10-YEAR WATER RESOURCES PLAN
TOWN OF FREDERICK

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DECEMBER 6, 2021

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TOWN OF FREDERICK

PREPARED BY

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Water Consulting

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DECEMBER 6, 2021

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List of Abbreviations

AF	acre-feet
AFY	acre-feet per year
C-BT	Colorado-Big Thompson Project
Central Weld	Central Weld County Water District
FHG	Farm headgate
Frederick	Town of Frederick
GIS	Geographic Information System
HCU	Historical consumptive use
NISP	Northern Integrated Supply Project
Northern Water	Northern Colorado Water Conservancy District
Town	Town of Frederick
WEP	Water Efficiency Plan

List of Key Definitions

Dependable Yield	Amount of water that can be delivered on a reliable basis. Typically determined by the historical yield in dry years, but Windy Gap supply is also limited by West Slope storage space and tunnel capacity in wet years.
Dual Water System	System with separate infrastructure that enables potable supplies to be used for domestic demands and raw supplies to be used for outdoor irrigation.
Master Meter	Water meter through which the Town's potable water supply on the east side of I-25 is delivered by Central Weld to the Town for distribution.
Potable	Municipal water supply treated to drinking water quality standards
Raw	Non-treated municipal water supply available for irrigation use. Synonymous with "non-potable."
Raw Losses	Losses occurring between the source of supply and the point of delivery to the Town's raw water customers.
Surcharge/Loss	Equal to 25% of the volume delivered to the Town's potable customer meters on the east side of I-25. Includes contractual obligations to Central Weld and other potable system losses.

Water Demand	Potable water demand is the volume of water required at the Carter Lake Filter Plant, including Surcharge/Loss. Raw water demand is the projected water use plus Raw Losses.
Water Meter	Instrument used to measure the volume of water delivered to a customer.
Water Use	Volume of water measured at the customer water meter.

Acknowledgements

ELEMENT would like to thank the following Town of Frederick staff who were instrumental in the development of this 10-year Water Resources Plan:

- Bryan Ostler, Town Manager
- Kevin Ash, Engineering Director
- Sarah Watson, Civil Engineer
- Jennifer Simmons, Planning Director

Town staff and ELEMENT would also like to thank Frederick's Board of Trustees for its review and support of the 10-year Water Resources Plan. It is with your support that the Town of Frederick will continue to thrive and provide a safe and reliable drinking water supply to residents and businesses into the future.

- Tracie Crites, Mayor
- Dan March, Mayor Pro Tem
- Kevin Brown, Trustee
- Mark Lamach, Trustee
- Adam Mahan, Trustee
- Rusty O'Neal, Trustee
- Windi Padia, Trustee

1. INTRODUCTION

The Town of Frederick (Frederick or Town herein) is located in southern Weld County, Colorado, situated along Interstate 25 (I-25) and generally north of Highway 52 (**Figure 1**). Frederick provides potable water service to customers located east of I-25 as well as raw water to customers within the Town's boundaries. The Town has an agreement with Left Hand Water District to supply potable water to customers located west of I-25. The water demands considered as part of this 10-Year Water Resources Plan include potable demands for customers east of I-25 and raw demands throughout the Town's entire "planning area" that extends to Highway 119 to the north, Weld County Road (WCR) 1 to the west, and WCR19 to the east (**Figure 1**).

Frederick was established in 1907 adjacent to the Denver Pacific Railway because local coal deposits in the "Carbon Valley" area were being used to supply fuel for locomotives. Over time, Frederick's major industry shifted from coal mining to be more diversified with manufacturing, oil and gas operations, and construction. I-25 was completed in 1969 and linked the Carbon Valley with Interstate 70 and the rest of the Front Range region, thereby expanding opportunities for industrial and suburban-style growth and development. Frederick has been experiencing significant growth, which generally aligns with the job and population growth experienced in recent decades across the Colorado Front Range. Frederick is emerging as a sought-after community that features a high quality of life and local businesses that serve Town residents, and consequently is attracting an increasing number of Boulder- and Denver-area commuters.

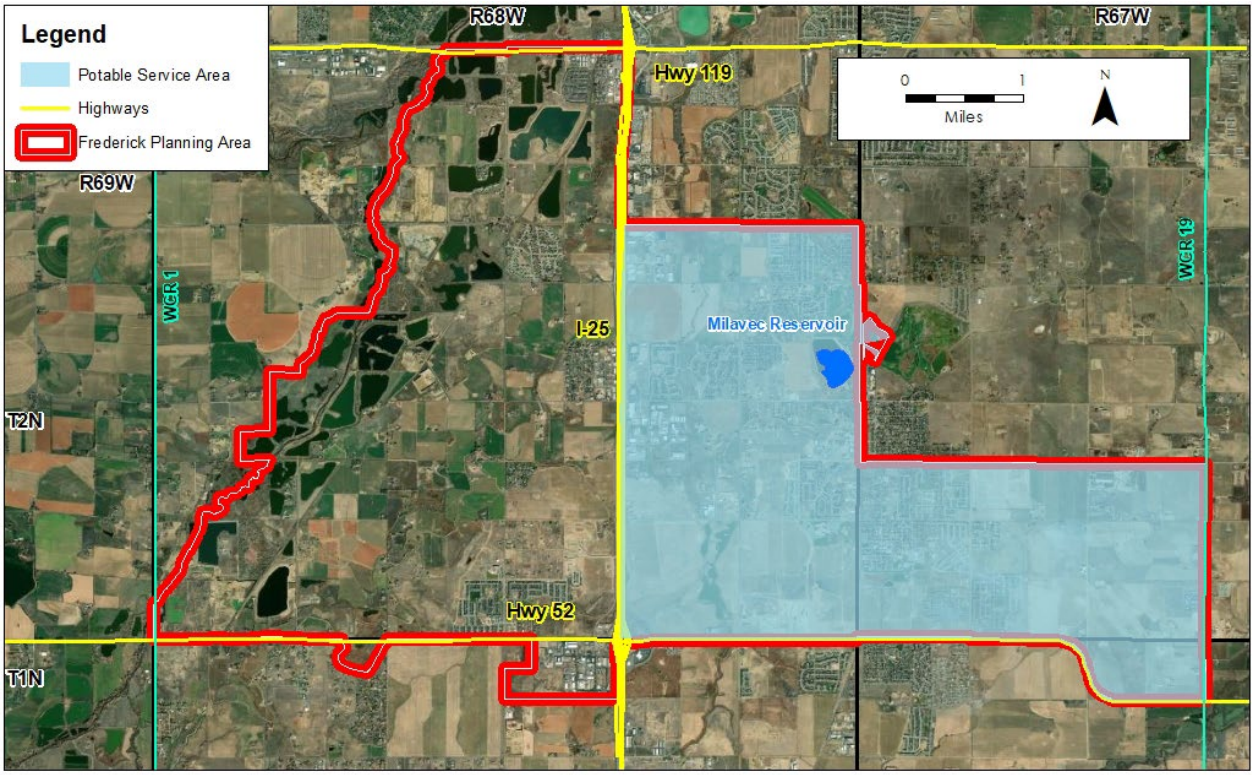

Figure 1: Town of Frederick General Location Map.

1.1 PURPOSE

Frederick is committed to developing and operating its water system to provide a dependable water supply to its current and future customers. To this end, the Town has undertaken efforts to update its water resources planning to evaluate demand-side and supply-side management options to provide a reliable water supply. This 10-Year Water Resources Plan is intended to provide Town residents, staff, and the Board of Trustees with an understanding of current and projected near-term conditions, and to help inform policy decisions related to future planning and development. The 10-Year Water Resources Plan is based on projected potable and raw demands and on water supplies that the Town presently owns or has identified as being likely to be developed over the planning period.

A water planning model was developed as part of the 10-Year Water Resources Plan effort to assess the ability of Frederick's water supply system to meet the Town's future water needs over the next 10 years. Historical population and metered water use data were used to develop baseline planning values, which were coupled with growth projections provided by the Town's Planning department to evaluate future demands. The model was also used to evaluate the Town's existing supplies and new supplies that are being developed over the 10-year planning period.

This document is intended to support Frederick's decision-making regarding water supply policies and to provide specific implementation strategies for addressing Frederick's future water needs. Where necessary, reasonable assumptions were made based on the best available information at the time of this effort. The 10-Year Water Resources Plan was developed under the direction of Town staff with input from the Board of Trustees.

1.1.1 RELATED PLANNING EFFORTS

Frederick is in the process of preparing a Long-Term Water Resources Plan[1] and updating its 2011 Water Conservation Plan (referred to hereafter as the 2021 Water Efficiency Plan or WEP).[2] The Long-Term Water Resources Plan will evaluate the Town's future supply and demand conditions over the next 50 years with a range of population/development conditions, water conservation/efficiency efforts, impacts of climate change, and future supply alternatives including the Northern Integrated Supply Project (NISP). The WEP will evaluate potential demand reductions and the recommended timing for implementation of water conservation and efficiency programs to achieve the targeted reductions over the next 7 to 10 years. Information from the 2021 WEP will be integrated into the demand projections that are prepared as part of the of the Long-Term Water Resources Plan.

The Town's Comprehensive Plan was most recently updated in 2016. This planning document is used by the Town to help guide decision making related to new growth. Town staff relied upon land use information presented in the Comprehensive Plan (**Figure 2**), along with recent development trends, to develop growth projections that were used to prepare the water demand projections presented herein.

[1] The long-term planning document is in process and will be completed in late 2021 or early 2022.

[2] The terms "water conservation," "water efficiency," and "demand management" are generally interchangeable throughout this report.

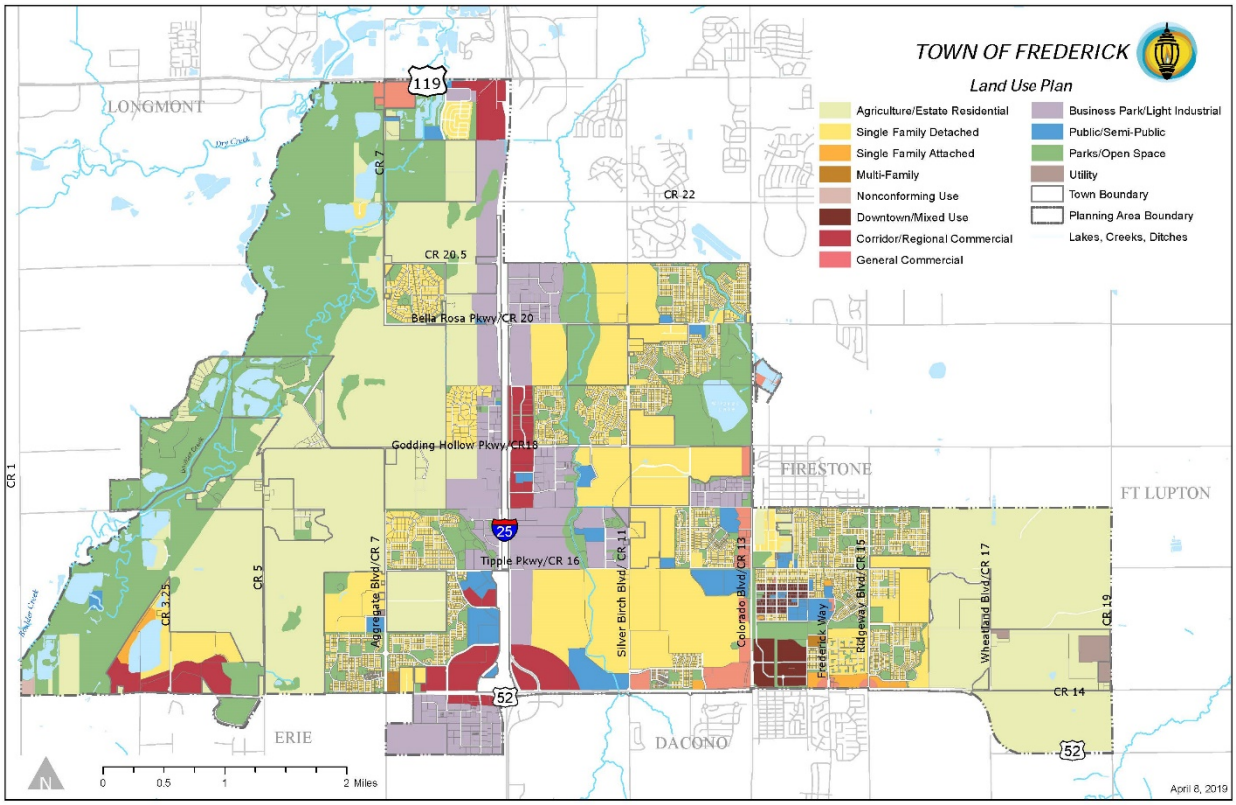

Figure 2: Town of Frederick Land Use Plan.

The Town prepared a Raw Water Infrastructure Master Plan in 2008 (2008 Plan) to evaluate then-current and future opportunities to use raw water supplies for irrigation and thereby reduce potable water demands. It is recommended that the Town prepare an update to its raw water master plan to refine the infrastructure requirements and cost analyses to reflect current conditions; however, the 2008 Plan continues to provide a reasonable representation of raw water use potential at buildout. Town staff used the 2008 Plan and information about recent and proposed development projects to identify areas that are reasonably likely to be developed over the 10-year planning period so that the use of raw supplies could be integrated into the current planning efforts.

2. CURRENT POTABLE SUPPLY AND DEMAND CONDITIONS

The Town currently provides potable water service to a total of approximately 4,100 customer connections within its potable service area on the east side of I-25. The potable service area population was approximately 12,000 in 2020 and the total Town population has been growing at an average rate of 6.15% over the last 10 years (Simmons, 2021). Potable water demand has been increasing similarly (**Figure 3**).

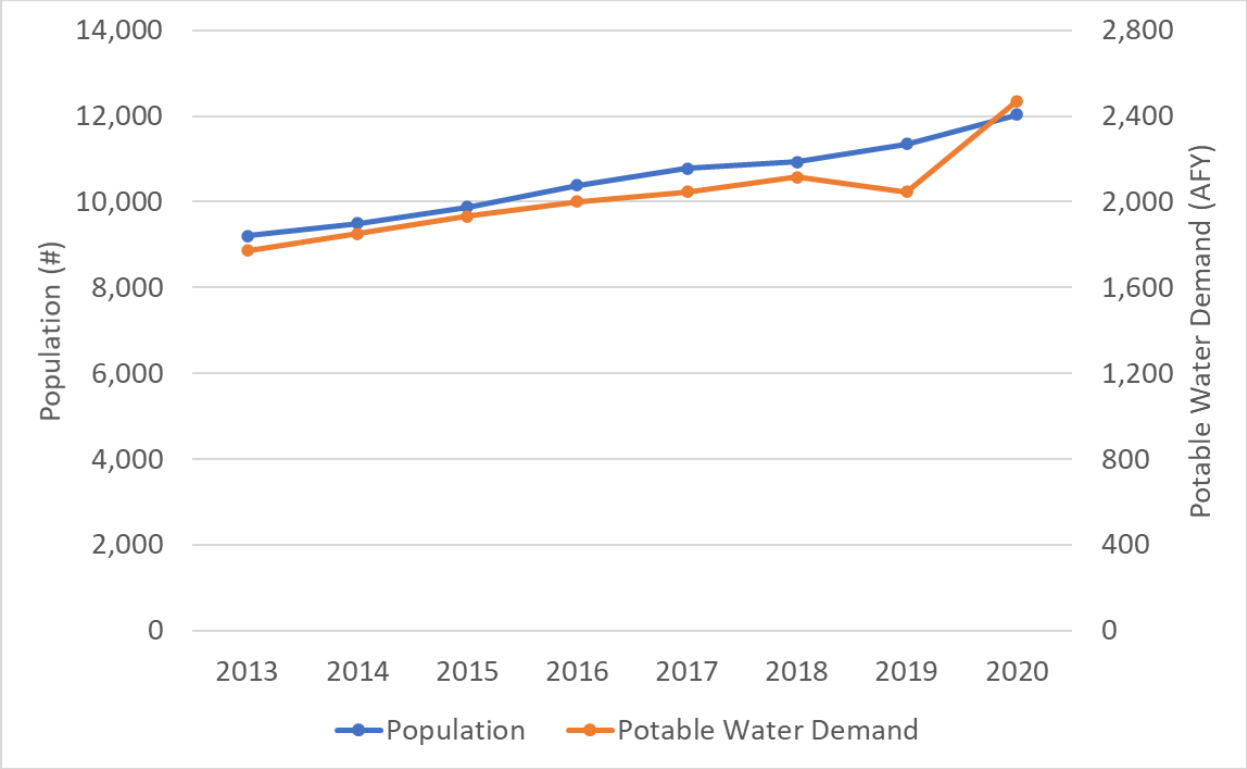

Figure 3: Historical Population for Potable Service Area and Potable Demand, 2013-2020.

The Town's existing potable water supply consists entirely of Colorado-Big Thompson (C-BT) project water,[3] which is treated and delivered to the Town by Central Weld County Water District (Central Weld). Central Weld treats the Town's C-BT water at the Carter Lake Filter Plant, which is approximately 20 miles northwest of the Town (**Figure 4**), and then delivers water to the Town's master meters. Under the Town's potable water service agreement with Central Weld, Frederick must provide Central Weld with water in an amount equal to 120% of the volume delivered through the Town's master meters, which is intended to account for system, treatment, delivery, and metering losses (Frederick-Central Weld, 1998). In order to account for the contractual requirements with Central Weld and additional losses between the master meters and the Town's customer meters, potable demand requirements were calculated to be 25% greater than the metered water use to account for "Surcharge/Loss." A schematic of the Town's potable water system is provided on **Figure 5**.

[3] The Town took delivery of Windy Gap water for the first time in 2021; however, this supply has not yet been used to meet potable demands.

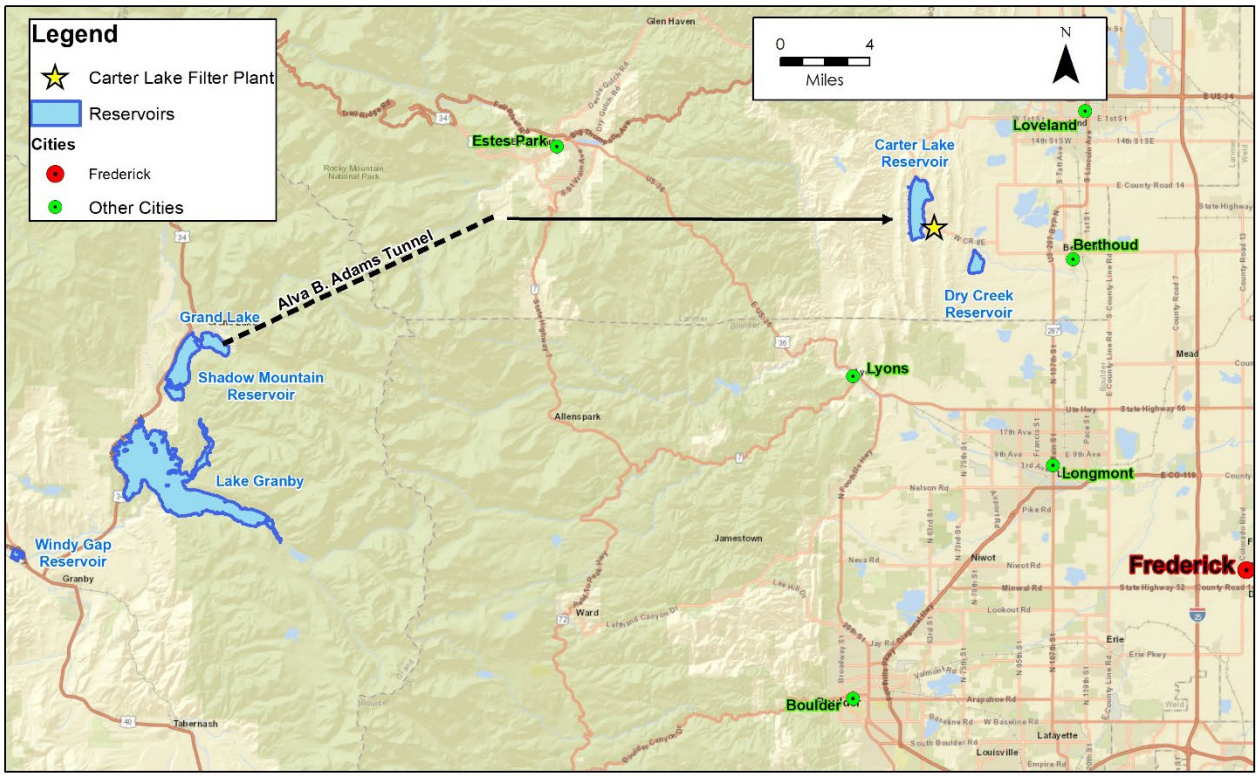

Figure 4: Potable Supply Vicinity Map.

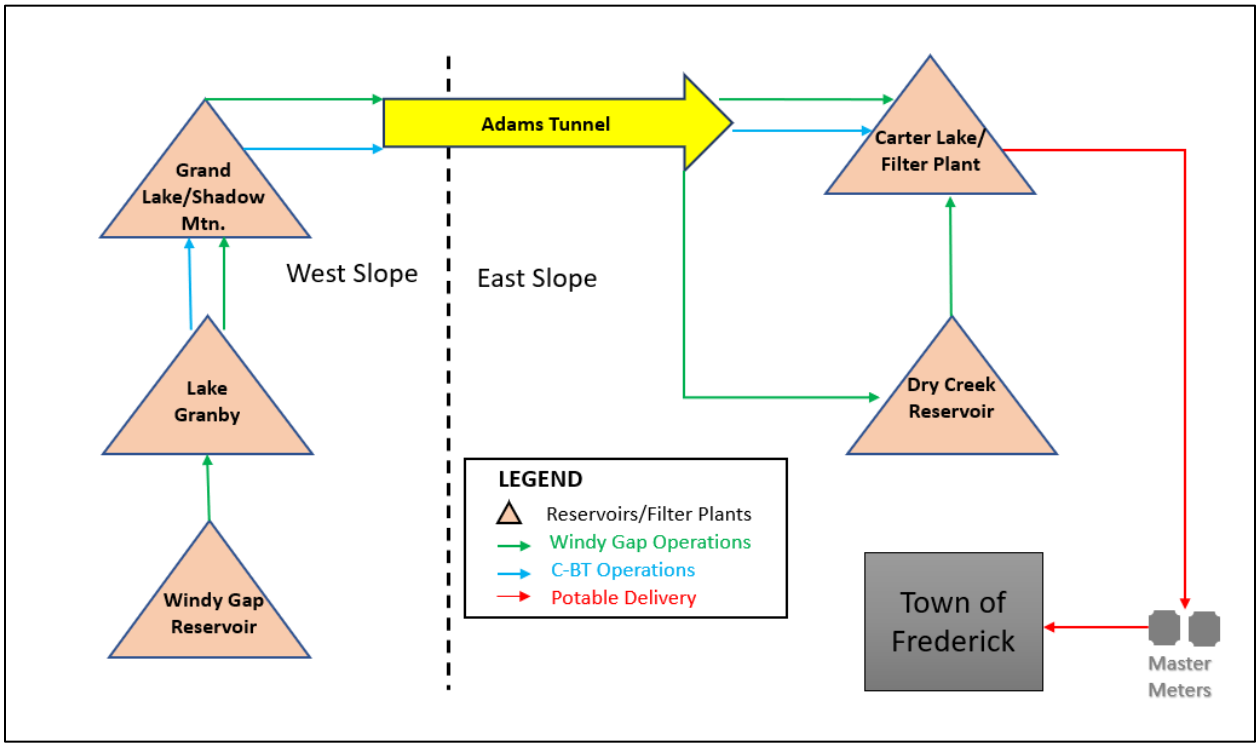

Figure 5: Potable Supply Schematic.

The C-BT project is operated and administered by Northern Colorado Water Conservancy District (Northern Water). Northern Water determines the annual "quota" of C-BT units, which has

historically ranged from 0.5 to 1.0 acre-feet per year (AFY) per unit with an average of 0.74 AFY/unit from 1957 – 2020 (Northern Water, 2020). The Town currently owns 4,373 C-BT units, indicating that the total annual supply can range from approximately 2,190 to 4,370 AFY depending on the annual quota and would average approximately 3,240 AFY based on historical conditions.
Baseline potable demand factors from the historical analysis were paired with the current service area population and number of non-residential accounts to prepare two sets of current demands – one based on average conditions ("Average"), and one based on higher outdoor usage observed during a hot/dry year ("High Use Year"). The Average and High Use Year demands were plotted against a range of C-BT quota yields on **Figure 6**. The results show that the Town's C-BT supplies are sufficient for both current demand conditions at a C-BT quota of 0.6 AFY/unit or higher; however, shortages are possible with a quota of 0.5 AFY/unit. While there have been only 5 years within the 1957 – 2020 period when the quota was less than 0.6 AFY/unit, the Town should be prepared to implement demand management measures (e.g., watering restrictions) during years when the quota is less than 0.6 AFY/unit and there is no carryover supply[4] from the prior year. While Northern Water generally tends to allocate a higher C-BT quota in years when ditch irrigation rights are projected to have lower yields,[5] this does not mean that the C-BT quota will be larger in a High Use Year with greater outdoor municipal demands.

The Town prepared a "Water Shortage Contingency Plan" in 2002 that outlines five "water shortage stages" with demand reduction goals, ranging from 10% to 35%, and demand-side and supply-side implementation measures to achieve the stated goals. This Water Shortage Contingency Plan is referenced throughout Section 13-81 of the Town's Municipal Code. Given that the plan was prepared approximately 20 years ago, we recommend that the Town plan and budget to prepare an update in 2022 or 2023 with subsequent changes integrated into the Municipal Code.

[4] Northern Water operates a "carryover program" that allows Frederick to carry over a portion of the C-BT quota not used in the prior year. The analyses prepared for this planning effort have assumed that there would be no carryover and that the current year's quota would be the only C-BT supply available for meeting potable demands. This is an appropriate planning assumption because low quotas may extend for several years, such as from 1996 – 1998 when the average quota was 0.53 AFY/unit.
[5] See: https://www.northernwater.org/your-water/allottees/cbt-quota.

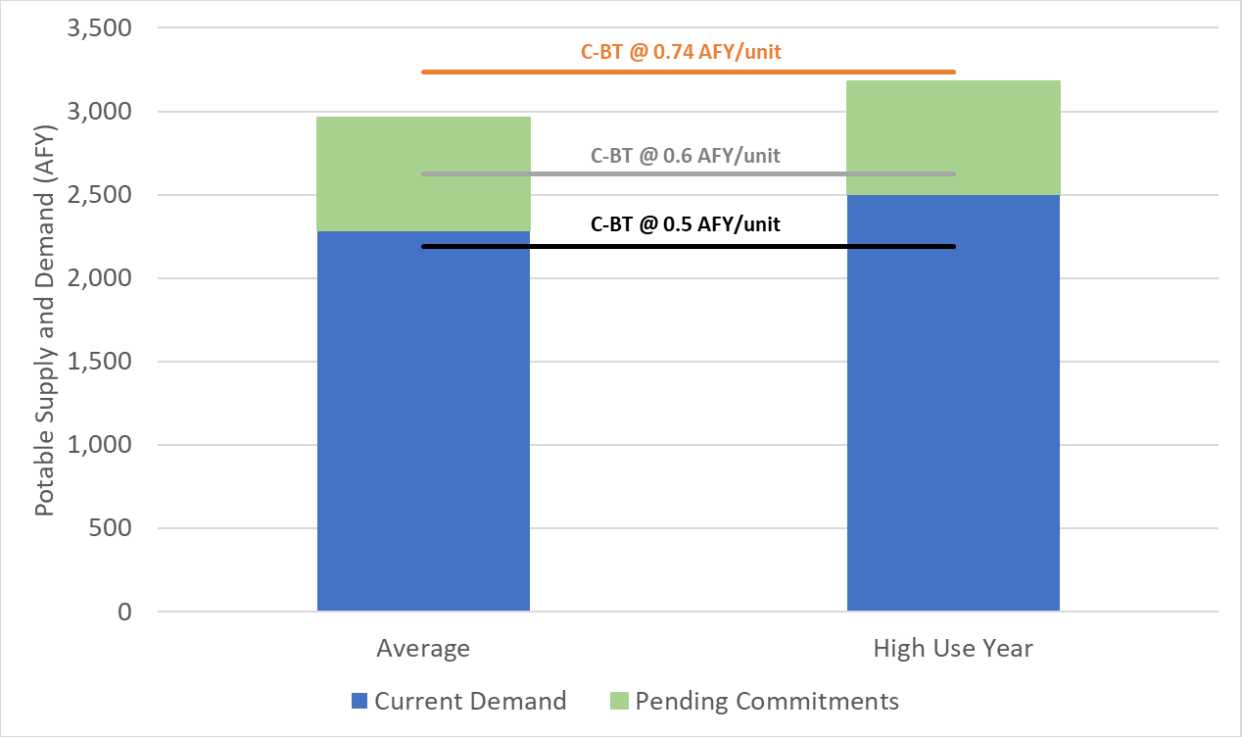

Figure 6: Frederick's Current Potable Supply and Demand Conditions.

In addition to the Town's current demands, there are pending development projects (**Figure 7**), which are mostly residential, for which the Town has committed to provide water service; any C-BT units already dedicated to the Town for those developments are included in the current total of 4,373 units. The total potable demand for these "pending commitments" is approximately 680 AFY (**Table 1**), which exacerbates the potential for shortages under current supply conditions when that demand is added to the current demand (**Figure 6**). A key objective of this planning effort was to develop a clear path toward satisfying the Town's existing service commitments and developing adequate supplies to support new commercial customers.

Table 1: Tabulation of Frederick's Pending Potable Supply Commitments.

Project Name	Demand (AFY)
Wyndham Hill	86.0
LIFE Fellowship	27.0
Clearview Villages	77.4
Agilent	86.8
Silverstone 1 - 3	118.5
Hidden Creek	140.4
Clark Ranch aka Village East	8.1
Westview	9.1
Maple Ridge II	2.6
Prairie Greens	23.7
Carriage Hills 1, 2 & Market Place; Prairie Greens 2)	100.0
Total:	**679.6**

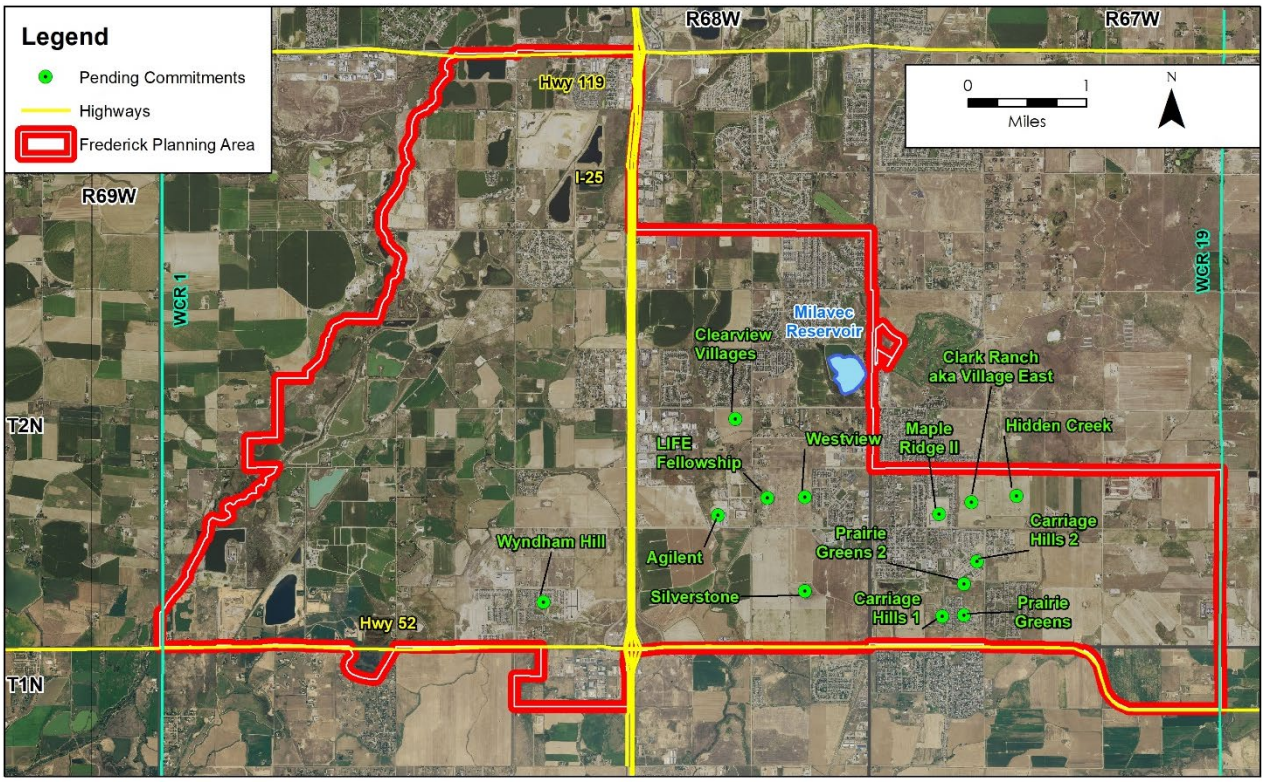

Figure 7: Frederick's Pending Potable Service Commitments.

3. FUTURE POTABLE SUPPLY AND DEMAND CONDITIONS

The purpose of this section is to summarize the Town's projected potable demands over the 10-year planning period and outline potential potable supply and demand reduction projects to reduce the potential for water supply shortages.

3.1 POTABLE DEMAND PROJECTIONS

Town staff provided guidance on growth rate assumptions for projecting residential and non-residential development over the 10-year planning period. The residential population was projected to increase by 2.5% per year, resulting in a 2030 potable service area population of approximately 15,400 people. The number of non-residential accounts was also projected to increase by 2.5% per year with the same distribution of account types that currently exists. With direction from Town staff and the Board of Trustees, potable demands projections were further adjusted to include additional commercial development beyond what would occur with the 2.5% per year non-residential growth rate. The Town is interested in attracting additional commercial development and plans to offer water-related incentives in the near-term; therefore, having adequate supply to support this development is a key objective of the 10-year planning effort. It was assumed that "incentivized commercial" development would result in up to an additional 20 non-residential accounts, each with a 2-inch potable water tap connected to the system by 2030. The 20 incentivized commercial taps would be in addition to the 30 commercial accounts that are projected to be added under the 2.5% per year non-residential growth rate.

The growth projections were paired with the High Use Year baseline water demand factors to develop the annual potable demand projections.[6] The modeling shows that residential demands would increase by approximately 540 AFY by 2030, and non-residential demands would increase by approximately 170 AFY (**Figure 8**). The combined total increased demand of 710 AFY is slightly higher than the Town's "pending commitments" of approximately 680 AFY. This indicates that the majority of the projected potable residential and non-residential demand increases could be related to (i.e., overlap with) the pending service commitments. Incentivized commercial development was projected to further increase the potable demand projection by 120 AFY (**Figure 8**).[7]

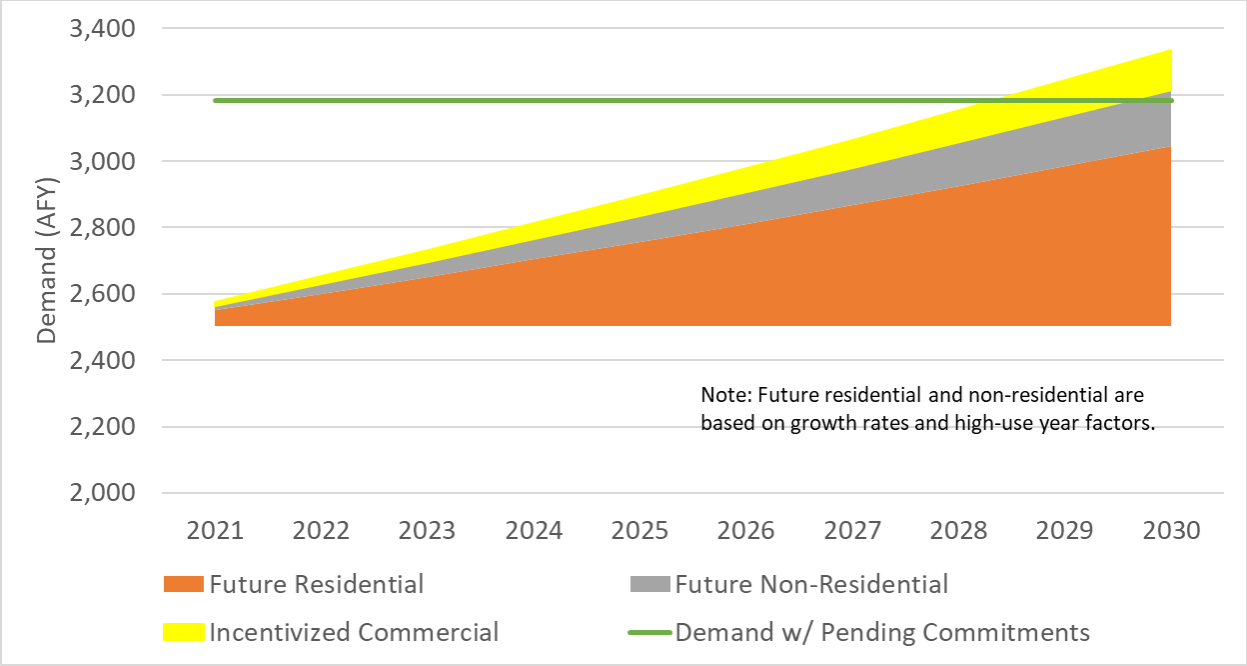

Figure 8: Potable Demand Projections Based on Growth Rates.

3.2 Potable Supply and Demand Reduction Projects

There are several mechanisms under which the Town may develop a dependable potable supply portfolio to meet projected demands over the 10-year planning period. Four potential projects were presented to the Board of Trustees for consideration. Two of the projects would increase the Town's potable supplies through the acquisition of additional C-BT and Windy Gap units. The other two projects would decrease the Town's potable demands by a) converting the irrigation supply for up to 18 properties, mostly parks, currently being served by potable water to instead be provided from raw water sources; and b) implementing outdoor water conservation and efficiency measures. The following sections provide an overview of these projects, including the estimated yield, planning-level costs,[8] and recommended timing for implementation.

[6] In order to plan conservatively, for dependable water supply, it has been assumed that a High Use Year may occur at times when the available supply is low.
[7] Each 2-inch tap was assumed to have a demand of 6.0 AFY based on the Town's current Fee Schedule for Municipal Utilities (Frederick, 2020).
[8] Cost information is based on conceptual projects and will need to be updated if the project advances beyond conceptual level, as engineering, permitting, and construction-related information becomes available. Cost information reflects only acquisition and/or initial project implementation costs. Operation, maintenance, and replacement costs will need to be evaluated if a project advances beyond conceptual level.

3.2.1 C-BT ACQUISITIONS

The Town currently owns 4,373 C-BT units. However, the Town can purchase additional units while remaining in compliance with the "ownership limitation" that is imposed by Northern Water for domestic and municipal users. Frederick's current C-BT ownership limitation specified by Northern Water is 4,741 units, but Town staff estimate that if an updated analysis were requested of Northern Water, the ownership limitation would be increased to 4,987 units. The Town could request an updated analysis and then purchase C-BT units on the open market to bolster its potable supply. If the Town were to purchase 614 C-BT units, which is the maximum under the estimated ownership limitation, the potable supply would be increased by approximately 370 AFY assuming a quota of 0.6 AFY/unit. C-BT units have recently been offered for sale to the Town for $65,000/unit (approximately $108,000/AFY) and are projected to be approximately $80,300/unit (approximately $134,000/AFY) in 2030 with inflation.[9] The timing at which C-BT supplies are purchased is controllable by the Town subject to units being available for purchase and adequate funding being available. For reference, if 614 C-BT units were acquired in 2021, then the estimated acquisition cost would be approximately $40 million.

C-BT units that are dedicated by developers do not count against the Town's ownership limitation as long as the lots to be developed were not platted and included in the prior limitation calculation. The Town's current dedication policy facilitates the development of a larger C-BT supply portfolio to support future growth. In the absence of a dual water system, the Town requires the dedication of 1.0 C-BT unit per single-family equivalent. For projects with dual water systems, the Town prepares a demand analysis to determine the number of C-BT units to be dedicated for potable water service and native water to be dedicated for raw water service. Recommended adjustments to the Town's dedication policies are presented below in Section 3.4.

3.2.2 WINDY GAP/DRY CREEK RESERVOIR

Frederick currently owns 7.0 Windy Gap units that were purchased in 2018. The Town's 7.0 Windy Gap units are not participants in the Windy Gap Firming Project being implemented by Northern Water; however, the Town has entered into a long-term lease agreement for 2,000 acre-feet (AF) of storage space in Dry Creek Reservoir (see **Figure 4** and **Figure 5**) to independently firm its Windy Gap supplies. The dependable yield of the Town's 7.0 Windy Gap units without reuse is estimated to range from 265 to 315 AFY. We have conservatively used a dependable yield of 265 AFY for the 10-year planning effort, and the yield estimate may continue to be refined as the project commences operations and the Town pursues a plan to reuse the unconsumed portion of (i.e., the return flows from use of) Windy Gap deliveries.

The total purchase price for the 7.0 Windy Gap units was $16 million (approximately $2.3 million per unit). The lease agreement for Dry Creek Reservoir requires annual lease payments of $300,000 in the first year, $600,000 in the second year, and $900,000 from the third year onwards; the lease payments in the second year and onward are subject to inflation adjustments using the Consumers Price Index, and potential adjustments for comparable storage lease agreements are also possible starting in 2026. We estimated that combined lease payments over the 10-year planning period would be $9,100,000. The combined purchase and 10-year lease costs indicate that the total cost will be approximately $95,000/AFY of dependable yield, which is approximately $13,000/AFY less than the cost of C-BT as noted above.

[9] Inflation was estimated based on average Consumers Price Index (CPI) for Denver-Aurora-Lakewood from 2012 – 2020, which averaged 2.38% per year.

The Town began taking delivery of Windy Gap supplies in 2021 and has started firming operations using Dry Creek Reservoir. Actual yields must be monitored as the project is operated, but for planning purposes, we have projected that the full dependable supply of 265 AFY will be available starting in 2026 to account for hydrologic variability and the potential for years with low Windy Gap yields.

Our modeling shows that the 2,000 AF of leased Dry Creek Reservoir space is capable of firming up to 8.0 total Windy Gap units; therefore, we recommend that the Town consider purchasing an additional 1.0 unit if the opportunity arises. If the 1.0 unit were purchased for $3 million in 2026 (a 30% increase over what was paid in 2018), then the equivalent cost would be approximately $79,000/AFY because no additional acquisition costs would be incurred for the use of Dry Creek Reservoir.

3.2.3 Potable to Raw Conversions

There are 18 accounts, predominantly parks, that currently receive potable C-BT supplies for landscape irrigation purposes but have been identified by Town staff for future connection to the raw water system (**Figure 9**). Converting these properties to use raw water would reduce the Town's current potable demands, thereby increasing the potable supply available for other uses. Upon full conversion, there would be approximately 96 AFY of potable demand reduction. Given the proximity of the accounts to the existing raw water system and planned development, Town staff have indicated that it would be feasible to convert all accounts over the 10-year planning period. For planning purposes, it has been assumed that these properties will be converted starting in 2022 and that full conversion will be complete in 2030.

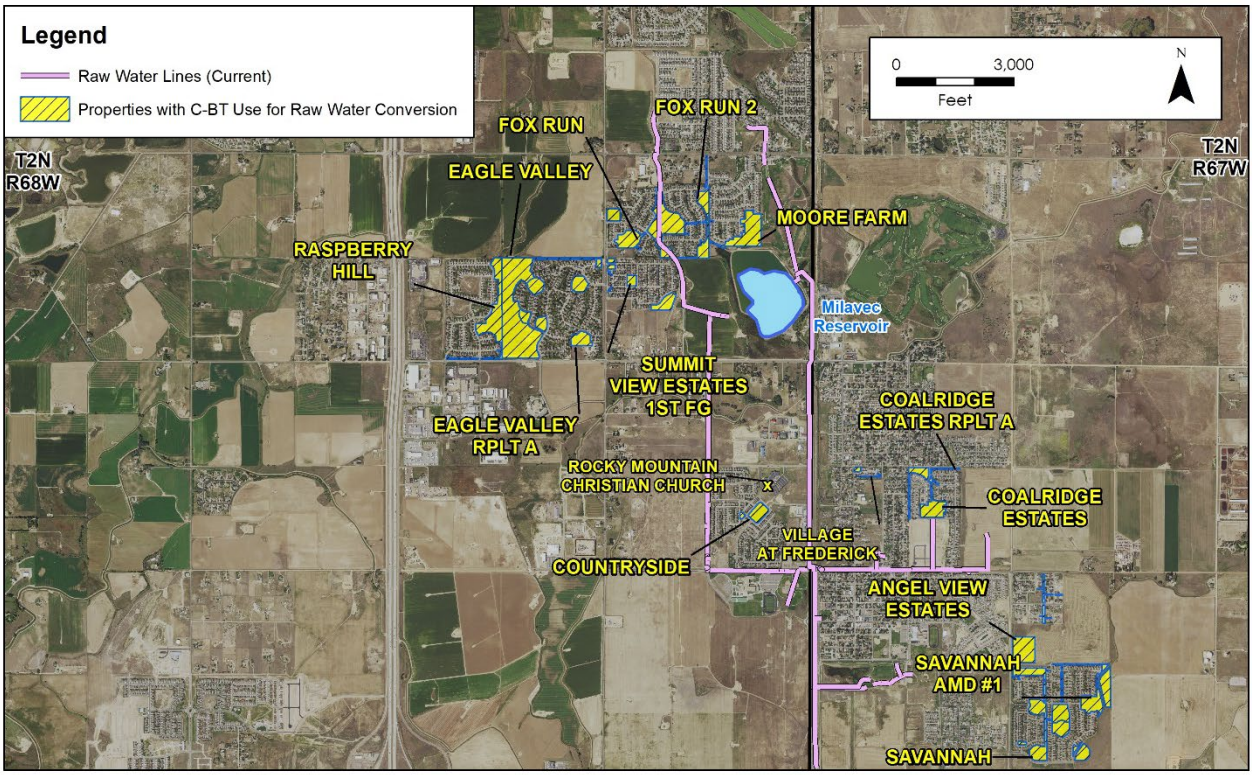

Figure 9: Properties to be Converted from Potable to Raw Irrigation Supply.

Infrastructure costs to implement the potable conversion project are still being evaluated by Town staff. For comparison against other projects under consideration, a planning-level cost of $4.3 million for infrastructure was used based on information in the 2008 Plan.[10] This planning-level analysis indicates that the cost to implement the potable conversion project is approximately $94,000/AFY of demand reduction.

3.2.4 Outdoor Conservation

The Town is evaluating opportunities to reduce potable demands through outdoor conservation programs that will be implemented under the forthcoming 2021 WEP update; however, preliminary planning-level demand reduction values have been incorporated into the 10-Year Water Resources Plan analyses for comparison against other projects. It has been assumed that outdoor conservation programs implemented over the 10-year planning period would be capable of reducing outdoor potable demands by 5%, which would result in a demand reduction of approximately 100 AFY in 2030.

A robust water conservation program would be necessary to achieve outdoor demand reductions on the order of 5% over the 10-year planning period. It is also important that the selected programs continue to be implemented over time so that the savings are maintained. Following are examples of the types of measures being evaluated with Town staff.

- Improved utility water loss control.
- Rebates for landscape irrigation technology such as irrigation controllers that adjust watering due to actual weather conditions.
- Landscape water budgets and water rates tied to each customer's budget.
- Turf replacement incentive program.
- Water-efficient landscape ordinances for new construction, redevelopment, and municipal facilities.

The preliminary annual budget for implementing the outdoor conservation program is estimated at $200,000 per year in 2022 and $450,000 per year in subsequent years through 2030 with adjustments for inflation. These planning estimates are based on a review of six recent WEPs published by Colorado Front Range utilities and include a combination of program and infrastructure costs.[11] The planning estimate includes the addition of a full-time equivalent staff person to focus on implementing the selected programs, as success is unlikely without a dedicated staff member.

The total planning-level cost for the outdoor conservation program over the 10-year planning period is $4.3 million. This indicates that the cost to implement this project is approximately $43,000/AFY of demand reduction; however, the costs would be ongoing beyond the 2030 planning horizon. The projected costs will be further refined as part of the WEP and Long-Term Water Resources Plan.

3.3 Potable Alternatives

The Town's current C-BT and Windy Gap supplies are insufficient to meet the projected potable demands through 2030. Four alternative combinations of the projects described above in Section 3.2 (Alternatives 1 – 4) were originally prepared for consideration by Town staff and the Board of

[10] Based on information in the 2008 Raw Water Infrastructure Master Plan to construct Systems B, E, and F, adjusted by inflation for this report.
[11] Implementation of certain types of water loss control projects could far exceed these costs and are not accounted for in this plan.

Trustees in determining the preferred implementation approach (**Table 2**). The Board of Trustees provided direction to prepare a fifth alternative (Alternative 5) that pursues all four potable supply and demand reduction projects. Following is a summary of key assumptions relied upon in the alternatives.

- Each alternative has been structured to meet the future potable demand projections in **Figure 8**, including 120 AFY for incentivized commercial development.
- The current C-BT supply is 4,373 units with a dependable yield of 2,624 AFY.
- Under each alternative, it has been assumed that C-BT purchases would be used to meet any remaining supply gap after other projects have been implemented. Accordingly, the number of C-BT units is lower when there are more projects included under an alternative.
- The Town's current 7.0 Windy Gap units and Dry Creek Reservoir will supply a dependable yield of 265 AFY.
- An additional 1.0 Windy Gap unit will increase the dependable yield by approximately 38 AFY.
- Potable-to-raw conversions will reduce potable demands by approximately 96 AFY.
- Outdoor conservation will reduce potable demands by approximately 100 AFY.

Table 2: Summary Matrix of Potable Alternatives.

Category	Project	Alternative No.				
		1*	2	3	4	5
Supply Increase	C-BT Purchases (# units)	745	586	522	420	357
	Windy Gap Purchase, 1 unit			✓		✓
Demand Reduction	Potable-to-Raw Conversions		✓	✓	✓	✓
	Outdoor Conservation				✓	✓

*Alternative exceeds C-BT ownership limitation but is included for comparison purposes.

A graphical representation of how each alternative will meet the projected potable demand in 2030 is provided in **Figure 10** along with total planning-level costs over the 10-year planning period. Illustrative annual planning-level costs for each alternative are provided as **Attachment A**. As noted above, each alternative assumes that the Town will purchase C-BT units to eliminate the remaining supply gap after implementing other projects. Attachment A provides an illustration of the number of C-BT units that must be purchased each year; however, the total for each alternative is a better indicator of C-BT units to acquire given that the schedule for demand increases and the implementation of supply projects may vary from the projections.

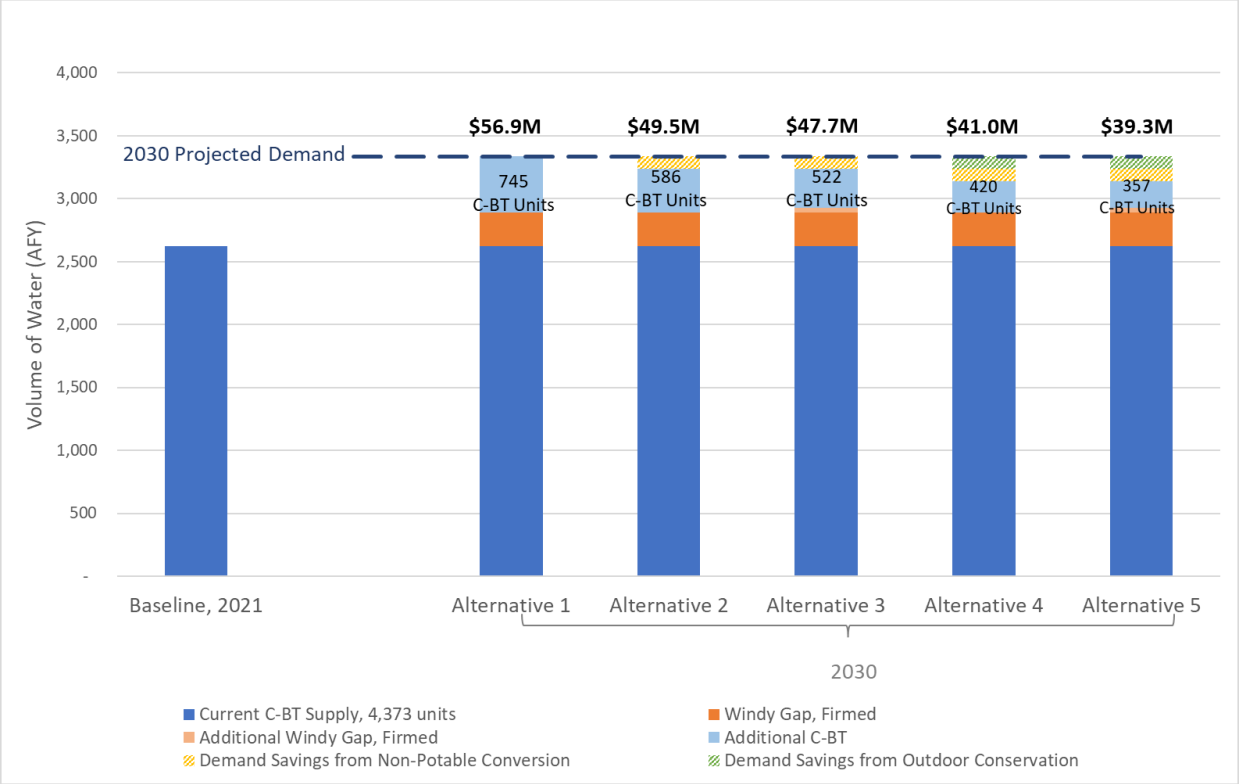

Figure 10: Potable Demand Alternatives.

3.4 Potable Implementation Plan

Alternative 5 was selected for implementation by the Board of Trustees, which includes all four potable supply and demand reduction projects. This multi-pronged approach is projected to have the lowest cost among the alternatives if all projects are successfully implemented. Should a given project not be fully achieved, such as outdoor conservation or purchasing an additional Windy Gap unit, then the implementation approach will need to be adapted to include the purchase of additional C-BT units, and the end result may align more closely with Alternatives 2 – 4. This approach is practical because it pursues the lowest cost solution available to the Town while also providing backup opportunities to develop a dependable supply.

The following potable implementation plan has been prepared to guide Town staff and the Board of Trustees towards developing adequate supplies to meet projected demands, including for incentivized commercial customers.

3.4.1 Purchase Additional C-BT and Windy Gap Units

Each Alternative includes purchasing a large number of C-BT units, ranging from 357 units under Alternative 5 to 745 units under Alternative 1. Therefore, we recommend that the Town proceed with purchasing up to 357 C-BT units earlier in the planning period as funding permits and as opportunities arise given that C-BT costs are likely to continue increasing. To this end, the Town has budgeted to purchase up to 200 C-BT units in 2022.

The Town will pursue opportunities to purchase an additional 1.0 Windy Gap unit to be firmed using the existing leased space in Dry Creek Reservoir. It is recommended that Town staff contact Northern Water and current Windy Gap allottees to inform these entities of the Town's interest in acquiring an

additional unit. There are fewer than 20 parties that own Windy Gap units, so targeted outreach is a reasonable approach.

3.4.2 Implement Potable to Raw Conversion Project

Town staff will advance efforts to convert the 18 accounts that currently receive potable C-BT supplies for landscape irrigation purposes to use raw water sources. Infrastructure and associated budgeting requirements will need to be refined, and we recommend that the Town plan to engage an infrastructure design consultant to assist with this effort in 2022. As properties are converted, Town staff should maintain tracking of irrigated acreage that has been converted as well as historical water use for integration into the planning tool that is described below in Section 3.4.4.

3.4.3 Implement outdoor Conservation Program

The Town will begin implementing its outdoor conservation program in 2022 with the addition of a new full-time employee who is dedicated to implementing efficiency measures to be identified in the WEP. The Town is committed to achieving potable demand reductions through water conservation and efficiency measures because it is the most cost-effective project currently under consideration. The Town intends to maintain these programs so that the savings do not diminish over time, and the 2021 WEP will be updated at least once during the 10-year planning period. Budgeting requirements will need to be refined as conservation program details are prepared and after the next WEP update. Town staff will monitor water usage trends over time to quantify water savings and integrate this information into the planning tool that is described below in Section 3.4.4.

3.4.4 Conduct Ongoing Monitoring, Planning, and Implementation

Quality data is an integral component to support future supply and demand planning efforts. The Town currently tracks its water use and water supply data on a monthly basis. Town staff will monitor future demands and track the availability of potable supplies using the potable planning tool that was developed by ELEMENT. The planning tool is configured to integrate additional C-BT and Windy Gap supplies that are acquired by the Town as well as potable demand reductions that result from raw conversions and/or water conservation measures. The planning tool will allow staff to track the availability of any surplus potable supplies when evaluating new service commitment requests.

The 2021 WEP and the Long-Term Water Resources Plan will be prepared and implemented. Through these plans, the Town will continue evaluating opportunities to integrate its water and land use planning. The Town is fortunate to have land use jurisdiction throughout its water service area, and we recommend that the Town's Planning and Utilities departments formalize arrangements for sharing data and information. For example, growth projections and the resultant water demand implications are important for consistent planning between the Town's Utilities and Planning departments. Regular communication between these departments is foundational to the integration between water and land use planning.

3.4.5 Municipal Code Revisions

Section 13-55 of Frederick's Municipal Code specifies the water rights dedication requirements related to the provision of water service and the subdivision/annexation of land. No building permit for residential development may be issued by the Town unless C-BT units, and "native" water rights for projects with dual systems, have been accepted by the Town to satisfy the water dedication requirement (see 13-55.4.c as amended by Ordinance No. 1333). For commercial and industrial

applications, the dedications must be completed in full at the time of tap application (see 13-55.4.d). The Municipal Code currently allows the Board of Trustees to delegate the authority to accept cash-in-lieu of C-BT unit dedications for the following specific purposes, with a cumulative annual cap of 30 C-BT units.

- One C-BT unit in one single-family residence; and
- Not more than three C-BT units for one commercial/industrial unit.

We recommend adjusting the Municipal Code to allow the Board of Trustees to vary the potable supply made available through the cash-in-lieu program each year based on the surplus of potable supplies, if any, determined then to be available by Town staff. It is important that the Town not make supplies available through the cash-in-lieu program until a surplus is determined to be available, which Town staff will track using the potable planning tool. Subject to review by the Town Attorney, we recommend that Section 13.55.4(f) of the Municipal Code be revised along the lines of the following:

> *The Board of Trustees shall annually designate the annual surplus of potable supply available for which cash-in-lieu of* C-BT unit *dedications will be accepted. The Board of Trustees by resolution may delegate authority to Town staff to accept cash-in-lieu up to the annual surplus for the following limited purposes: 1) one C-BT unit for one single-family residence; and 2) not more than three C-BT units for one commercial/industrial unit.*

Aside from when cash-in-lieu is authorized for potable water dedications, the Town will continue to require the dedication of water to supply all new development projects. The Town's current Municipal Code outlines the three alternatives under which water dedication requirements may be satisfied. There are two alternatives for east of I-25 ("1E" and "2E") where potable service is required and one alternative for west of I-25 ("1W") where only raw water service is requested from the Town. Alternatives 2E and 1W both require the construction of a dual water system whereas Alternative 1E is for projects with all demands met with potable supplies. Recommendations related to raw water dedication requirements for Alternatives 2E and 1W are presented below in Section 4.3.

As discussed above in Section 2, it is recommended that the Town plan and budget to prepare an update to its Water Shortage Contingency Plan in 2022 or 2023. After the plan is updated, revisions will need to be integrated into the Municipal Code.

4. RAW WATER ANALYSES & RECOMMENDATIONS

A raw water demand forecast was prepared for irrigated lands to be supplied with the Town's portfolio of irrigation water rights, which includes Lower Boulder Ditch shares, Coal Ridge Ditch shares, and Milavec Reservoir storage rights. The source of supply needed to irrigate a given parcel is dependent on its location and other factors. Unchanged[12] irrigation rights may generally be used on lands lying downgradient from the applicable ditch. Changed irrigation rights are needed on lands located upgradient of the ditch and when lands below the ditch are encumbered by a dry-up restriction.[13] The Town filed a Water Court application in August 2021 to change the use of the majority of its Lower Boulder Ditch shares and also filed a substitute water supply plan (SWSP)

[12] "Unchanged" refers to irrigation water rights that are diverted and used pursuant to their original decree(s). "Changed" refers to water rights that have undergone a change of use in Water Court to allow for new types of use and/or new locations of use not allowed under the original decree.

[13] When irrigation water rights are changed in Water Court, the lands historically irrigated with those water rights are typically required to be removed from irrigation ("dried up").

request in November 2021 to allow for temporary use of a portion of the shares for changed uses starting during the 2022 irrigation season. A summary of use options for the Town's irrigation rights is provided in **Table 3** and displayed graphically on **Figure 11**; however, it should be noted that the representation of changed supplies reflects the Lower Boulder Ditch change case having been finalized.

Table 3: Irrigation Right Use Options.

Raw Water Use Location	Lower Boulder		Coal Ridge	Milavec
	Changed	Unchanged	Unchanged	Unchanged
Inside Historical Ditch Service Area	✓	✓*	✓*	✓*
Outside Historical Ditch Service Area	✓	-	-	-

*Lands must not be encumbered by a dry-up requirement that prohibits the use of the unchanged irrigation supply. We recommend that the Town require developers to provide documentation that no such restrictions exist.

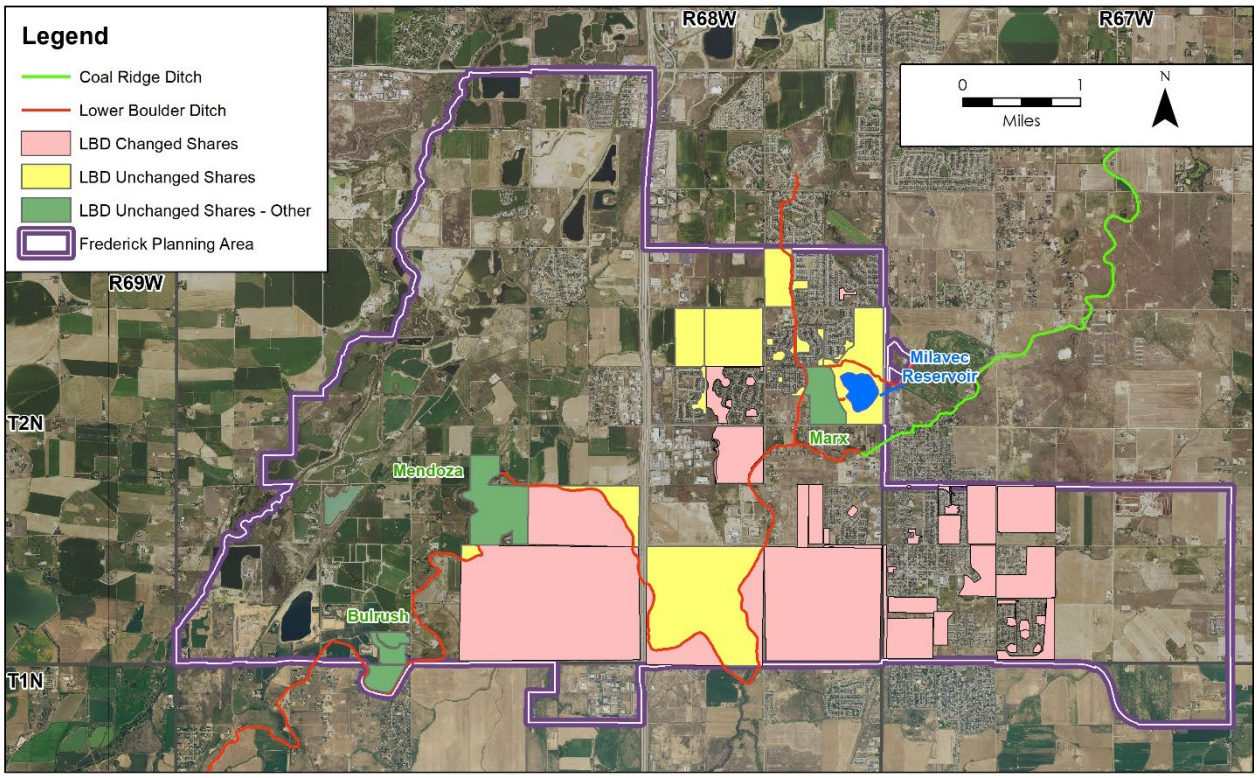

Figure 11: Location of Use Opportunities for Unchanged and Changed LBD Supplies.

4.1 RAW DEMANDS

The baseline irrigation demand for current raw system customers with established landscapes is approximately 250 AFY, and future irrigation demands are projected to be 1,030 AFY at the end of the 10-year planning period (**Figure 12**). Approximately 390 AFY of the projected raw water demands can be supplied using unchanged rights and approximately 640 AFY of demands will require the use of changed Lower Boulder Ditch shares. In addition to the irrigation demands, the Town uses a portion of its unchanged Lower Boulder Ditch shares for maintenance of the Bulrush wetlands and also leases a portion of its shares for agricultural irrigation on the Mendoza and Marx properties; these sites are labeled as "LBD Unchanged Shares – Other" on **Figure 11**. However, we

understand that the leases for agricultural irrigation may be terminated at some point in the future. Recommendations for tracking raw water demands and supplies are presented below in Section 4.3.

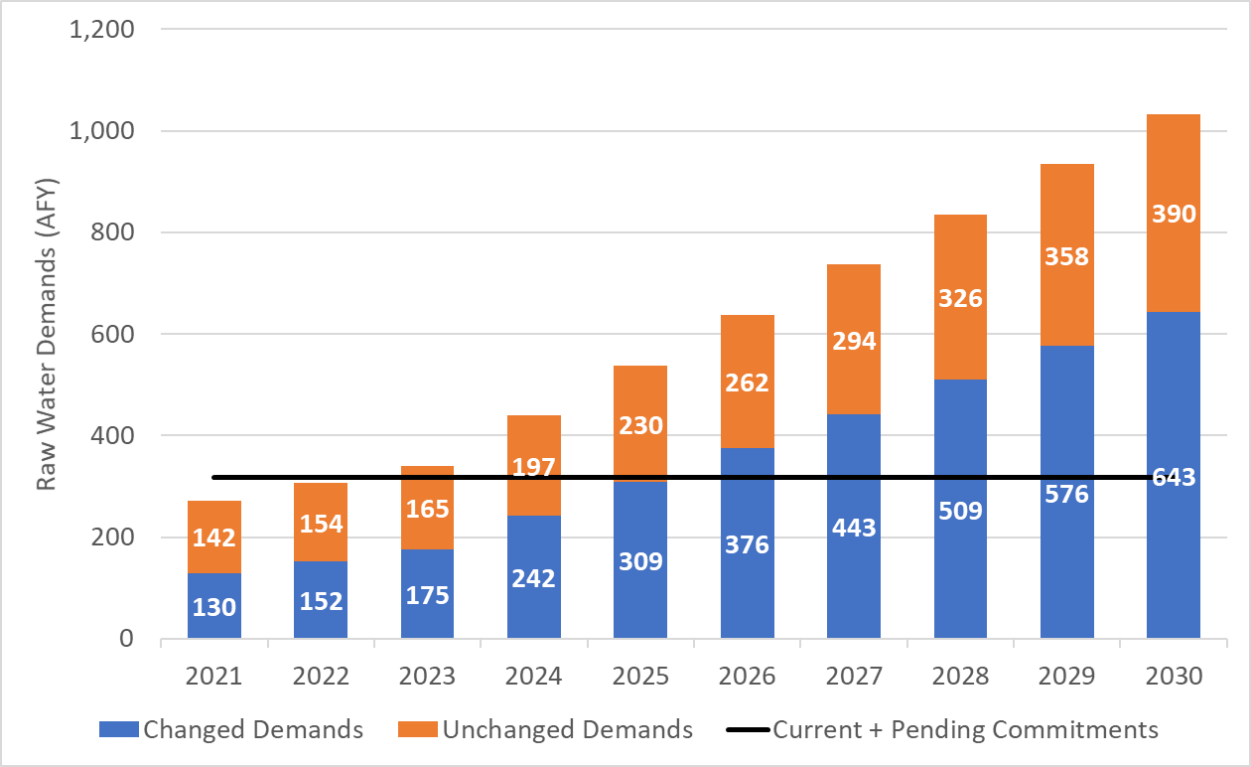

Figure 12: Raw Water Demand Projections.

4.2 RAW SUPPLIES

Following is an overview of raw supplies available from the Town's portfolio of irrigation water rights that includes Lower Boulder Ditch shares, Coal Ridge Ditch shares, and Milavec Reservoir storage.

Lower Boulder Ditch

The Town is the largest shareholder in the Lower Boulder Ditch with 18.4% of total Preferred shares and 22.1% of total Common shares. ELEMENT prepared the technical analyses to support a Water Court application that was filed by the Town in August 2021 to change the use of the majority of its Lower Boulder Ditch shares. Unchanged shares will continue to be available for irrigation use on lands that are within the historical service area and that are not encumbered with dry-up restrictions.

The future supply from the Town's Lower Boulder Ditch shares will be different for changed and unchanged shares. Unchanged shares will be entitled to the same amounts that are made available to other shareholders that take delivery of water for irrigation uses under the ditch; this amount is referred to as the farm headgate delivery (FHG). Conversely, the supply from changed shares will be limited to the historical consumptive use (HCU) of the shares. Estimated average and dry-year yields for the Town's Lower Boulder Ditch shares are summarized in **Table 4**.

Table 4: Estimated Future Supply from Lower Boulder Ditch Shares.

Share Type	Designation	Supply (AFY/share)	
		Average	Dry*
Preferred	Unchanged (FHG)	43.1	27.2
	Changed (HCU)	27.0	17.0
Common	Unchanged (FHG)	8.7	0.2
	Changed (HCU)	5.4	0.1

*Preferred based on the minimum value over study period. Common based on the average of the lowest 3 years in the study period, which equates to the 10th percentile.

A SWSP request was filed in November 2021 to allow for temporary use of a portion of the Town's Lower Boulder Ditch shares for changed uses starting during the 2022 irrigation season. The number of temporarily changed shares available for use under SWSP approvals is expected to increase over time as the Town implements plans to satisfy historical return flow obligations. A raw water planning tool was developed for Town staff to use for tracking the availability of temporarily changed, permanently changed. and unchanged Lower Boulder Ditch shares.

Coal Ridge Ditch

The Town owns 8.0 shares in the Coal Ridge Ditch, representing a 0.4% ownership interest in the company. None of the Coal Ridge Ditch shares were included in the Town's pending change case for the Lower Boulder Ditch shares, so the Town's future supply will be equal to the same amounts that are made available to other shareholders that take delivery of water for irrigation uses under the ditch. Given that all shares will remain unchanged, all future use must occur within the ditch's historical service area. However, very few raw water development projects are anticipated to occur within the Coal Ridge Ditch service area over the 10-year planning period.

Milavec Reservoir

Frederick owns storage rights for Milavec Reservoir, which have been used to provide a portion of historical raw water deliveries. Per the State's records, native diversions into Milavec Reservoir averaged 495 AFY from 2017 – 2020, but diversions in earlier years were as low as 67 AFY. Town staff question the accuracy of the State's records and recently improved the accounting forms to provide better documentation of diversions under the Town's junior and senior rights going forward. Given the uncertainty in available records, for the 10-year planning effort it has been assumed that the Town's Milavec Reservoir storage rights would be used to offset losses associated with the storage of changed Lower Boulder Ditch supplies stored in the reservoir. No dependable yield was attributed to the Milavec Reservoir storage rights for supplying raw demands, but this can be updated in the planning tool when adequate supporting information is available.

4.3 RECOMMENDATIONS

The Town's existing Municipal Code requires that "native" water rights be dedicated to supply raw demands for projects with dual water systems. Native water does not include C-BT units; therefore, other direct flow and/or storage water rights must be dedicated under the current Municipal Code. The Town's current Fee Schedule for Municipal Utilities (Frederick, 2020) specifies the cash-in-lieu fee for raw water dedications; however, this program is not described in the current Municipal Code and has reportedly only been offered in the past at the discretion of the Board of Trustees. Given that the Town is supportive of developers integrating the use of dual water systems to supply raw water for irrigation, the recommendations provided below were prepared with the intent of supporting an

expanded program that allows the Town's surplus raw supplies, when available, to be used for satisfying native dedication requirements.

Raw Recommendation #1 – Track Availability of Surplus Raw Supplies

As described above in Section 4.2, the Town has Lower Boulder Ditch shares that can be used to supply current and future raw water demands. Unchanged shares are currently available to supply irrigation uses. However, shares cannot be used for changed purposes until there is an approved SWSP in place, and the final yield will not be confirmed until the final Water Court decree has been entered, which is unlikely to occur prior to 2025. The number of temporarily changed shares available for use under SWSP approvals is expected to increase over time as the Town develops plans to satisfy return flow maintenance obligations. These considerations highlight the importance for Town to staff track the status of available Lower Boulder Ditch supplies as physical and legal conditions change.

A spreadsheet planning tool was developed for use by Town staff to track the availability of temporarily changed, permanently changed, and unchanged Lower Boulder Ditch supplies over time to determine whether a surplus exists to support a new service commitment. Following is an overview of considerations integrated into the planning tool.

Unchanged Shares

- Unchanged shares are available to be used now, as they do not require an approved SWSP or Water Court decree.
- The Town needs to reserve a portion of its unchanged shares to supply properties that will be converted from potable use to raw water use. The estimated irrigation demand for these uses will be approximately 40 AFY at full conversion.
- The Town also needs to reserve a portion of its unchanged supply for maintenance of the Bulrush wetlands and leases for agricultural irrigation on the Mendoza and Marx properties, to the extent these are extended in the future. The planning tool has input cells that allow Town staff to vary the number of shares being reserved for these uses as conditions change.
- Unchanged supplies not needed for the above uses may be made available to support new development for which irrigation use would occur downgradient of the ditch. The planning tool has been configured to assess supply availability based on the dry-year yields presented in **Table 4** to ensure that raw water demands do not exceed the available supply.

Shares for Changed Uses

- Shares cannot be used for changed purposes until an approved SWSP is in place or the Water Court decree has been finalized. It is expected that the initial SWSP approval will be obtained in advance of the 2022 irrigation season; however, the permanent change of use is unlikely to be decreed prior to 2025.
- The number of shares available for changed uses will increase over time as the Town implements plans to satisfy historical return flow obligations.
- The Town needs to reserve a portion of its changed shares to supply properties that will be converted from potable use to raw water use. The estimated irrigation demand for these uses will be approximately 50 AFY at full conversion.
- Changed supplies may be made available to support new development if there is a projected surplus in supply. The planning tool has been configured to assess supply availability based on the dry-year yields presented in **Table 4** to ensure that raw demands do not exceed the available supply. Additionally, the planning tool has been configured to assume a lower dry-

year yield while the Town is operating under a SWSP, as the dependable yield cannot be finalized until the final Water Court decree has been entered.

An illustrative example depicting the projected raw demands for changed supplies versus the potential availability of changed supplies is presented on **Figure 13**. The raw demands for changed supplies are consistent with what was presented above in Section 4.1. The changed supplies that are depicted are based on assumptions for preliminary planning and the further assumption that all changed shares will be available for use starting in 2025. This is merely for illustrative purposes, and the actual changed supply available will need to be regularly evaluated using the planning tool as conditions change.

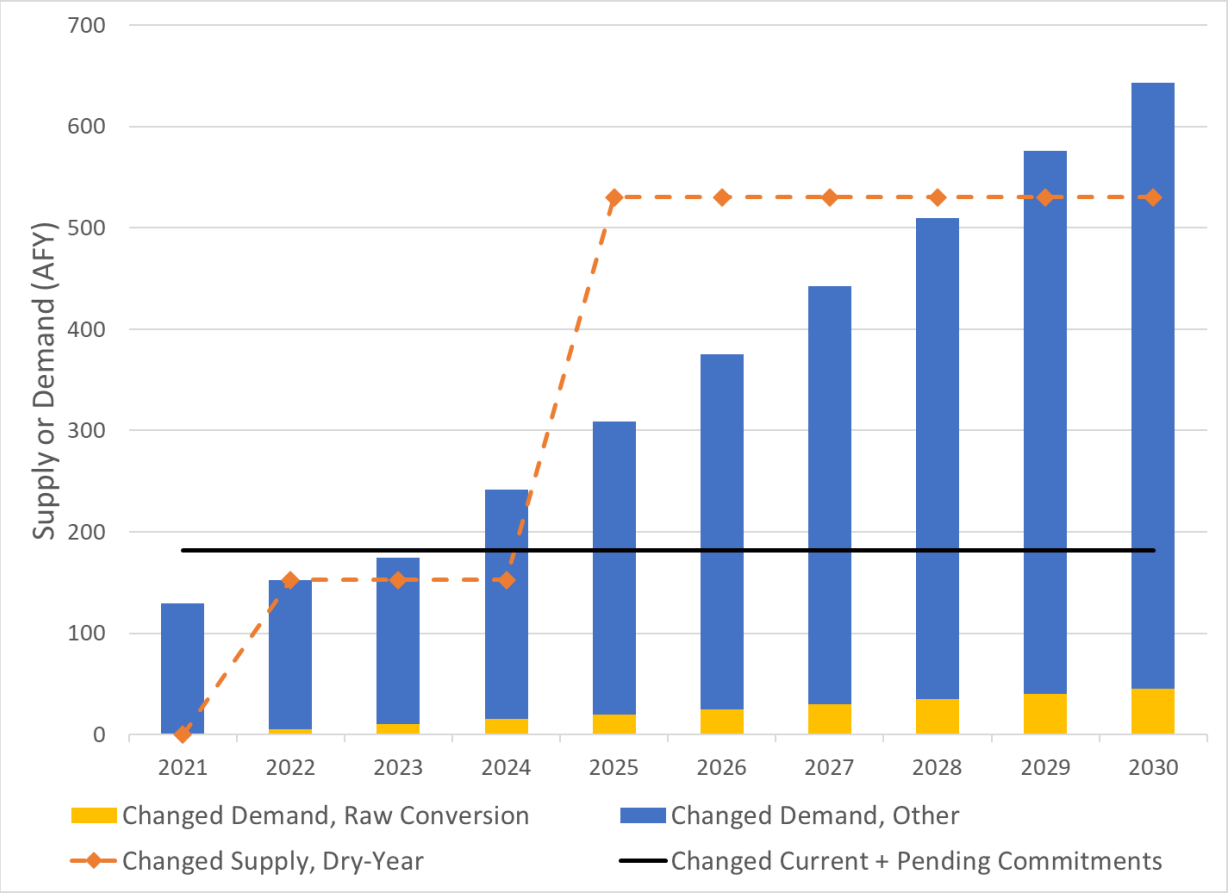

Figure 13: Illustrative Example of Changed Raw Demands versus Potential Changed Supplies.

Raw Recommendation #2 – Municipal Code Revisions

The Town's current Municipal Code describes the cash-in-lieu program for potable dedications; however, no details are provided about cash-in-lieu of raw water dedications. Municipal Code updates are needed to outline the program under which surplus raw supplies will be made available to satisfy native water dedication requirements when there is a dual water system. As described above, the surplus availability will vary annually because the Town has a finite supply of irrigation ditch rights, and conditions will change over time as the Town implements plans to use shares for changed uses. Town staff will regularly evaluate conditions using the raw water planning tool.

The Town is working with its legal counsel to evaluate the preferred approach for making surplus raw water supplies available to satisfy native dedication requirements when there is a dual water system. One alternative is to offer a cash-in-lieu program similar to what is available for potable dedications with an annual cap and constraints on the types of allowed uses (see Section 3.4.5). Another alternative is to allow native water dedication requirements to be satisfied by the developer providing payment for "water credits" that are made available to developers through a competitive bidding process and limited to use at locations approved in the decrees for the underlying water rights (e.g., not available for re-sale for use outside of the Town's service area). Town staff will work with the Board of Trustees to select the preferred approach in early 2022, and then specific Municipal Code updates will be prepared.

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APPENDIX A

Planning-Level Costs for Potable Alternatives

Attachment A. Planning-Level Costs for Potable Alternatives

Alternative #1 - Purchase Additional C-BT to eliminate entire shortage

			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Supply Increase	CBT	Additional Units Needed (#)	-	-	6	46	49	51	142	148	150	153	745
		Estimated Cost	$ -	$ -	$ 410,000	$ 3,210,000	$ 3,500,000	$ 3,730,000	$ 10,630,000	$ 11,350,000	$ 11,770,000	$ 12,290,000	$ 56,890,000
	Purchase of 1 Addtl Windy Gap Unit		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Demand Reduction	Potable-to-Raw Conversions		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Outdoor Conservation		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Estimated Cost			**$ -**	**$ -**	**$ 410,000**	**$ 3,210,000**	**$ 3,500,000**	**$ 3,730,000**	**$ 10,630,000**	**$ 11,350,000**	**$ 11,770,000**	**$ 12,290,000**	**$ 56,890,000**

Alternative #2 - Potable Conversions, then Purchase Additional C-BT to eliminate shortage balance.

			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Supply Increase	CBT	Additional Units Needed (#)	-	-	-	-	30	33	124	130	133	136	586
		Estimated Cost	$ -	$ -	$ -	$ -	$ 2,150,000	$ 2,420,000	$ 9,290,000	$ 9,970,000	$ 10,440,000	$ 10,930,000	$ 45,200,000
	Purchase of 1 Addtl Windy Gap Unit		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Demand Reduction	Potable-to-Raw Conversions		$ -	$ 430,000	$ 440,000	$ 450,000	$ 460,000	$ 470,000	$ 480,000	$ 500,000	$ 510,000	$ 520,000	$ 4,260,000
	Outdoor Conservation		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Estimated Cost			**$ -**	**$ 430,000**	**$ 440,000**	**$ 450,000**	**$ 2,610,000**	**$ 2,890,000**	**$ 9,770,000**	**$ 10,470,000**	**$ 10,950,000**	**$ 11,450,000**	**$ 49,460,000**

Notes

- Cost information is based on conceptual projects and needs to be updated if the project advances beyond conceptual level, as engineering, permitting, and construction-related information becomes available.
- Cost information reflects only acquisition and/or initial project implementation costs. Operation, maintenance, and replacement (OM&R) costs will need to be evaluated if a project advances beyond conceptual level.
- C-BT acquisition cost based on $65,0000/unit in 2021 and then escalated at 2.38% per year based on average Consumers Price Index (CPI) for Denver-Aurora-Lakewood from 2012 - 2020. Does not include any broker fees. It is recommended that the Town proceed with purchasing up to 357 C-BT units earlier in the planning period as funding permits and as opportunities arise given that C-BT costs are likely to continue increasing
- Acquisition cost for additional 1.0 Windy Gap unit based on purchase price for 7.0 units acquired in 2018 and then escalated based on actual or average CPI, then rounded to $3.0 million/unit. Illustrated to be purchased in 2026 due to uncertainty.
- Implementation cost for potable-to-raw conversion project is based on information in the 2008 Raw Water Infrastructure Master Plan to construct Systems B, E, and F, then escalated based on actual or average CPI. Infrastructure design consulting fees are not included.
- Implementation costs for outdoor conservation based on a review of six recent Water Efficiency Plans published by Colorado Front Range utilities and include a combination of program and infrastructure costs. However, the implementation of certain types of water loss control projects could far exceed these costs and are not accounted for in this plan.

Alternative #3 - Potable Conversions, Purchase Additional WG unit, then Purchase Additional C-BT to eliminate shortage balance.

			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Supply Increase	CBT	Additional Units Needed (#)	-	-	-	-	30	-	94	130	133	135	522
		Estimated Cost	$ -	$ -	$ -	$ -	$ 2,150,000	$ -	$ 7,040,000	$ 9,970,000	$ 10,440,000	$ 10,850,000	$ 40,450,000
	Purchase of 1 Addtl Windy Gap Unit		$ -	$ -	$ -	$ -	$ -	$ 3,000,000	$ -	$ -	$ -	$ -	$ 3,000,000
Demand Reduction	Potable-to-Raw Conversions		$ -	$ 430,000	$ 440,000	$ 450,000	$ 460,000	$ 470,000	$ 480,000	$ 500,000	$ 510,000	$ 520,000	$ 4,260,000
	Outdoor Conservation		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Estimated Cost			**$ -**	**$ 430,000**	**$ 440,000**	**$ 450,000**	**$ 2,610,000**	**$ 3,470,000**	**$ 7,520,000**	**$ 10,470,000**	**$ 10,950,000**	**$ 11,370,000**	**$ 47,710,000**

Alternative #4 - Potable Conversions, 5% Outdoor Conservation, then Purchase Additional C-BT to eliminate shortage balance.

			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Supply Increase	CBT	Additional Units Needed (#)	-	-	-	-	-	12	102	102	102	102	420
		Estimated Cost	$ -	$ -	$ -	$ -	$ -	$ 880,000	$ 7,640,000	$ 7,820,000	$ 8,010,000	$ 8,200,000	$ 32,550,000
	Purchase of 1 Addtl Windy Gap Unit		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Demand Reduction	Potable-to-Raw Conversions		$ -	$ 430,000	$ 440,000	$ 450,000	$ 460,000	$ 470,000	$ 480,000	$ 500,000	$ 510,000	$ 520,000	$ 4,260,000
	Outdoor Conservation		$ -	$ 200,000	$ 450,000	$ 470,000	$ 480,000	$ 490,000	$ 500,000	$ 510,000	$ 520,000	$ 540,000	$ 4,160,000
Estimated Cost			**$ -**	**$ 630,000**	**$ 890,000**	**$ 920,000**	**$ 940,000**	**$ 1,840,000**	**$ 8,620,000**	**$ 8,830,000**	**$ 9,040,000**	**$ 9,260,000**	**$ 40,970,000**

Notes

- Cost information is based on conceptual projects and needs to be updated if the project advances beyond conceptual level, as engineering, permitting, and construction-related information becomes available.
- Cost information reflects only acquisition and/or initial project implementation costs. Operation, maintenance, and replacement (OM&R) costs will need to be evaluated if a project advances beyond conceptual level.
- C-BT acquisition cost based on $65,0000/unit in 2021 and then escalated at 2.38% per year based on average Consumers Price Index (CPI) for Denver-Aurora-Lakewood from 2012 - 2020. Does not include any broker fees. It is recommended that the Town proceed with purchasing up to 357 C-BT units earlier in the planning period as funding permits and as opportunities arise given that C-BT costs are likely to continue increasing
- Acquisition cost for additional 1.0 Windy Gap unit based on purchase price for 7.0 units acquired in 2018 and then escalated based on actual or average CPI, then rounded to $3.0 million/unit. Illustrated to be purchased in 2026 due to uncertainty.
- Implementation cost for potable-to-raw conversion project is based on information in the 2008 Raw Water Infrastructure Master Plan to construct Systems B, E, and F, then escalated based on actual or average CPI. Infrastructure design consulting fees are not included.
- Implementation costs for outdoor conservation based on a review of six recent Water Efficiency Plans published by Colorado Front Range utilities and include a combination of program and infrastructure costs. However, the implementation of certain types of water loss control projects could far exceed these costs and are not accounted for in this plan.

Alternative #5 - Potable Conversions, Purchase Additional WG unit, 5% Outdoor Conservation, then Purchase Additional C-BT to eliminate shortage balance.

			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Supply Increase	CBT	Additional Units Needed (#)	-	-	-	-	-	-	51	102	102	102	357
		Estimated Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,820,000	$ 7,820,000	$ 8,010,000	$ 8,200,000	$ 27,850,000
	Purchase of 1 Addtl Windy Gap Unit		$ -	$ -	$ -	$ -	$ -	$ 3,000,000	$ -	$ -	$ -	$ -	$ 3,000,000
Demand Reduction	Potable-to-Raw Conversions		$ -	$ 430,000	$ 440,000	$ 450,000	$ 460,000	$ 470,000	$ 480,000	$ 500,000	$ 510,000	$ 520,000	$ 4,260,000
	Outdoor Conservation		$ -	$ 200,000	$ 450,000	$ 470,000	$ 480,000	$ 490,000	$ 500,000	$ 510,000	$ 520,000	$ 540,000	$ 4,160,000
Estimated Cost			**$ -**	**$ 630,000**	**$ 890,000**	**$ 920,000**	**$ 940,000**	**$ 3,960,000**	**$ 4,800,000**	**$ 8,830,000**	**$ 9,040,000**	**$ 9,260,000**	**$ 39,270,000**

Notes

- Cost information is based on conceptual projects and needs to be updated if the project advances beyond conceptual level, as engineering, permitting, and construction-related information becomes available.
- Cost information reflects only acquisition and/or initial project implementation costs. Operation, maintenance, and replacement (OM&R) costs will need to be evaluated if a project advances beyond conceptual level.
- C-BT acquisition cost based on $65,0000/unit in 2021 and then escalated at 2.38% per year based on average Consumers Price Index (CPI) for Denver-Aurora-Lakewood from 2012 - 2020. Does not include any broker fees. It is recommended that the Town proceed with purchasing up to 357 C-BT units earlier in the planning period as funding permits and as opportunities arise given that C-BT costs are likely to continue increasing
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