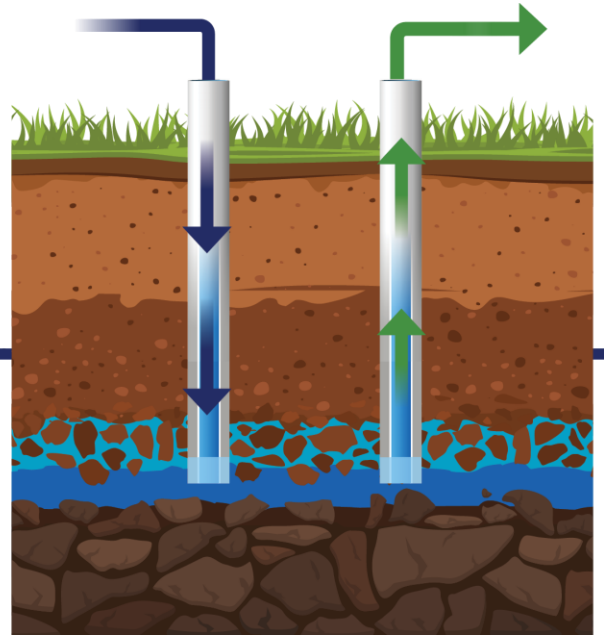


During droughts, water is extracted from the aquifer, treated, and delivered to Greeley

What are the triggers for needing Terry Ranch?

- Terry Ranch is eventually required in all future conditions as a drought supply
- Triggering Terry Ranch will be influenced by demand growth and yield impacts

Terry Ranch Needed for Drought Supply



Present ●·····► **Future**

Factors that could trigger Terry Ranch **earlier**
- High demand growth
- Significant yield impacts

Factors that could trigger Terry Ranch **later**
- Lower demand growth

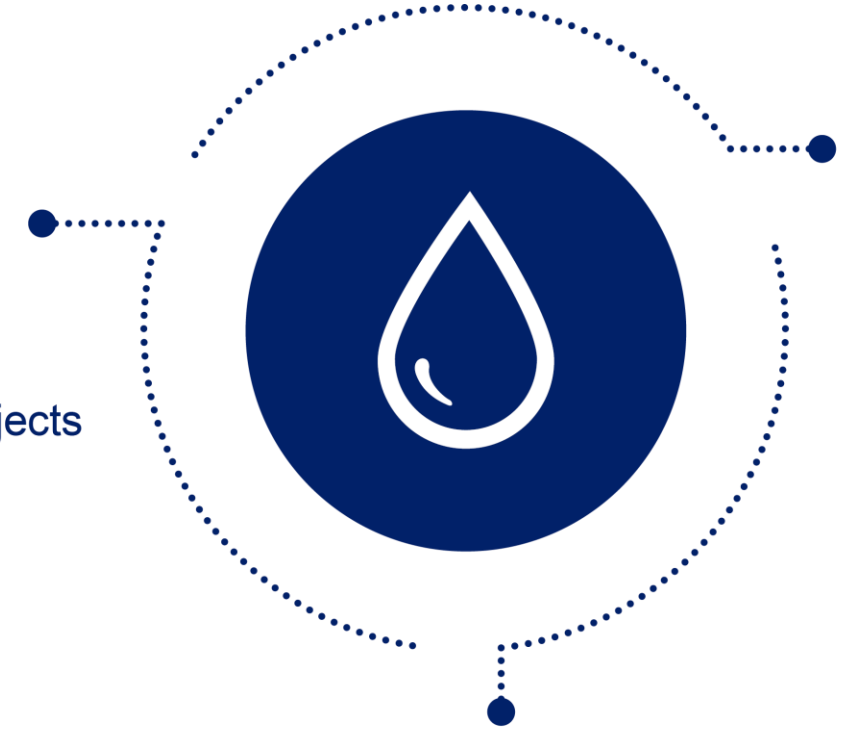
Greeley’s Plan for Sustainable Water Supply

What is the water supply system strategy?

What is Greeley’s 10-year plan?

How will Greeley monitor IWRP outcomes?

What is water supply system strategy?



Build Robust Water Portfolio

- Change agricultural water rights
- Continue strategic acquisitions
- Continue developing storage projects

Responsibly Develop Terry Ranch

- Complete priority Terry Ranch infrastructure
- Balance phasing Terry Ranch with other needs
- Study IWRP-recommended projects

Ensure Sustainable and Affordable Water

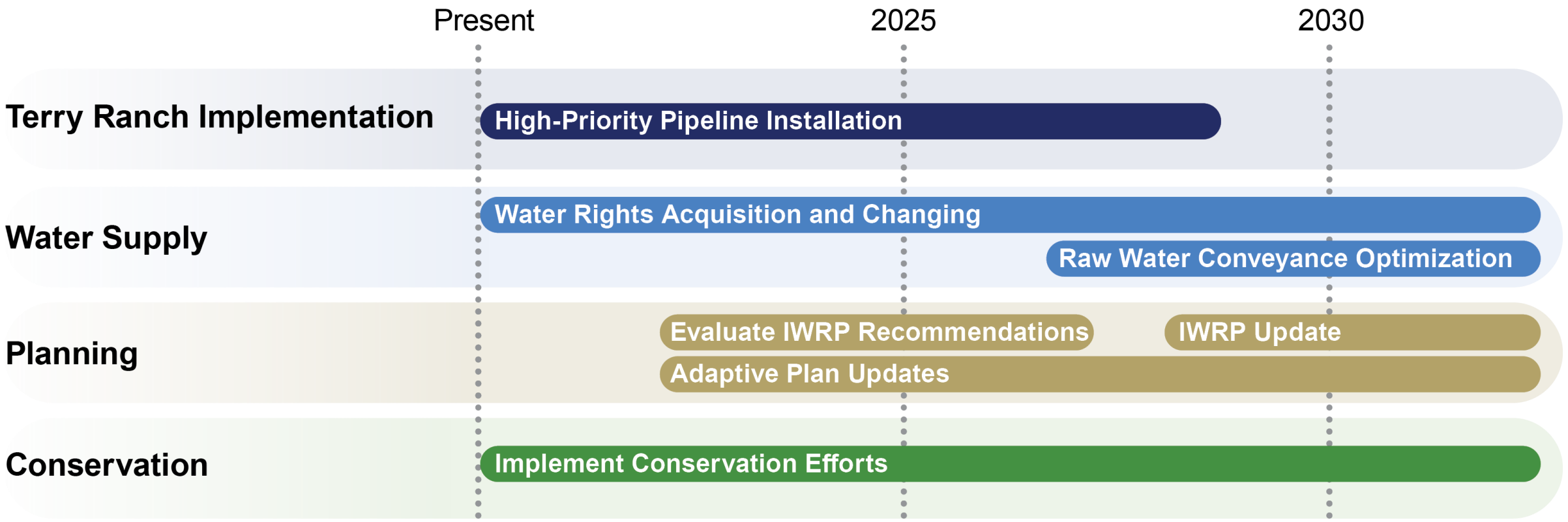
- Continue implementing demand management
- Monitor demand growth and supply conditions
- Implement Adaptive Planning

What is Adaptive Planning?

- Recognizes uncertainty around IWRP outcomes and recommendations
  - Demand growth, climate change, water rights
- Establishes process to monitor and respond to changes
  - Actions that Greeley will complete annually
- Extends life of IWRP to improve water supply system sustainability

What is Greeley's near-term plan?

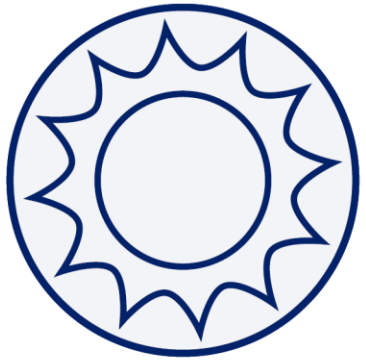
- Balance Terry Ranch investment with other needs



How will Greeley monitor IWRP outcomes?

- Adaptive Plan defines actions for Greeley to take each year

Monitor Demand Growth and Water Supply Conditions



Evaluate Terry Ranch Triggers

Update Terry Ranch Implementation Plan

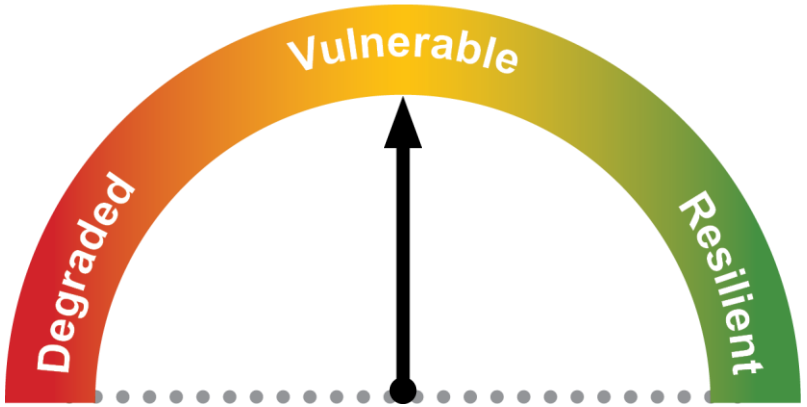
Assess Water Rights Changes and Acquisitions

Review Other Water Supply Opportunities

Complete Adaptive Plan Actions Each Year

How does the Adaptive Plan Monitoring Water Supply Conditions?

- Each year Greeley staff will characterize the health of the major basins

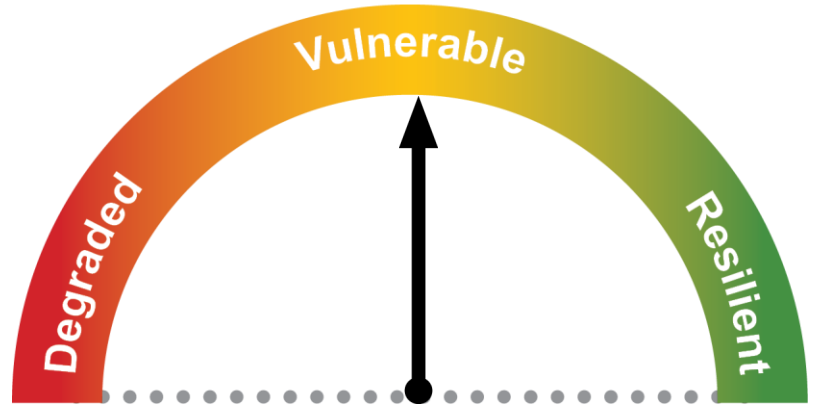


Colorado System

- On-going Colorado River Basin drought

Upper Poudre System

- Yields post-wildfires are resilient



Big Thompson System

- System more exposed to hydrologic variability

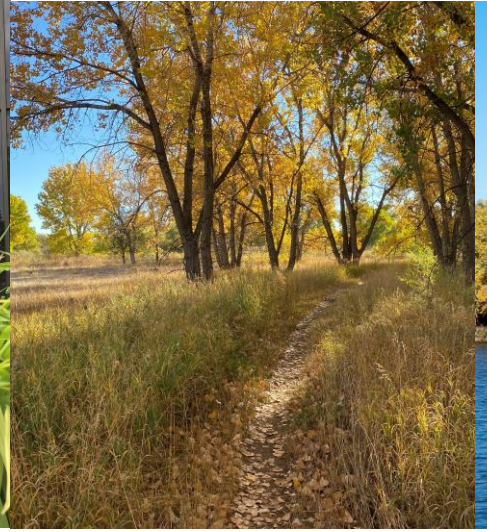



Summary

- Greeley's current water supply system is robust under near-term future conditions
- The Terry Ranch Project can sustainably provide water supply long-term in many future conditions
- Adaptive Planning will be implemented to ensure sustainable and affordable water supplies and trigger Terry Ranch implementation

‘23 IWRP Outcome Summary






- IWRP guides staff and policy makers to ensure sustainable and affordable water supplies for the future
- Greeley’s current water supply system is robust under near-term future conditions
- The Terry Ranch Project provides drought resilient long-term water supply to Greeley's system
- Need for continued investments in infrastructure, storage and the strategic acquisition of water resources
- An annual review of trends will provide for the adaptive management of water resources, storage and infrastructure

Thank you

City of Greeley Colorado