TOWN OF FREDERICK

Non-Potable Water Infrastructure Master Plan

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ACRONYMS

AF, AC-FT	acre-feet
AFY	acre-feet per year
ALT	alternative
AVG	average
C-BT	Colorado-Big Thompson
CCF	hundred cubic feet
CDPHE	Colorado Department of Public Health and Environment
CFS	cubic feet per second
CIP	Capital Improvements Plan
CR	County Road
CWCB	Colorado Water Conservation Board
CWCWD	Central Weld County Water District
EDU	equivalent dwelling unit
FT-MSL	feet, mean sea level
GAL	gallons
GPCD	gallons per capita per day
GPD	gallons per day
GPM	gallons per minute
HP	horsepower
KGAL	one thousand gallons
LHWD	Left Hand Water District
LTWRP	Long-Term Water Resources Plan
MP	Master Plan
MG	million gallons
MGD	million gallons per day
NPW	non-potable water
PS	Pump Station
PSI	pounds per square inch
SFE	single family equivalent
SH	State Highway
WEP	Water Efficiency Plan
WTP	water treatment plant

EXECUTIVE SUMMARY

Frederick is experiencing rapid growth, highlighting the importance of strategic water planning to provide reliable and sustainable infrastructure. Non-Potable Water (NPW) is important to reduce demand for potable water, especially during irrigation season when water demands are at their peak.

Consistent with Frederick's goals for Strategic, Reliable & Sustainable Infrastructure, this Non-Potable Water Infrastructure Master Plan:

1. Develops a plan to reduce dependency on potable water to irrigate parks and open spaces, and instead utilize NPW.
2. Outlines a vision to expand the NPW system for irrigation of parks and open spaces constructed for future development.
3. Provides recommendations consistent with guidance included in previously completed Town water plans, the recent Comprehensive Plan Update, and pending revisions to the landscaping requirements in the Town's Land Use Code.
4. Documents a Capital Improvements Plan to improve reliability and sustainability for the NPW system.

Crist Park

Current Non-Potable Water System

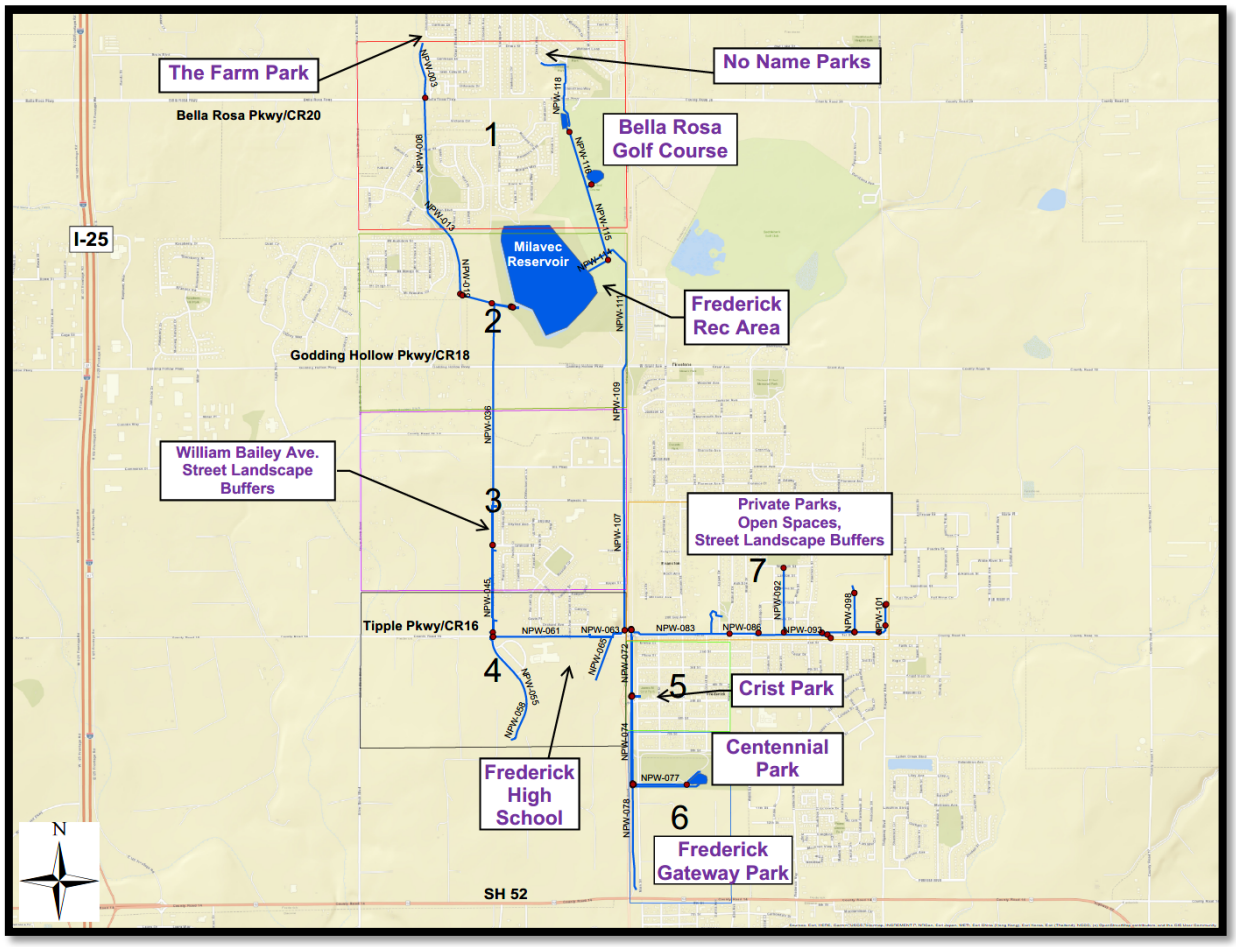
Frederick's current non-potable water service area is east of Interstate 25 as shown in Figure 1. Frederick's non-potable water infrastructure conveys water to selected lands on the east side of Interstate 25, including Bella Rosa Golf Course, Frederick High School, Frederick Recreation Area, Centennial Park, and other properties shown in Figure 1.

The Bulrush Wetlands Park on the west side of I-25 receives water directly from the Lower Boulder Ditch and has no NPW infrastructure. Frederick is currently working with the Wyndham Hill residential development, also located west of I-25, to construct a diversion on the Lower Boulder Ditch to utilize the Town's ditch shares for irrigation of Wyndham Hill's parks and open spaces.

Frederick holds shares in the Lower Boulder Ditch, which can supply water to Milavec Reservoir from Boulder Creek. From Milavec Reservoir, the Town's infrastructure conveys NPW through gravity and pumped transmission pipes. Milavec Reservoir is the Town's

current NPW source, although diversions directly from the Lower Boulder Ditch are recommended where practical for future expansion of the NPW system.

Figure 1 – Current Non-Potable Water System, Town of Frederick



Infrastructure Condition Assessment

This Master Plan includes an assessment of the existing NPW infrastructure. Most of the infrastructure is in good condition with many years of remaining useful life. The only NPW line replacement recommended for the short-term planning period is the 8-inch pipeline along Colorado Boulevard, between the East Milavec Pump Station and Tipple Parkway. Upgrades to the East Milavec Pump Station and Centennial Park Pump House are also recommended to improve redundancy and increase capacity to meet future estimated NPW demands.

Public Engagement for Master Plan

Milavec Reservoir

The public outreach for this Non-Potable Water Infrastructure Master Plan was primarily through an on-line survey. The input received from the survey is incorporated into the Master Plan approaches and recommendations, and addressed as follows:

Topic	How Topic is Addressed in Master Plan
Utilize NPW for irrigation	Recommends expanding NPW system to irrigate existing and future parks and open spaces.
Water Quality	Recommends continuing efforts to improve water quality at Milavec Reservoir, and recommends filtration be added at the Centennial Pump Station.
Affordability of water	NPW infrastructure for parks and open spaces in future developments are recommended to be paid for by the developers.
Low-water landscaping	Master Plan irrigation demand estimates are based on using more native grasses and low-water use landscaping for future parks and open spaces.

Future NPW Service Area

The Town's existing NPW infrastructure is east of I-25, allowing cost-effective expansion to irrigate properties east of the interstate. The Lower Boulder Ditch and other creeks and ditches flow through the west side of I-25, providing opportunities for direct connections for irrigation of existing and future parks and open spaces west of the interstate. Lower irrigation demands are also generally expected west of I-25 due to the floodplains, agricultural and low-density residential land uses, and commercial zoning along the I-25 west frontage road.

West of I-25, several properties, including Wyndham Hill and the Town's Mendoza Open Space, are positioned for direct connections to irrigation ditches. See Figure 2.

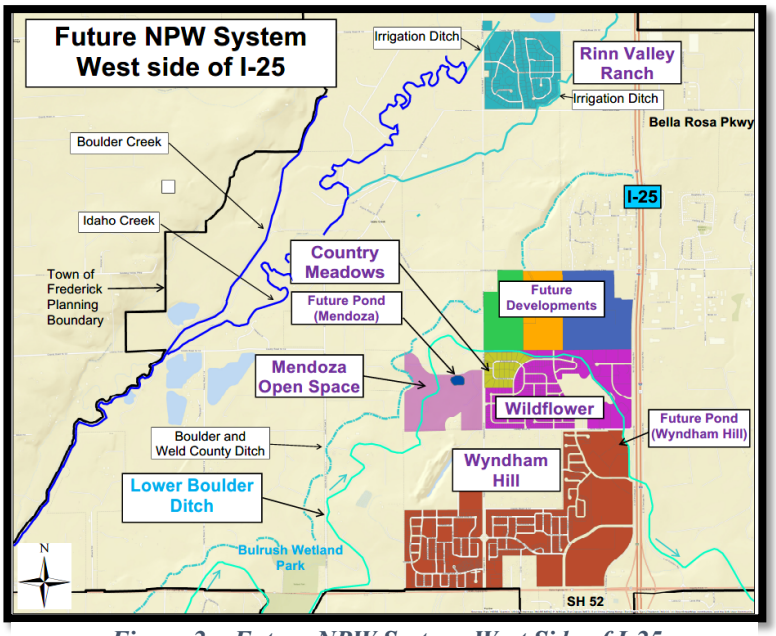


Figure 2 – Future NPW System, West Side of I-25

On the east side of I-25, the priority for expansion of the NPW system is to irrigate parks and open spaces that are currently being irrigated with potable water. As other properties and associated parks and open spaces are developed throughout the Town's Planning Area, ideally NPW will be extended to these areas to further preserve Frederick's potable water.

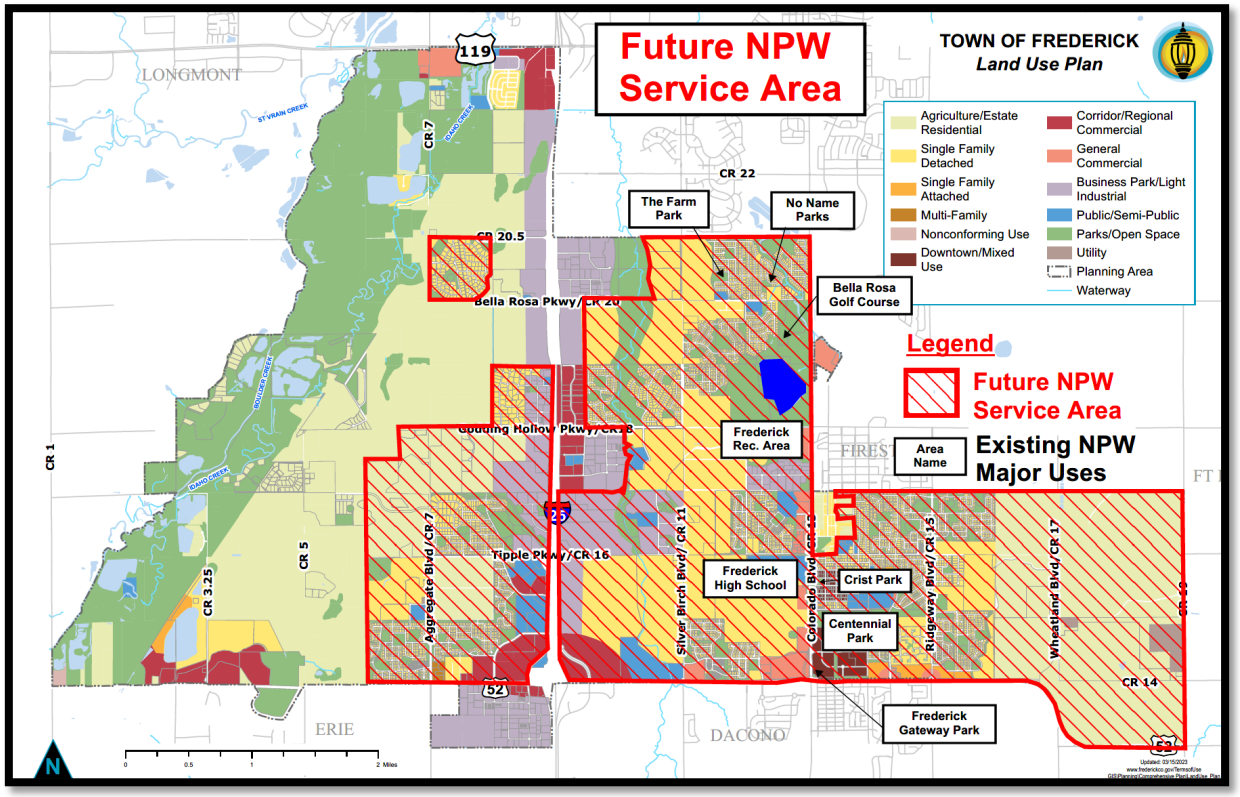
The Town has plans for the 25/52 Subarea East to be a 600-acre multi-use development northeast of the I-25/State Highway 52 interchange. The Lower Boulder Ditch flows through this property, as well as the Nelson Farm property, and these two areas are expected to connect directly to the Lower Boulder Ditch for irrigation water.

Larger areas for expansion of the NPW infrastructure include the southeast area of the Town Planning Area to Weld County Road (WCR) 19, and west of Milavec Reservoir along Godding Hollow Parkway (WCR 18). The Town's recently completed Comprehensive Plan Update results in denser development through more multi-family residential development. The Town also is implementing new population-based methods to calculate required areas for parks and open spaces, and this was referenced to estimate NPW irrigation demands using the modified land uses.

To minimize financial burden to existing Town customers, NPW improvements needed for future development are recommended to be funded by the developers.

Figure 3 below shows the future expected Frederick NPW service area through buildout of the Planning Area on both sides of I-25. Buildout is anticipated to occur around 2070.

Figure 3 – Future NPW Service Area, Town of Frederick



Projected Non-Potable Water Demands

Table 1 below provides a summary of the current and estimated short-term and long-term NPW irrigation demands for parks and open spaces, through build-out of the Frederick planning area. The estimated build-out demand is approximately 2,116 AFY, which is slightly higher than the 1,960 AFY projected in Frederick's Long-Term Water Resources Plan (LTWRP).

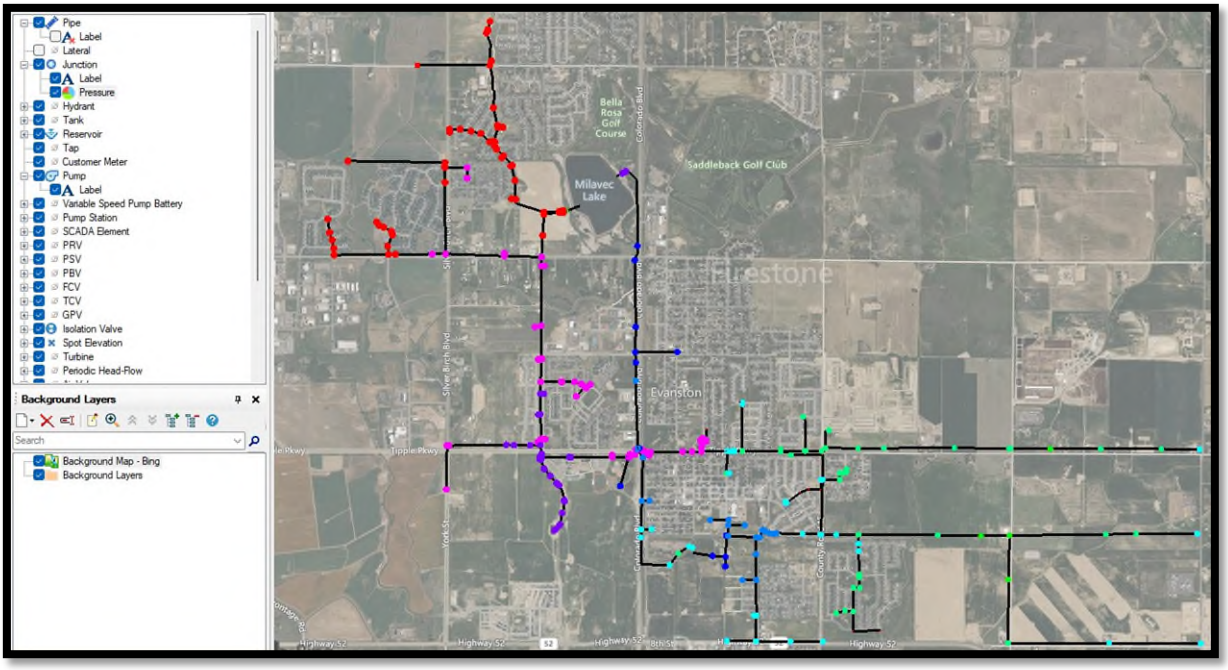
Table 1 - NPW Irrigation Demands Summary

Description	Est. NPW Demand (AFY)
Existing NPW System	452
Short-Term Future Demand	143
Future Build-out, East of I25	1,161
Future Build-out, West of I25	360
Total	**2,116**

Hydraulic Model

A hydraulic model was developed to size and locate infrastructure for the future service area. The model can be updated, as development or Town zoning designations change, to confirm NPW infrastructure is planned and designed to accommodate future development.

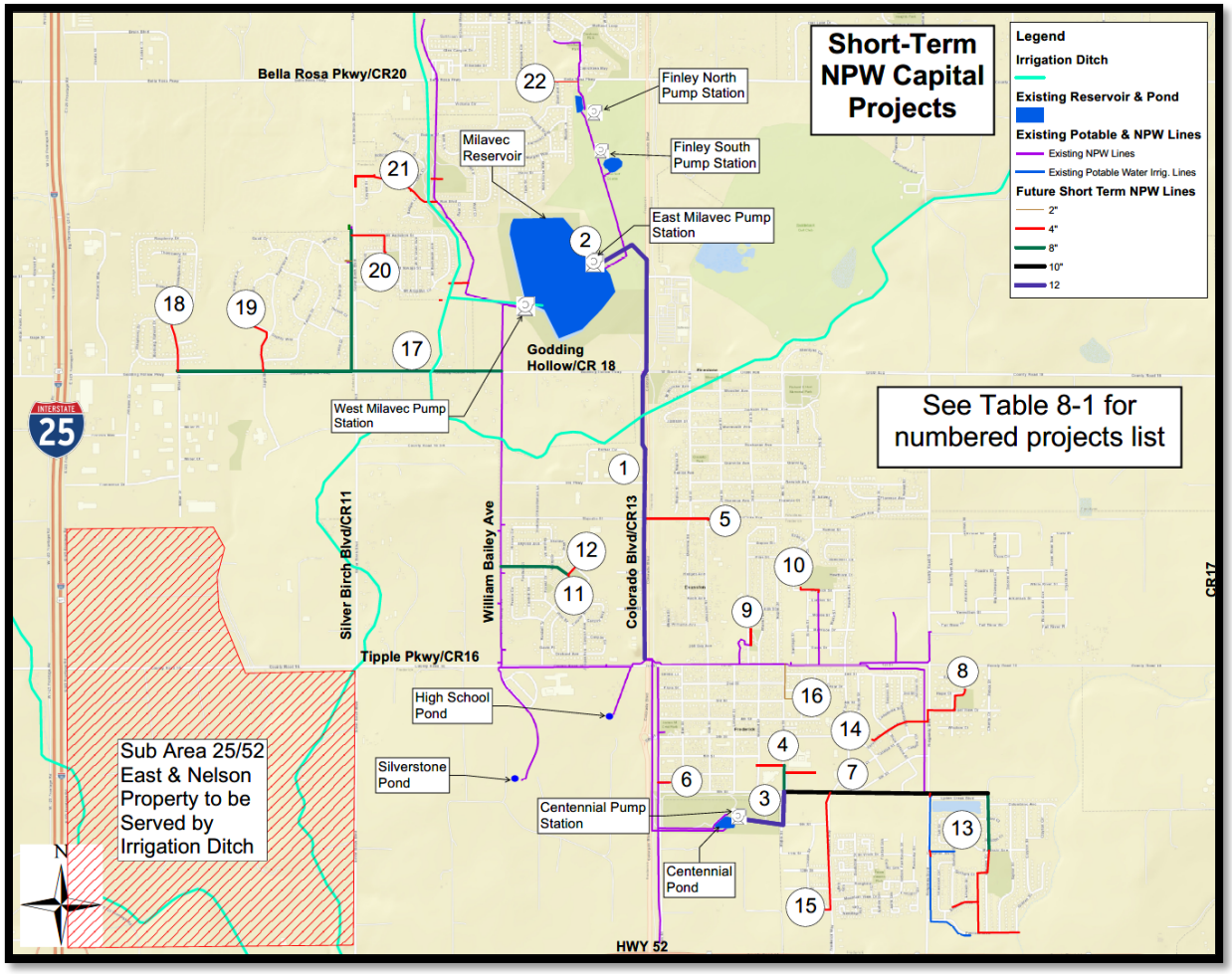
Frederick Non-potable Water System, Buildout Conditions Hydraulic Model Screenshot



Short-Term Capital Improvements Plan

To achieve the Town's goal to irrigate additional existing parks and open spaces with NPW instead of potable water, a Short-Term Capital Improvements Plan (CIP) was developed to expand NPW to irrigate existing parks and open spaces. There were 22 Short-Term Capital projects identified as shown in Figure 3.

Figure 3 – Short-Term NPW Capital Projects



In collaboration with Town Engineering staff, the 22 projects were divided into four tiers based generally on location and priority. Opinions of Probable Cost were developed for each project, for a total of $18.625 million to deliver an estimated 143.2 AFY of NPW to irrigate parks and open spaces. Please refer to Table 8-1 in Section 8 of this Master Plan for a list of the 22 projects corresponding by number to the map shown in Figure 3.

Table 2 provides a summary of the estimated costs and NPW demands. The timing of the Short-Term Improvements will be dependent on availability of funding.

Table 2 - Short-Term Capital Improvements
Total Estimated Costs and NPW Demands

Project Group	Preliminary Opinion of Probable Cost	NPW Demand (AFY)
Tier 1 Projects	$7,359,000	25.4
Tier 2 Projects	$2,840,000	41.0
Tier 3 Projects	$3,124,000	33.7
Tier 4 Projects	$5,302,000	43.1
TOTAL	**$18,625,000**	**143.2**

Development will drive the timing of other recommended future infrastructure through buildout of the planning area. Town planning and engineering staff will be able to utilize the information in this Master Plan to require that developers construct NPW lines as shown, and adequately sized to sustain future development.

Cost Comparison to C-BT Units

To determine the cost-effectiveness of the Short-Term NPW Improvements projects, the estimated project costs are compared to the cost of purchasing Colorado-Big Thompson (C-BT) water units, which is the Town's primary potable water supply. The current cost of one C-BT unit is approximately $70,000, and is equivalent to 0.6 AF. The estimated 143.2 AFY is equivalent to 238.67 C-BT units, which has a value of $16,706,900 at the current C-BT cost. However, this value of C-BT units will likely increase over time due to inflation.

The first two Tier 1 projects are the replacement of the existing NPW pipeline along Colorado Boulevard, and upgrades to the East Milavec Pump Station. These are essentially maintenance projects that could be excluded from the C-BT cost comparison. The combined estimated cost of these two projects is $4.05 million. Therefore, when these two projects are excluded from the cost comparison the total estimated costs decrease to $14,575,000, which is less than the $16,706,900 value of the equivalent C-BT units. There is also the potential for a portion of the Centennial Park Pump Station Upgrade (Project No. 3) to be funded by the developer of Miner's Park Town Centre, which would further reduce the Town's costs for the projects.

It is also noted that 6 of the 22 projects are estimated to cost greater than the current $70,000 per C-BT unit cost. From this C-BT cost comparison perspective, these 6 projects are not considered to be cost-effective on an individual project basis. The Town may wish to consider alternatives to constructing these NPW line extensions, such as turf replacement or xeriscape landscaping modifications at the parks and open spaces to reduce or eliminate potable water usage. See Section 9 of this Master Plan for additional details.

Future Development Reviews

Future NPW infrastructure recommended and shown in this Master Plan is intended to provide minimum requirements to aid the Town in development reviews. Except where otherwise explicitly agreed by the Town, it is the responsibility of developers to design and construct the necessary NPW infrastructure based on the most recent available information at the time of development, and in accordance with all Town of Frederick policies, guidelines, codes, rules, and regulations.

Coal Ridge Park

It is further noted Town Engineering staff directed this Master Plan be based on developers constructing irrigation ponds and associated pump houses to irrigate future parks and open spaces. This reduces the peak NPW demand on the Town's system. Therefore, Town staff should require each development to provide the necessary irrigation ponds to provide water storage and reduce peak NPW demands supplied by the Town.

Future Master Plan Updates

It is recommended that this Master Plan be updated every five to seven years to confirm recommendations, budget costs and project schedules.

1.0 INTRODUCTION

1.1 Overview

The Town of Frederick straddles the Interstate 25 corridor in southern Weld County, approximately 25 miles north of Denver and 10 miles northeast of Boulder, as shown in Figure 1.1. Milavec Reservoir is a 60-acre lake on the east side of I-25 and is the primary storage site for the Town's Non-Potable water (NPW), also referred to as "raw" water. Boulder Creek supplies water to Milavec Reservoir via the Lower Boulder Ditch. Frederick's NPW system provides irrigation to some parks and open spaces on the east side of Interstate 25, including the Frederick Recreation Area and Centennial Park. The NPW system also irrigates the Town-owned Bella Rosa Golf Course with water from Milavec Reservoir. Frederick's Bulrush Wetlands Park, west of I-25, utilizes water directly from the Lower Boulder Ditch.

Figure 1.1 Location Map, Town of Frederick

1.2 Master Plan Goals

Frederick is experiencing rapid growth, highlighting the importance of strategic water planning to provide reliable and sustainable infrastructure. Non-Potable Water (NPW) is important to the Town's water portfolio because it reduces demand for potable water, especially during irrigation season when water demands are at their peak. Existing irrigation ditches, Milavec Reservoir, and other smaller ponds position Frederick to expand their existing NPW infrastructure.

Bella Rosa Golf Course, Finley South Pond

With more development on the horizon, the Town selected Forsgren Associates Inc. (Forsgren) to prepare this Non-Potable Water Infrastructure Master Plan (MP) to maximize the use of NPW to irrigate current and future parks and open spaces. Through an effective NPW system, the Town can preserve limited water resources to achieve long-term drinking water reliability and sustainability by reducing use of potable water for irrigation.

This MP is informed by the Town's 10-year and Long-Term Water Resources Plans and is consistent with these and other water-related studies, including the recently completed Potable Water Infrastructure Master Plan. This MP focuses on the Town's NPW infrastructure; it does not include evaluation of water supplies or water rights, which are evaluated in-depth in other Town studies. Specifically, the goals of this MPlan are to:

1. Improve NPW irrigation service to current and future users
2. Outline a vision for the "buildout" NPW system
3. Evaluate reliability and sustainability of infrastructure
4. Recommend and prioritize short-term and long-term infrastructure improvements
5. Develop estimates of project costs for recommended short-term improvements
6. Be consistent with guidance included in previous water plans, as well as Frederick's Comprehensive Plan Update, and pending Land Use Code revisions.

In achieving the goals stated above, this Plan is also consistent with Frederick's small-town, livable community character through improved irrigation of parks and open spaces.

1.3 Coordination with Comprehensive Plan Update

The Town recently completed an update to its Comprehensive Plan to guide future development, infrastructure and amenities. Non-potable water is an important resource to enhancing the livelihood of Frederick as laid out in the Comprehensive Plan's vision.

Public feedback on the Comprehensive Plan update indicates citizens would like to see more amenities and recreational opportunities while preserving Frederick's small-town character.

Forsgren collaborated with Town staff and the Comprehensive Plan consultant to include NPW issues in the Comprehensive Plan public outreaches as described in Section 3.

The Comprehensive Plan Update includes Land Use Plan recommendations to increase multi-family residential development. This increasing development density is considered for the estimates for future parks and open space areas, and associated irrigation demands.

2.0 INFRASTRUCTURE CONDITION ASSESSMENT

2.1 Existing Non-Potable Water Infrastructure

Frederick's NPW infrastructure conveys water to selected lands on the east side of Interstate 25. The Bulrush Wetlands Park on the west side of I-25 receives water directly from the Lower Boulder Ditch and has no NPW infrastructure. Frederick is currently working with the Wyndam Hill residential development, also located west of I-25, to construct a diversion on the Lower Boulder Ditch to utilize the Town's ditch shares for irrigation of Wyndam Hill's parks and open spaces.

Frederick holds shares in the Lower Boulder Ditch, which supplies water to Milavec Reservoir. From Milavec, the Town's infrastructure conveys NPW through a combination of gravity and pumped transmission pipes. Milavec Reservoir is the Town's main NPW source, although diversions directly from the Lower Boulder Ditch are recommended where practical for future expansion of the NPW system.

Milavec Reservoir

The Town's NPW infrastructure includes:

- Milavec Reservoir
- East pump station at Milavec Reservoir and transmission pipes to convey NPW to Town-owned parks and open spaces.
- West pump station at Milavec Reservoir and transmission pipes. This pump station primarily conveys NPW to privately owned parks and open spaces, but also to Frederick High School, and the Town-owned skate park at the Frederick Recreation Area.
- Gravity pipeline from Milavec Reservoir to two ponds at Bella Rosa Golf Course (Finley North Pond & Finley South Pond).
- Irrigation pump houses at Centennial Park, Finley North Pond & Finley South Pond.

This Master Plan does not include evaluation of irrigation piping and irrigation application systems supplied from Town-owned pump houses. These systems are maintained by the Frederick Parks and Open Space Department and are being evaluated in a separate report. Evaluation of existing irrigation infrastructure not owned by the Town is also beyond the scope of this study. This includes privately owned systems and Frederick High School's system owned by St. Vrain Valley School District.

Town-owned parks and open spaces that are irrigated with NPW include:

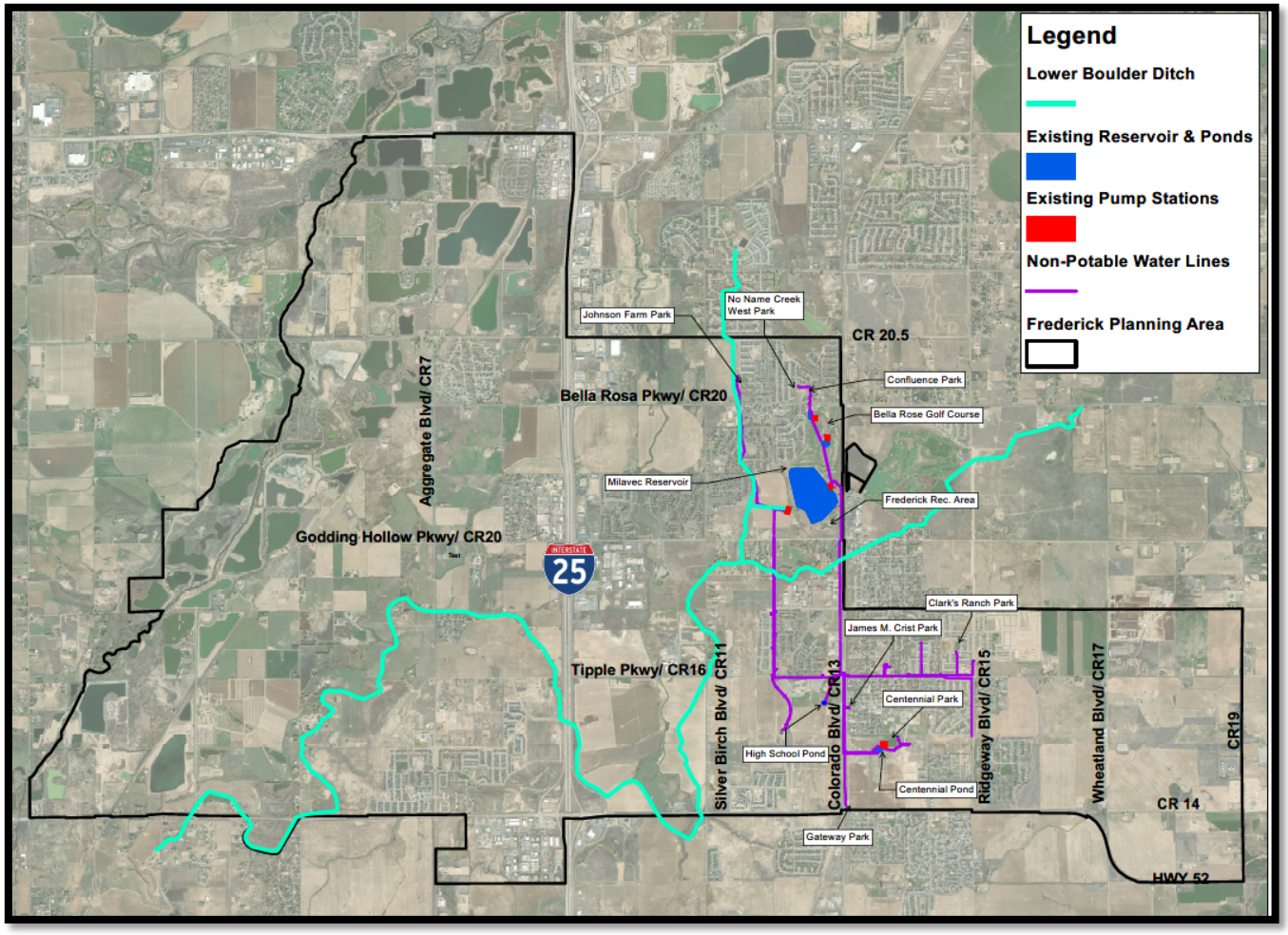
- Frederick Recreation Area (FRA)
- Centennial Park
- James M. Crist Park
- Frederick Gateway Park
- Johnson Farm Park
- No Name Parks

Non-Town parks, open spaces, and street rights-of-way irrigated with NPW include:

- Frederick High School
- St. Brigit Church open space
- Maple Ridge II open space and adjacent Tipple Parkway landscape buffer
- Clark Ranch/Village East open space
- Carriage Hills II open space, and adjacent Tipple Parkway and Ridgeway Boulevard landscape buffers
- William H. Bailey Avenue west landscape buffer and park (Westview)
- William H. Bailey Avenue east landscape buffer (Countryside and Cobb)

Two private developments, Silverstone and Hidden Creek, also have NPW service, but usage data for these developments is not available. Refer to Figure 2.1 for a map of the Town's existing NPW system. The system includes over 10 miles of pipe, predominantly between 4-inch and 10-inch diameter.

Figure 2.1 Town of Frederick, Non-Potable Water System and Service Area Map



2.1.2 Frederick High School Irrigation

Frederick High School receives NPW from the Town's West Milavec Pump Station system into an onsite pond. The School District utilizes water from their pond to irrigate athletic fields and open spaces on the property. The high school is one of the largest users of NPW.

2.1.3 Town Engineering Department Input

Based on feedback from the Frederick Engineering Department, the most significant issue with the existing NPW system is inadequate water volume and pressure in the eastern portion of the system along Tipple Parkway. This portion of the system receives water from the West Pump Station at Milavec Reservoir. The Town's NPW distribution system includes an interconnect between the East and West Pump Station zones at the Colorado Boulevard/Tipple Parkway intersection that the Town utilizes to improve water pressure at the eastern portion of the system along Tipple Parkway. The Town is also installed two additional pumps in 2024 at the West Milavec Pump Station to address the issue. In 2024,

Town staff reported a blockage was found in the pipe system, and the water volume and pressure has since improved in the eastern portion of the Tipple Parkway system.

Regarding breaks or repairs in the NPW distribution system, Town staff reports that there have been only two known breaks. One occurred when another utility bore hit the Town's NPW line on Colorado Boulevard, north of Tipple Parkway. The other break occurred on the NPW line along Colorado Boulevard to Frederick Gateway Park at State Highway 52. The cause of this pipe break is unknown, but is suspected to have been due to freezing.

2.2 Risk and Reliability Rating System – NPW Piping

A risk and reliability rating system was developed to evaluate the NPW piping system. NPW waterlines were divided into over 120 individual pipe segments, primarily between fittings and valves. A risk and reliability rating was calculated for each pipe segment using the three factors listed below.

- Condition
- Criticality
- Vulnerability

A value was assigned for each of the three factors based on Tables 2.1, 2.2 and 2.3 below, and an overall score was calculated. Each pipe received only one value (highest) from each of the three factors. This score was used to rank the NPW waterlines from the highest risk to lowest. The pipe condition is based solely on the estimated remaining useful life as shown in Table 2.1. Field tests were beyond the scope of this Master Plan and were not performed.

Table 2.1 - Pipe Condition

Criteria	Condition Assessment	Point Rating
Remaining Useful Life < 10 yrs	Poor	4
Remaining Useful Life 11 to 20 yrs	Fair	3
Remaining Useful Life 21 to 40 yrs	Good	2
Remaining Useful Life > 40 yrs	Very Good	1

Table 2.2 - Pipe Criticality

Criteria	Criticality Assessment	Point Rating
Transmission Main from water supply	Extremely High	4
*Regional and Community Parks	Extremely High	4
Main Feeder Pipe	High	3
Athletic Field Irrigation	High	3
Neighborhood Parks	Medium	2
Open Spaces and Pocket Parks	Low	1

*Regional and Community Parks include:

- Frederick Recreation Area
- Centennial Park

Table 2.3 - Pipe Vulnerability

Criteria	Vulnerability Assessment	Point Rating
High maintenance difficulties	Very High	3
History of Pipe Breaks or Repairs	High	2
Higher Pressure	Medium	1
No history of pipe breaks, not higher pressure	Low	0

Asbestos-cement (AC) pipe is no longer used for public water infrastructure. AC pipe is considered relatively safe for water conveyance provided it is not compromised in a way that would release asbestos fibers into the water or the air. If a pipe connection needs to be made to the AC pipe, or if the AC pipe needs to be repaired, stringent safety measures must be taken to protect workers and the public from inhaling asbestos. For these reasons, AC pipe is assigned a Very High rating in the Pipe Vulnerability category.

The estimated useful life of each pipe segment varies based on the pipe material as listed in Table 2.4 below. Town staff provided approximate installation dates that were used to calculate the remaining useful life for each pipe. In some instances, no data is available to confirm the installation date. In these cases, remaining useful life is listed as “unknown.”

Table 2.4 - Pipe Useful Life Estimates

Pipe Material	Estimated Useful Life (years)
Polyvinyl Chloride (PVC)	100
Asbestos Cement (AC)	70
Copper	50

2.2.1 Total Risk & Reliability Rating

The summation of points for the three categories provides the Total Rating. The maximum possible rating is 11. Pipes with higher Total Ratings carry greater risk. Pipes with a Total Rating of 7 or more have a higher likelihood of failure and are recommended for replacement or rehabilitation. Refer to the Pipe Map and Risk & Reliability Rating spreadsheet table in the Appendix for ratings for each numbered pipe segment.

2.2.2 Summary of NPW Pipe Ratings

Based on Town staff input, most of the NPW distribution system is constructed of polyvinyl chloride (PVC) pipe, which has an estimated useful life of approximately 100 years. All the PVC pipes were installed in 2008 or later, so the remaining useful life is greater than 80 years for most of the NPW distribution system.

The exception is the 8-inch asbestos-cement (AC) NPW line along Colorado Boulevard between the Milavec Lake East Pump Station and Tipple Parkway. This pipe was installed in approximately 1978, originally as a potable waterline from the Town's old water treatment plant. AC pipe's estimated useful life is 70 years, so this pipe has an estimated remaining useful life of 24 years. Because this NPW line is AC pipe, it also received a Very High Vulnerability rating.

The 8-inch NPW line along Colorado Boulevard has other features that make it an important infrastructure component. There is an interconnect at the Tipple Parkway intersection that connects this Milavec East Pump Station discharge pipe with the Milavec West Pump Station distribution pipe. The Town has used this interconnect to supply additional water and pressure to the Milavec West distribution system.

The 8-inch NPW line along Colorado Boulevard transitions from AC to PVC south of Tipple Parkway, eventually discharging to the irrigation pond at Centennial Park. The Town irrigates this community park by pumping out of this pond. Therefore, the 8-inch Colorado Boulevard NPW line is critical to the reliability of the Town's NPW system.

The 8-inch AC pipe between the East Pump Station and Tipple Parkway, along Colorado Boulevard, received a Total Rating of 9 and is therefore recommended for replacement. No other pipes received a Total Rating above 6, so no other NPW lines are recommended for replacement.

2.2.3 Conclusions – NPW Pipe Ratings

Based on relatively long remaining useful pipeline lives and minimal history of line breaks, the only NPW line recommended for replacement is the 8-inch AC pipe between the East Milavec

Pump Station and Tipple Parkway.

It is recommended the Town track locations of future line breaks and update the pipe rating table approximately every five to seven years as ratings and priorities will change based on repairs and remaining useful pipe lives.

2.3 NPW Pump Stations and Equipment

Based on site visits and information supplied by the Town, the condition of existing pump stations and treatment equipment are described below.

2.3.1 East Milavec Pump Station

East Milavec Pump Station

The East Milavec pumping equipment is housed in the lower level of the old water treatment building on the east side of the lake. The age of the building is unknown, and the building interior needs lighting and safety access upgrades for this lower level, which the Town is planning to undertake. The south side of the building includes a fishing mural that contributes to the aesthetics of the recreation area. The Town is separately studying the feasibility of a potential potable water treatment plant on this side of the lake. For these reasons, replacement of the building should be delayed until decisions are made regarding a potential water treatment facility. However, repainting of the other exterior walls is needed as the paint has worn off in several places.

East Milavec Pump Room

There are two vertical turbine NPW pumps housed in this building that serve two different functions. One pump is rated for 850 gallons per minute (gpm) and has a 60-horsepower (hp) motor with a variable frequency drive (VFD). This 60hp pump is used primarily to transfer water from Milavec Reservoir to fill the pond at Centennial Park. A secondary function of this pump is to supplement the West Pump Station pressure zone when the Town opens the piping interconnect at Colorado Boulevard and Tipple Parkway. This pump was last replaced in 2017 and is considered to be in good condition based on general appearance and feedback from Town Engineering staff.

The second pump is rated for 180 gpm. This 20-hp pump delivers water from the lake to

irrigate the Frederick Recreation Area. This pump also has a VFD, and was installed in approximately 2009. It is 15 years old and in fair condition. Replacement of this pump should be scheduled in the Town's maintenance program within the next five years.

The Town is unable to remotely monitor the pump equipment, so a new telemetry system is recommended.

It is recommended the East Milavec Pump Station be upgraded as follows:

- Install a second pump to fill the Centennial Park irrigation pond, sized for 960-gpm capacity to meet the Short-Term future demand outlined in Section 7 of this Master Plan. A second pump also provides redundancy to improve system reliability.
- Install a smaller pressure-sustaining pump to minimize motor starts for the larger pumps when the interconnect with the West Pump Station system is opened.
- Reconfigure the piping and install electrical upgrades needed to accommodate the additional pumps
- Upgrade the lighting and access for the pump room
- Repaint the exterior walls
- Upgrade the telemetry system to provide remote monitoring capabilities

2.3.2 West Milavec Pump Station

The West Milavec Pump Station is a wood-framed building constructed over a concrete wetwell, located on the west side of the lake. The pump station was constructed in 2016 and the building appears to be in satisfactory condition. This station pumps water from Milavec Reservoir north to Johnson Farm, and south to the William Bailey Avenue landscaped buffers, Frederick High School pond, and the NPW users along Tipple Parkway.

West Milavec Pump Station

When the pump station was originally constructed, a prefabricated pump and piping skid was installed that included one vertical turbine pump and a smaller pressure-sustaining pump. The skid also included spaces for two additional vertical turbine pumps. During the time this Plan was being developed, the Town engaged a contractor to install two additional vertical turbine pumps of similar pumping capacity to the original pump, and modify the controls to incorporate the new pumps.

Each of the three vertical turbine pumps has a 150-hp motor and is rated for a pumping capacity of approximately 1335 gpm. The original pump was installed in 2016, and the other two pumps were installed in 2024. These types of pumps have useful lives of 15 to 20 years, and are considered to be in good condition.

West Milavec Pump Skid

West Milavec Pump Station Filters

The West Milavec Pump Station is also equipped with two in-line self-cleaning filters. These filters, installed in 2016, are on the pump discharge pipes, and are in good condition. However, the Town is considering constructing an enclosure to protect the filters from the weather.

No other upgrades are recommended for the West Milavec Pump Station.

2.3.3 Centennial Park Pump House

Centennial Park Pump House

The Centennial Park Pump House is located adjacent to the pond. The age of the building is unknown, but appears to be in fair condition. One main 40-hp vertical turbine pump is used to irrigate portions of the park. The rated pumping capacity is 450 gpm. This pump was installed in 2003 and is near the end of its typical useful life. Later in this Plan the Centennial Park Pump House is recommended for use as a regional pump station with an expanded NPW service area, requiring an upgraded capacity for the pump station. The existing pump should be replaced in conjunction with that recommended upgrade.

2.3.4 Centennial Park Irrigation Pond

The irrigation pond at Centennial Park stores raw water pumped out of Milavec Reservoir by

the East Milavec Pump Station. The pond has a surface area of approximately 74,000 square feet, or 1.7 acres. Based on information in the 2008 Raw Water Master Plan, the pond is approximately 10 feet deep. Since the level in the pond is maintained by pumping water from the East Milavec Pump Station, a reasonable pond sizing approach is to have sufficient volume in the top 3 feet to meet a maximum daily irrigation demand. This volume provides storage to allow time for maintenance events at the East Milavec Pump Station. Based on the 2008 Raw Water Master Plan, the top 3 feet has an estimated volume of 215,290 cubic feet, or 1.6 million gallons.

Based on meter data for the Centennial Park Pump House, average irrigation demand is approximately 75,000 gpd. Utilizing a maximum daily factor of 2.5 results in a current maximum daily demand of 187,500 gallons.

In Section 7 of this Master Plan, in, upgrades are described for the Centennial Park Pump House to meet future conditions. Recommended short-term projects result in Centennial Park Pump Station providing irrigation water to the Thunder Valley Athletic Fields, and parks and open spaces at Angel View Estates, Savannah, Maplewood Filing No. 5, and Carriage Hills. This will bring the estimated average irrigation demand to approximately 175,000 gpd. Using the 2.5 factor results in a short-term maximum daily irrigation demand of 437,500 gpd.

Section 7 of this Master Plan also estimated future buildout conditions for the Centennial Park Pump Station, which adds an average daily irrigation demand of 436,800 gpd. Combining this with the 175,000 gpd for current and short-term projects results in a total buildout average daily demand of approximately 612,000 gpd. Applying the 2.5 factor estimates a maximum daily irrigation demand of approximately 1.53 mgd.

The volume for the top 3 feet of the pond was estimated in the 2008 Raw Water Master Plan to be 1.6 million gallons, so there appears to be sufficient storage in the pond to meet future buildout conditions.

The potential relocation of the irrigation pond is being considered in conjunction with the development of the Miners Park Town Centre property directly south of Centennial Park. Relocating the irrigation pond would allow the connection of Locust Street to Miners Park, while also providing the opportunity for the developer to enlarge the existing stormwater pond. The size of the irrigation pond, if relocated, should be at least equivalent to its current size to ensure it is adequate to meet future conditions.

2.3.5 Bella Rosa Golf Course Pump Houses

The Finley North and South Pump Houses at Bella Rosa Golf Course are wood-framed structures constructed over wetwells, located adjacent to their respective ponds. Each pump house has one vertical turbine pump used to irrigate portions of the golf course. Both building structures are in fair condition. Evaluation of the pumping equipment at the golf course is beyond the scope of this Plan, but is being reviewed separately by the Town's Parks and Open Space Department.

2.3.6 Milavec Reservoir Aeration and Mixing Systems

Three solar-powered floating water circulators are utilized at Milavec Reservoir to improve water quality. These circulators were installed in 2020 and are in good condition. There are also two air compressors inside the decommissioned water treatment plant on the east side of the lake. These compressors inject air into the lake to improve water quality. The age of these compressors is unknown, but based on visual observation they appear to be in fair condition. The Town also recently installed an ultrasonic treatment system as an additional algae control method. No upgrades to the existing Milavec Reservoir water quality equipment are recommended.

2.3.7 Telemetry Systems

The Town's current telemetry system allows monitoring of the West Milavec Pump Station, and water levels for Milavec Reservoir, Centennial Park pond, North Finley pond, and South Finley pond. The Town is unable to monitor the East Milavec Pump Station, so it is recommended that a telemetry system be installed in conjunction with the recommended upgrades to that pump station. The telemetry system should be integrated into the Town's existing software used to monitor the West Milavec Pump Station.

2.4 Conclusions

2.4.1 NPW Piping System

Based on relatively long remaining useful pipeline lives and minimal history of line breaks, the only NPW line replacement recommended for the ten-year planning period is the 8-inch AC pipe between the East Milavec Pump Station and Tipple Parkway. It is recommended the Town track locations of future line breaks and update the pipe rating table approximately every five years as ratings and priorities will change based on repairs and remaining useful pipe lives.

2.4.2 NPW Pump Stations and Equipment

Upgrades to the East Milavec Pump Station and Centennial Pump House are recommended as described in this Section. These improvements should be incorporated into the Short-Term Capital Improvements recommended later in this Master Plan.

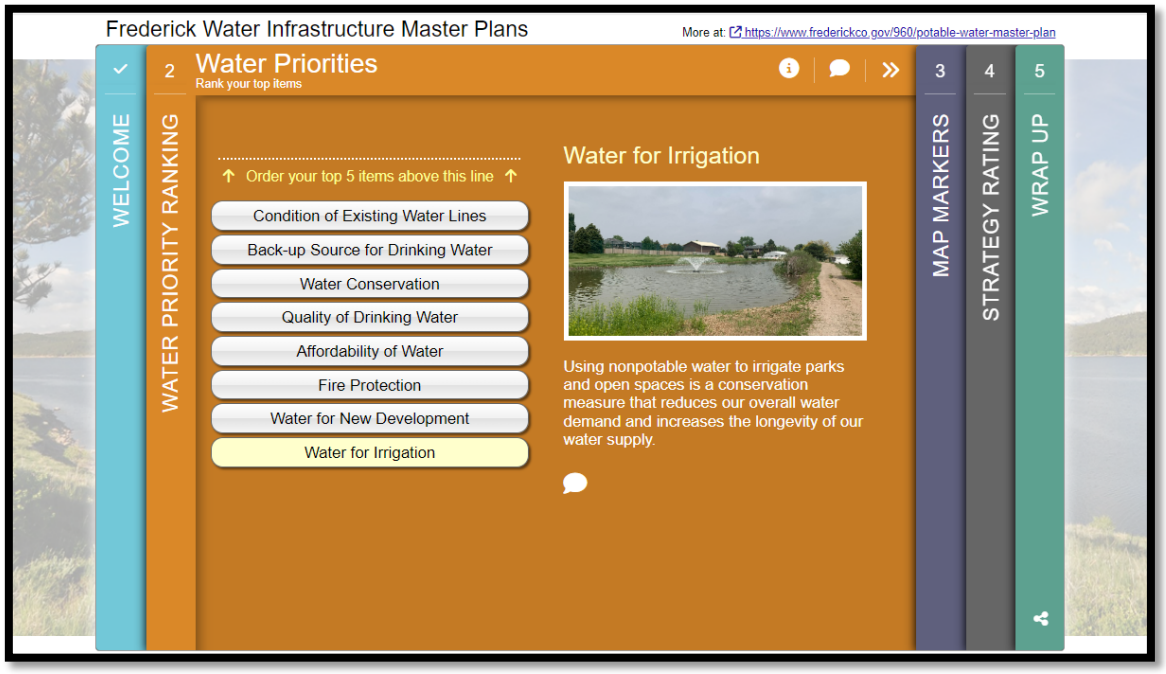
2.4.3 Centennial Park Pond

The existing Centennial Park Pond has adequate capacity to meet current and future irrigation demand conditions for the foreseeable future. If the pond is relocated in conjunction with the development of the Miners Park property, the surface area and volume of the pond should not be reduced.

3.0 PUBLIC ENGAGEMENT

3.1 Web-based Public Survey

An online platform (Metroquest) was developed by Forsgren's subconsultant, Michael Baker International, to engage the community on water issues during summer 2023, including both potable and non-potable (raw) water. The Town advertised the survey on their Facebook page, website, and electronic newsletter (Frederick Flash). Flyers in English and Spanish with QR codes and website links to the MetroQuest page were distributed at public events. The survey was active for over two months and had 111 unique participants provide input.



On-line Water Survey Screenshot

3.1.1 Public Comments – Water Priorities

Community members were asked to rank their water priorities. With respect to the Town's NPW system, the following priorities ranked highest by the participants.

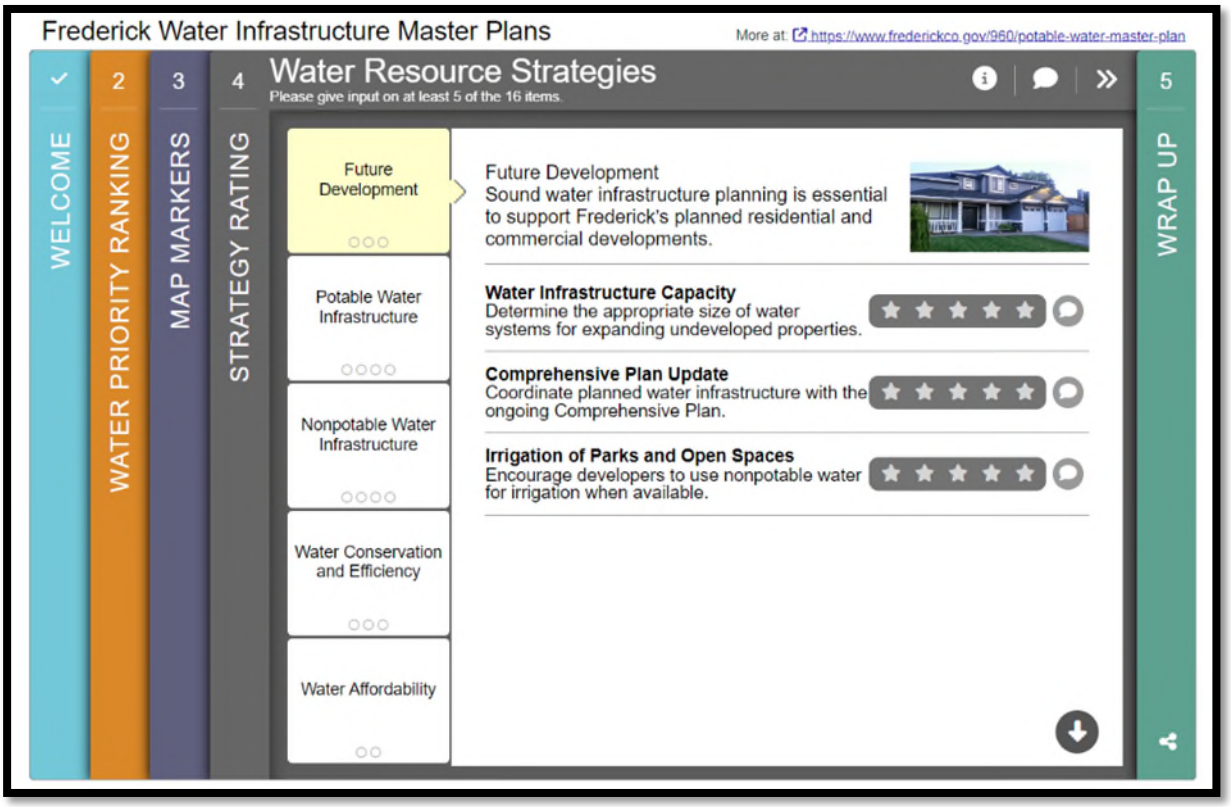
- Utilize NPW for irrigation to preserve potable water
- Water quality
- Water affordability
- Low-water landscaping

The overall theme is that participants want the Town to be a good steward of water resources. Comments related to NPW included:

- Utilize NPW for irrigation of parks and open spaces, especially for future development
- Desire to see improved water quality at Milavec Reservoir
- Developers should pay their fair share for water infrastructure for future development
- Utilize waterwise landscaping and irrigation systems

3.2 Water Strategy Input

The strategy rating slide included five categories and a total of 16 strategies. Participants were asked to rate each strategy on a scale of 1 to 5 based on number of stars selected, with five



stars being the highest importance, and one star being the lowest importance. The five general categories for the strategies included:

1. Future Development
2. Potable Water Infrastructure
3. Non-potable Water Infrastructure
4. Water Conservation and Efficiency
5. Water Affordability

Based on input from the Water Strategy survey screen, the public indicated that topics of highest importance are:

1. Require developers to pay their fair share of water infrastructure costs.

2. Develop a multi-year Capital Improvements Plan to prioritize upgrades for replacement and expansion of existing infrastructure.
3. Convert parks and open space irrigation to non-potable water to conserve potable water.
4. Support policies that require xeriscaping or low-water landscaping.

3.3 Public Engagement Conclusions

The public outreach for this Non-Potable Water Infrastructure Master Plan was primarily through the on-line survey. The input received from the survey is incorporated into the Master Plan approaches and recommendations, and addressed as follows:

Topic	How Topic is Addressed in Master Plan
Utilize NPW for irrigation	Recommends expanding NPW system to irrigate existing and future parks and open spaces.
Water Quality	Recommends continuing efforts to improve water quality at Milavec Reservoir, and recommends filtration be added at the Centennial Pump Station.
Affordability of water	NPW infrastructure for parks and open spaces in future developments are recommended to be paid for by the developers.
Low-water landscaping	Master Plan irrigation demand estimates are based on using more native grasses and low-water use landscaping for future parks and open spaces.

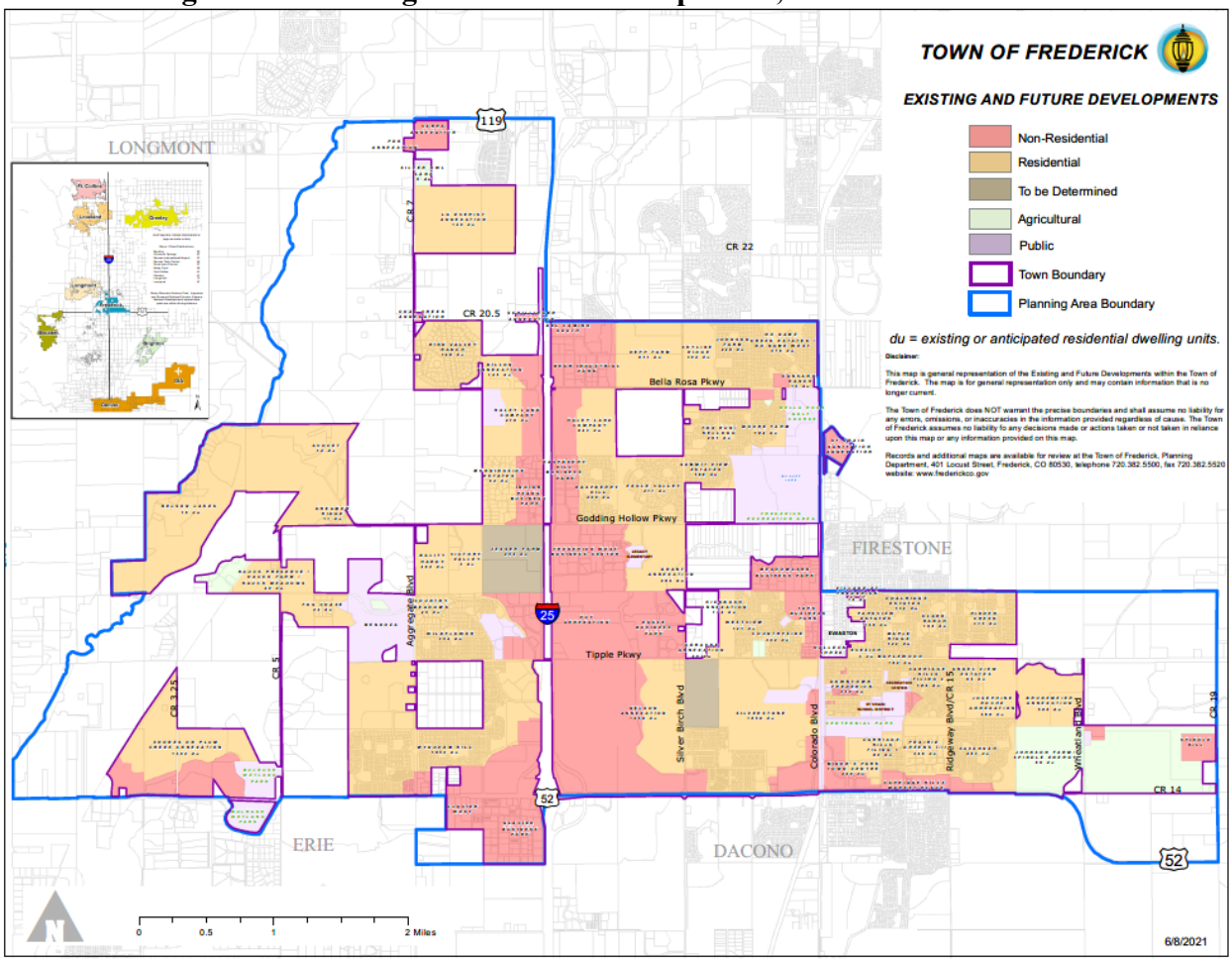
4.0 PLANNING

4.1 Growth Planning Overview

The Town Planning Department provided information related to development trends, targeted growth areas, and new development applications that are at various stages in the Town's review process. Most undeveloped areas within the Town's planning boundary generally do not have NPW infrastructure.

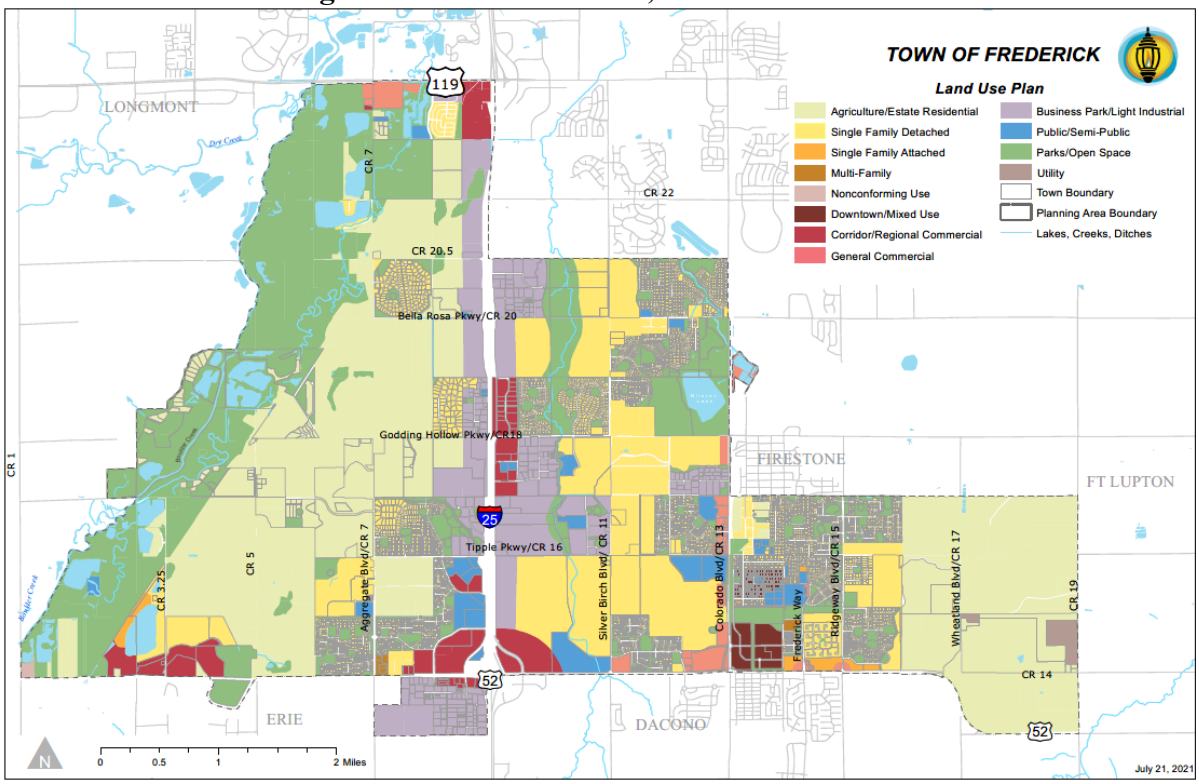
The Planning Department provided the land use and zoning exhibits shown below in Figures 4.1, 4.2 and 4.3. These exhibits include land uses and parcel sizes, and Figure 4.1 provides the expected number of dwelling units for some of the properties in the Town's planning area.

Figure 4.1 Existing and Future Developments, Town of Frederick



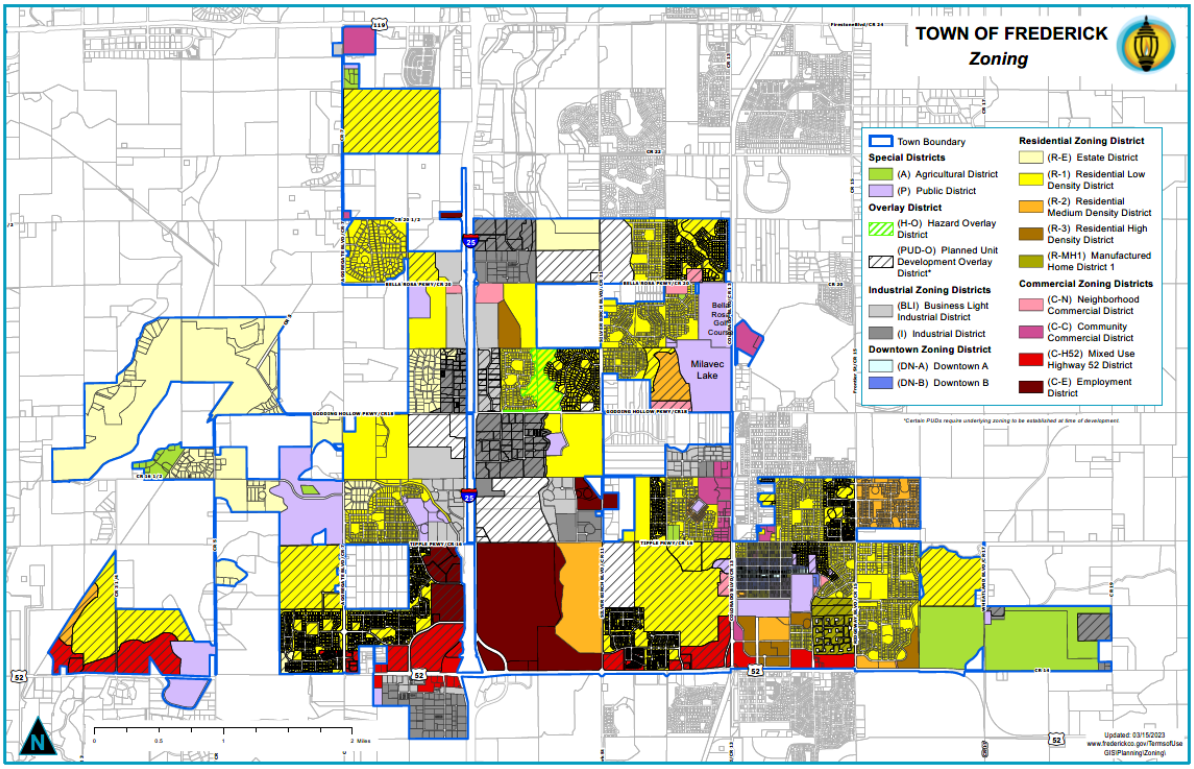
Source: Town of Frederick

Figure 4.2 Land Use Plan, Town of Frederick



Source: Town of Frederick

Figure 4.3 Zoning Map, Town of Frederick



Source: Town of Frederick

4.2 Frederick Comprehensive Plan - 2024 Update

The timing of this NPW Infrastructure Master Plan overlapped with the Town's development of an update to the Comprehensive Plan. The Comprehensive Plan update includes a revised land use map that includes some new land use categories and generally results in more multi-family development. This Master Plan utilizes the information in this updated land use map, combined with additional input from Town staff, to estimate future NPW irrigation demands.

The Town has identified the I-25/SH 52 interchange as a potential large, mixed-use destination to attract both local and regional visitors. The 2024 Comprehensive Plan Update also identifies the Weld County Road (WCR) 19 Subarea in the eastern portion of the Town Planning Boundary. The WCR 19 Subarea is expected to be a mix of low-density residential and commercial development.

4.3 Frederick 25/52 East Subarea Plan

Frederick is planning a mixed-use development for over 600 acres on the northeast side of the I-25/SH 52 interchange. In 2022, the Town prepared the 25/52 East Subarea Plan (*Houseal Lavigne, 3/22/22*) outlining a vision for a retail and commercial center with residential units, creating an attractive gateway to the east side of Frederick.

The 25/52 East Subarea Plan's conceptual land use for the development is summarized in Table 4-1.

From 25/52 Subarea Plan (Houseal Lavigne, 2022)

Table 4-1 25/52 East Subarea Plan – Conceptual Land Use

Description	Acres
Retail/Entertainment	140
Corporate Campus/Office	126
Mixed Residential (Single & Multi-family)	150
Public/Civic	12
Recreation	23
Industrial	192
TOTAL	643

Source: 25/52 Subarea Plan, Houseal Lavigne, 3/22/22

The Lower Boulder Ditch runs through the 25/52 East Subarea land, and it is recommended NPW for irrigation of parks and open spaces be directed from the ditch to a local pond. The land use acreages shown in Table 4-1 serve as the basis for estimating NPW demands.

4.4 Frederick 10-Year Water Resources Plan and Long-Term Water Resources Plan

The Town's 10-Year Water Resources Plan (WRP) and Long-Term Water Resources Plan (*Element Water Consulting, 12/6/21 and 5/13/22* respectively) are important references for this Non-Potable Water Infrastructure Master Plan. The 10-year Water Resources Plan identifies specific parks and open space properties that the Town desires to convert from potable to non-potable water irrigation. Additionally, Town staff indicated that long-term, they would like most or all the parks and open spaces for current and future developments to be irrigated with NPW to reduce stresses on the potable supply. The 10-year WRP estimates raw water demand to increase to 1,030 acre-feet per year (AFY) by the year 2030. The Long-Term Water Resources Plan (LTWRP) estimates a buildout raw water demand of approximately 1,960 AFY to occur within the 50-year planning period.

4.5 Frederick Water Efficiency Plan

Frederick's Water Efficiency Plan (WEP) (*Element Water Consulting, October 2022*) lists a series of water efficiency goals estimated to reduce potable usage by approximately 160 AFY by 2030. Much of this reduction is achieved through the Town's plan to convert targeted potable irrigation accounts to raw (i.e., non-potable) water irrigation, with the stated goal of converting 76 AFY from potable to non-potable irrigation by 2030. Other water efficiency activities include installation of Automatic Meter Reading (AMR) systems to improve meter and recording accuracy, several irrigation conservation programs such as turf replacement and smart irrigation controllers, and an update to Town standards for landscape design, which was recently adopted.

4.6 Methodology for Future Parks and Open Space Areas

The Town Planning and Parks & Open Spaces Departments are in the process of modifying calculation methods for required open spaces and parks. The methodology under consideration utilizes population-based formulas. The Town does not expect larger regional parks to be constructed in conjunction with future development, so park estimates are based only on smaller pocket parks. Town staff provided the formulas shown in Table 4-2.

Table 4-2 Parks and Open Space Area Guidelines from Town Staff

Description	Town Guidelines
Open Space - Residential	17 acres x (no. of residents), 10 acre minimum
Pocket Parks - Residential	8.5 acres x (no. of residents), min ¼ acre, max 2 acre each park
Open Space - Commercial	15% of commercial property to be open space

After review and discussions with Town staff, the formulas were modified for more densely developed land uses to arrive at reasonable overall areas for parks and open spaces.

The 2024 Comprehensive Plan Update includes land use classifications and development type guidance as shown in Table 4-3. Based on this guidance, an estimated dwelling unit per acre (DU/AC) density was calculated for anticipated development within the Town's future NPW service area as shown in Table 4-3.

Table 4-3 Land Use and Development Guidance

[1]Land Use Classification	[1]Preferred Development Mix	[2]Est. DU/AC
Single-Family Oriented	80% Single-Family Detached, 20% Single Family Attached, 2 to 12 DU's per acre	6
Estate Residential	1 Single-Family home every 5 acres	0.2
Multi-Family	14 to 24 DU's per acre	20
Adaptable Neighborhood	50% Single-Family Detached, 35% Single-Family Attached, 15% Multi-Family, 2 to 12 DU's per acre	9.6
Downtown Hub	30% Single-Family Detached, 40% Single-Family Attached, 30% Multi-Family, 6 to 28 DU's per acre	11.5

[1]Land Use Classifications from Comprehensive Plan 2024 Update, Town of Frederick
[2]Estimated dwelling units per acre (DU/AC) used for this NPW Infrastructure Master Plan

Based on the estimated dwelling units per acre shown in Table 4-3, the number of dwelling units and residents is calculated for future development. The number of residents for each future development is estimated at 2.94 capita/unit for single-family residential based on U.S. Census Data for Frederick. Multi-family is estimated at 2.3 capita/unit.

4.7 Landscaping Guidelines and Irrigation Demand Estimate Criteria

Based on input from Town staff, landscaping for pocket parks is estimated at 50% high irrigation use (turf – Kentucky Bluegrass or similar), and 50% medium irrigation use for native grasses, trees and shrubs. Approximately 25% of the medium irrigation use area is assumed to be mulch or gravel, requiring no irrigation. Open spaces are considered low irrigation use areas that utilize native grass and low-water demand shrubs, perennials and trees.

Irrigation demand is estimated based generally on criteria included in the Town's Water Dedication Ordinance, as shown in Table 4-4.

Table 4-4 NPW Irrigation Demand Criteria

Irrigation Classification	Land Uses	Est. Irrigation Demand (AFY/ac)
High Demand	Kentucky Bluegrass or similar	2.5
Medium Demand	Some shrubs and perennials, trees, tall fescue grass	1.6
Low Demand	Native grasses (buffalo grass, blue grama grass), some shrubs and perennials)	0.8

5.0 CURRENT AND FUTURE NON-POTABLE WATER DEMANDS

5.1 Current Non-Potable Water Demands

Table 5-1 below provides non-potable water (NPW) usage for the period October 31, 2021 to October 31, 2022 based on the Town's main flow meters measuring water leaving Milavec Reservoir by either gravity or pumps. The table also includes the calculated average daily usage for the typical 6-month irrigation period of May 1 to October 31, 2022.

The daily NPW demand averaged approximately 589,000 gallons per day (gpd) during the 6-month irrigation season for 2022, of which approximately 228,200 gpd was conveyed to the two irrigation ponds (Finley North and South) at the Town's Bella Rosa Golf Course by gravity pipes from Milavec Reservoir.

Table 5-1 Non-Potable Water Usage, 2022

Meter	[a]Annual (gal)	Annual (AF)	Avg Daily 5/1 to 10/31 (gpd)
Milavec West 1 (West Pump Station)	20,314,610	62	112,653
Milavec West 2 (Johnson Farm only current property)	2,442,201	7	13,534
To Finley 1 & 2 ponds (Bella Rosa GC & No Name Ck W.)	71,172,047	218	228,168
Milavec Pump House (East Pump Station)	43,307,662	133	183,167
Frederick Recreation Area	9,893,661	30	51,481
Total	**147,130,181**	**452**	**589,003**

[a] 2022 Annual data based on October 31, 2021 through October 31, 2022

Finley North Pond, Bella Rosa Golf Course

The individual properties with the highest NPW usage are Frederick High School, the Frederick Recreation Area, and Centennial Park. Table 5-2 provides NPW use for the individual meters, which all receive NPW from one of the main meters listed in Table 5-1. Several meters showed no usage.

Table 5-2 Individual Non-Potable Water Meter Usage, 2022[a]

Meter	[a]Annual (gal)	Annual (AF)	Avg Daily Use 5/1 to 10/31 (gpd)
Milavec West 2 (Johnson Farm)	2,442,201	7.5	13,534
No Name Creek (from golf course ponds)	3,065,914	9.4	18,155
Centennial Park (from pond pump house)	14,502,379	44.5	74,553
Carriage Hills 2	0	0	0
St. Brigit	400,829	1.2	2,106
Frederick High School	14,521,176	45	80,671
Countryside 1 (William Bailey Ave ROW)	14,682	0.05	82
Countryside 2 (William Bailey Ave ROW)	0	0	0
Cobb	0	0	0
Westview 1	252,526	0.8	1,403
Westview 2	1,037,615	3.2	5,765
Westview 3	879,579	2.7	4,887
Village East	5,867,659	18.0	32,598
Maple Ridge II	614,000	1.9	3,411
Frederick Recreation Area	9,893,661	30	51,481
Total	**53,492,221**	**164.17**	**288,646**

[a] 2022 Annual data based on October 31, 2021 through October 31, 2022

5.2 Future Non-Potable Water Demands

5.2.1 Short-Term NPW Properties

The Town's 10-year Water Resources Plan identified properties recommended to be converted from potable water irrigation to NPW. Through discussions with Town staff, minor adjustments to this list of properties have been made, resulting in the properties shown in Figure 5.1 and Table 5-3. It is noted that some of the properties are not currently irrigated, but are included because they could be irrigated and it is preferred that NPW be utilized to further conserve potable water. The estimated irrigation demand for these properties is approximately 143 AFY. The 2022 potable water billing records were used to estimate demands. If water billing records were not available, irrigation demands are estimated as described in Section 4.

Figure 5.1 Potable to NPW Irrigation Conversion Properties

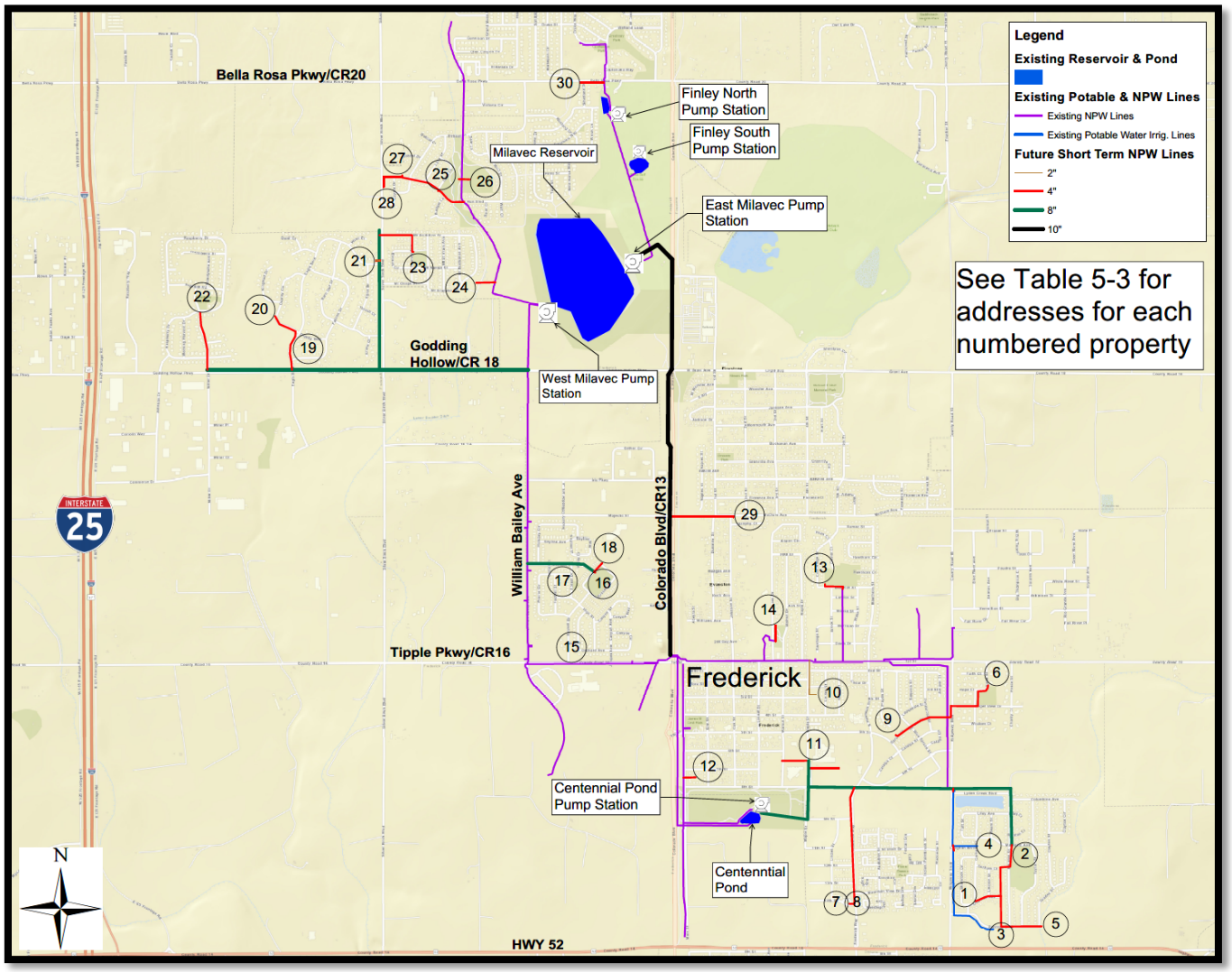


Table 5-3 Potable to NPW Irrigation Properties

Subdivision	Map No.	Address	[1]Annual Demand (gallons)	Demand (AFY)	Land Use
[3]Savannah	1	6125 1/2 Emerson Ave	585,000	1.8	Open Space
	2	6201 Ralston St	3,211,000	9.9	Park
	3	7125 Penrose Blvd	1,400,000	4.3	Open Space
	4A	7989 1/2 Laughlin Blvd	1,700,000	5.2	Open Space
	4B	7969 Gorham Ct	1,213,000	3.7	Open Space
	5	6108 Graden St	1,065,000	3.3	Open Space
Angle View Estates	6	6914 1/2 Saint St	881,000	2.7	Open Space
Carriage Hills	7	6669 14th St	586,000	1.8	Open Space
	8	6679 14th St	129,000	0.4	Open Space
Maplewood FG #5	9	830 Spruce Ct	691,000	2.1	Park
Maplewood FG #2	10	340 Maple St	388,000	1.2	Park
Thundervalley Sports Field	11	[2]Multiple addresses	6,907,000	21.2	Open Space/Turf
Grove Townhomes	12	742 Main St	912,000	2.8	Open Space
Coalridge Estates	13	301 Warwick St	4,256,000	13.1	Park
Firefighter's Park	14	11 Walnut Dr	933,000	2.9	Park
Countryside	15	7143 1/2 Russell Dr	171,000	0.5	Open Space
	16	5730 Russell Cir	2,658,000	8.2	Park
	17	7393 1/2 Grimson St	428,000	1.3	Open Space
Rocky Mountain Church	18	5860 Majetic St	4,003,000	12.3	Open Space
Eagle Valley	19	4800 1/2 Falcon Dr	863,000	2.6	Open Space
	20	4819 Osprey Cir	1,414,000	4.3	Park
	21	4890 Eagle Blvd	32,600	0.1	Open Space
[4]Raspberry Hill	22A	8039 1/2 Raspberry Dr	3,126,000	9.6	Open Space
	22B	8245 1/2 Miller Dr	1,399,000	4.3	Park
Summit View Estates	23	5130 Mt Pawnee Ave	1,210,000	3.7	Park
	24	5111 Mt Buchanan Ave	898,000	2.8	Open Space
Fox Run	25	5365 Fox Run Blvd	1,277,000	3.9	Park
	26	5401 1/2 Fox Run Blvd	415,000	1.3	Park
	27	5051 Fox Run Blvd	633,300	1.9	Open Space
	28	5303 Coyote Dr	838,000	2.6	Open Space
Village at Frederick	29	295 Brophy Ct	455,000	1.4	Open Space
Moore Farm	30	8859 1/2 Shetland Dr	1,960,000	6.0	Open Space
TOTAL			**46,637,900**	**143.1**	

Notes:

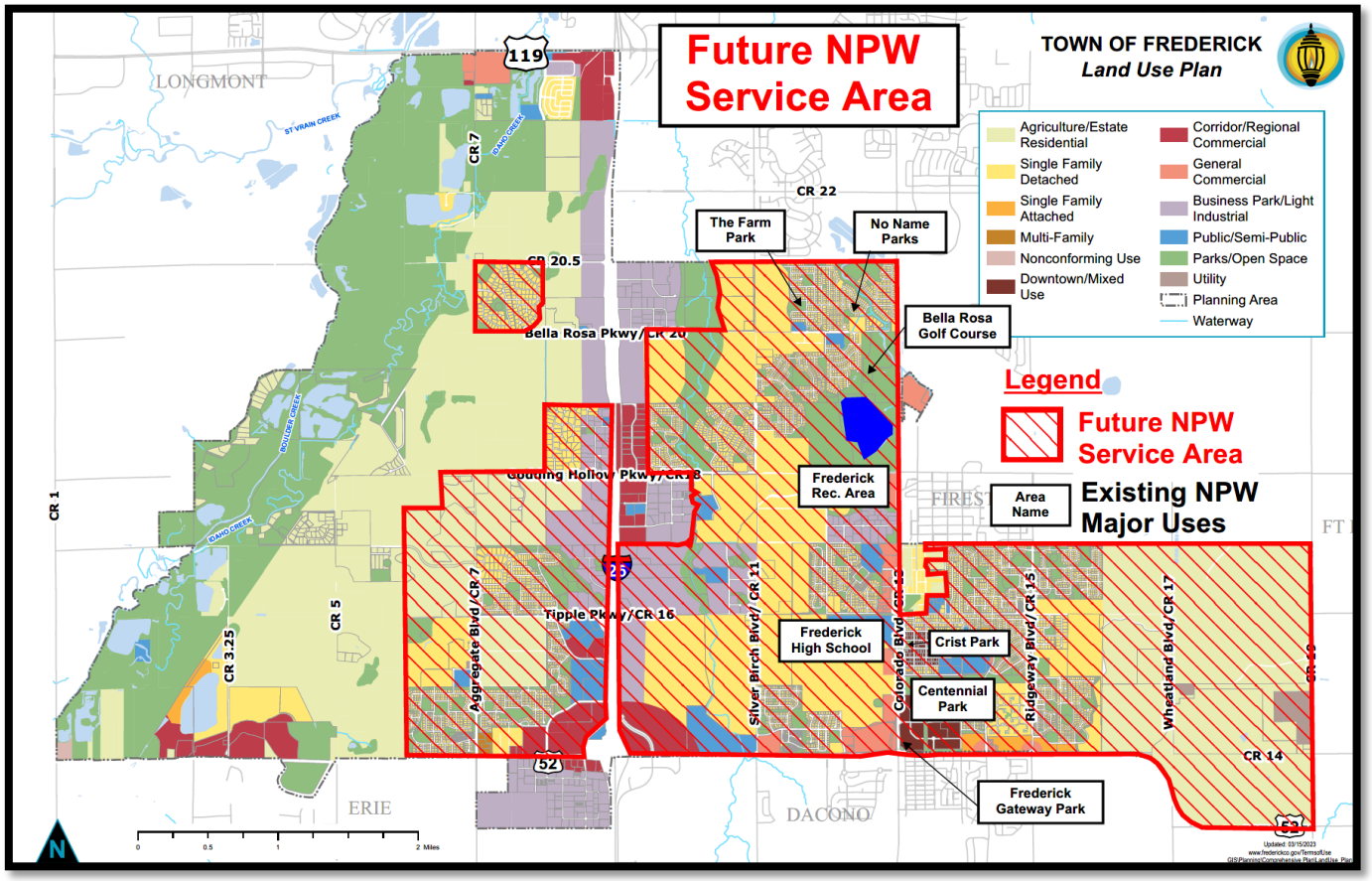
1. Annual Demand based on 2022 potable water billing records, unless otherwise noted. Demands for properties without meters estimated as described in Section 4 of this report.
2. Thunder Valley Sports Fields meter addresses include 555 8th St, 656 Locust St, and 600 5th St.
3. Savannah areas irrigation piping to be connected to reduce quantity of NPW meters.
4. Raspberry Hill meters to be combined into one NPW meter.

5.2.2 Future NPW Service Area

The Town's existing NPW infrastructure is east of I-25, which facilitates more cost-effective expansion east of the interstate compared to extending infrastructure to the west side of the interstate. The Lower Boulder Ditch and other creeks and ditches flow through the west side of I-25, providing

opportunities for direct connections for irrigation of existing and future parks and open spaces on the west side. Lower irrigation demands are generally expected there due to floodplains, agricultural and low-density residential land uses, and commercial zoning along the I-25 west frontage road. Figure 5.2 shows the future expected NPW service area in Frederick.

Figure 5.2 Future NPW Service Area

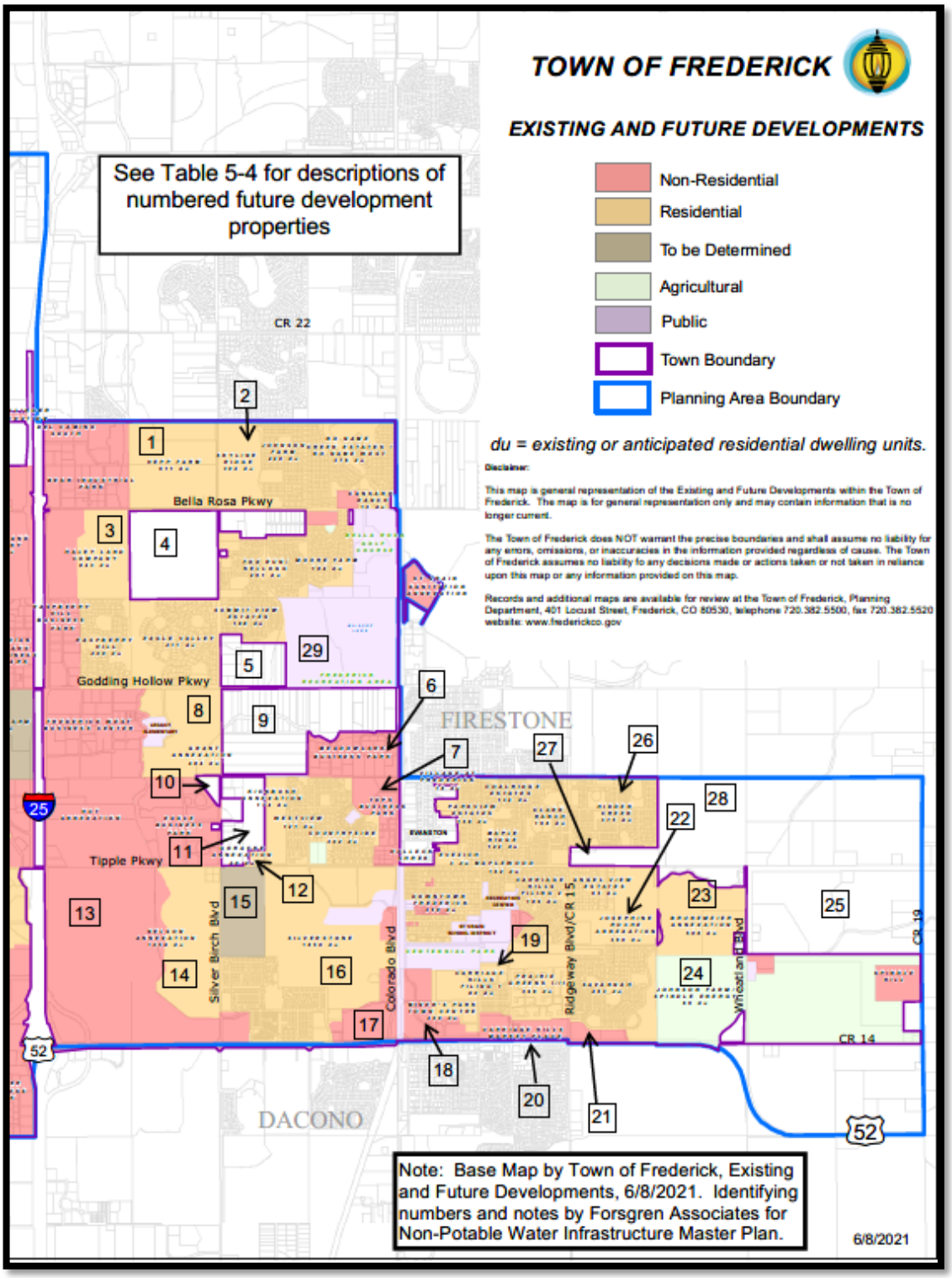


Base Land Use Map from Town of Frederick

Future NPW Demands - East of Interstate-25

Based on discussions with Town staff, future development that can utilize expansions to the Town's existing NPW infrastructure for irrigation of parks and open spaces are primarily expected to be east of I-25, within the Town's planning boundaries. See Figure 5.3 and Table 5-4 for property locations and estimated NPW demands through buildout, which is projected to occur around the year 2070. The Town's recent Comprehensive Plan Update modifies the land use classifications and densities that will dictate the development of many of these properties. Densities, acreages, and irrigation demands for the future parks and open spaces are estimated for each property using the criteria described in Section 4 of this report. See Appendix F for additional details on estimated NPW demands for future buildout.

Figure 5.3 Future Properties, East of I-25



Source: Base map is excerpt from Town of Frederick Existing and Future Developments Map, 6/8/2021

Table 5-4 Non-potable Water Demands, Future Development, East of I-25

Area No.	Description	[a]Apprx Area (AC)	Comp Plan Update Land Use	EDU's per acre	EDU's	# of resid.	Annual Irrigation Demand (AFY)
1	Hepp Farm	150	Adapt Nbd	9.6	1440	4104	33.9
2	Skyline Ridge	58	Adapt Nbd	9.6	557	1587	13.7
3	Haley Land Company	100	Adapt Nbd	9.6	960	2736	23.4
4	WCR 11 & WCR 20	80	Adapt Nbd	9.6	768	2189	19.4
5	WCR 11 & WCR 18 (N. of G.H.)	57	SF Oriented	6	342	1006	30.9
6	Meadowlark Bus Park	9	Bus Flex	-	-	-	1.1
7A	Tops Business Park (comm)	15	Mixed Use	-	-		1.8
7B	Tops Business Pk (MultiFam)	15	Mixed Use	20	300	690	6.2
8	Grant Annexation	95	SF Oriented	6	570	1676	48.0
9A	WCR 11 & WCR 18 -Adapt Nbd	143	Adapt Nbd	9.6	1373	3913	36.4
9B	WCR 11 & WCR 18 - Bus Flex	66	Bus Flex	-	-	-	8.4
9C	WCR 11 & WCR 18 -Commerc	7.5	Mixed Use	-	-	-	1.6
9D	WCR 11 & WCR 18 -Multi Fam	7.5	Mixed Use	20	150	345	3.1
10	Silver Birch Rd-light indust.	8	Bus Flex	-	-	-	1.1
11	Kickbush Annexation	72	SF Oriented	6	432	1271	37.7
12	Goracke Annexation	2	Adapt Nbd	9.6	19	55	2.2
[b]13	25/52 East Subarea	643	Mixed Use	-	-	-	155.2
14	Nelson Annexation	285	Adapt Nbd	9.6	2736	7798	72.3
15	Silver Birch Blvd/Tipple Pky	100	Adapt Nbd	9.6	960	2736	24.4
16	Silverstone future resident.	180	Adapt Nbd	9.6	1728	4925	40.7
17A	Silverstone-Mixed Use, Com	46	Mixed Use	-	-	-	7.4
17B	Silverstone-Resid, DT Hub	138	DT Hub	11.5	1587	3650	32.0
18A	Miners Park-Resid, DT Hub	56	DT Hub	11.5	644	1481	13.6
18B	Miners Park-Comm, DT Hub	31	DT Hub	-	-	-	6.3
19	Carriage Hills Filing 1	21	SF Oriented	6	126	371	13.0
20	Carriage Hills Market Place	17	Adapt Nbd	9.6	163	465	5.7
21	East of Carriage Hills Market	13	Adapt Nbd	9.6	125	356	4.9
22	Josephine Roche Annex	91	SF Oriented	6	546	1606	46.0
23A	Brunemeier Annex-SF Orient.	72	SF Oriented	6	432	1271	37.0
23B	Brunemeier Annex-Adapt Nbd	33	Adapt Nbd	9.6	317	903	27.0
24	Johnson Farm/Spindle (west)	147	SF Oriented	6	882	2594	74.0
[b]25	WCR-19 Subarea	1256	TBD	-	-	-	115.5
26	Hidden Creek	142	SF Oriented	6	852	2505	106.0
27	South of Hidden Creek	26	Adapt Nbd	9.6	250	712	8.4
28	East of Hidden Creek	142	Adapt Nbd	9.6	1363	3886	50.0
29	Fred. Rec Area (west of lake)	53	Parks/Open	-	-	-	47.5
30	Thunder Valley-east field		Athl. Field	-	-	-	4.8
	TOTALS	**4377**			**19,622**	**54,831**	**1,161**

Notes: [a]Approximate areas from aerial mapping. [b]See tables 5-5 and 5-6 for subarea irrigation demand estimates.

The Town's Comprehensive Plan Update includes plans for two multi-use subareas, the 25/52 East Subarea, and the Weld County Road 19 (WCR-19) Subarea. These subareas are described in Section 4 of this report. Tables 5-5 and 5-6 below provide NPW demand estimates for irrigation of parks and open spaces for these areas. The NPW demands shown should be re-evaluated after more detailed plans for these subareas are developed.

Table 5-5 25/52 East Subarea, Estimated NPW Demand

No.	Development Type	Approx. Area (AC)	Land Use	EDU's per acre	EDU's	# of resid.	Annual Irrigation Demand (AFY)
A	Residential, Single Family	100	SF Oriented	6	600	1764	51
B	Residential, Multi-family	50	Multi-Fam	20	1000	2300	15
C	Commercial	140	Bus Flex	-	-	-	17
D	Offices	126	Bus Flex	-	-	-	16
E	Industrial	192	Bus Flex	-	-	-	24
F	Public/Civic	12	Public	-	-	-	3
G	Recreation	23	Parks/Open	-	-	-	29
	TOTALS	**643**			**1600**	**4,064**	**155**

Table 5-6 WCR-19 Subarea, Estimated NPW Demand

No.	Development Type	Approx. Area (AC)	Land Use	EDU's per acre	EDU's	No. of resid.	Annual Irrigation Demand (AFY)
A	Residential, Estate-Agr	879	Estate Res	0.2	176	517	25.8
B	Open Space Buffers	63	Parks/Open	-	-	-	51.0
C	Commercial /Industrial	314	Bus Flex	-	-	-	38.7
	TOTALS	**1256**			**176**	**517**	**115.5**

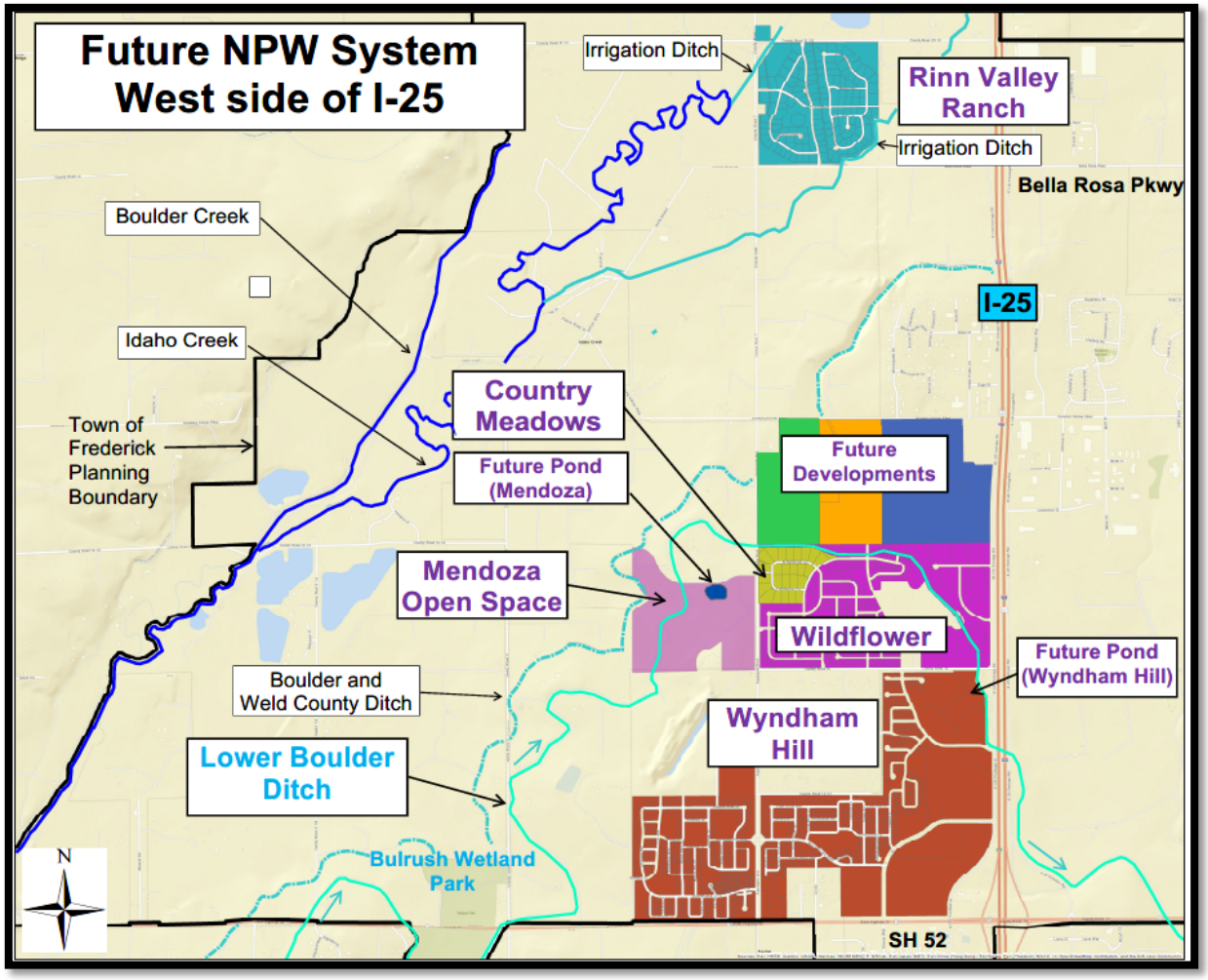
Future NPW Demands – West of I-25

Properties west of I-25 can be served with NPW irrigation directly from the Lower Boulder Ditch, the Godding Idaho Creek diversion, Idaho Creek, the Boulder & Weld County ditch, or other ditches. Properties identified for potential direct connections to streams and ditches include Wyndham Hill, Rinn Valley Ranch, Wildflower, Country Meadows, and other future developments just to the north of Wildflower and Country Meadows.

The Town is currently working with Wyndham Hills to construct a ditch diversion to feed a private pond and irrigation system for Wyndham Hills. The Town plans to develop the Mendoza Open Space into a park, and the Lower Boulder Ditch flows through the Mendoza Open Space. Since these properties will be supplied with raw water directly from the ditch, no NPW infrastructure is planned

to be extended west across I-25. See Figure 5.4 for a map of the potential properties west of I-25 that could utilize NPW from existing streams and ditches.

Figure 5.4 Potential Properties for NPW Irrigation, West of I-25



Raw water irrigation demand for Wyndham Hills is estimated at approximately 60 AFY based on past irrigation use. Town staff intends to pursue a low irrigation demand landscaping plan for the Mendoza property. Table 5-7 provides an estimate of NPW irrigation demands for the properties west of I-25. See Appendix F for additional details on estimated NPW demands for future buildout.

Table 5-7 Non-potable Water Demands, Future Development West of I-25

Area No.	Description	Approx. Area (AC)	Comp Plan Update Land Use	EDU's per acre	EDU's	# of resid.	Annual Irrigation Demand (AFY)
1A	Wildflower – Residential	118	SF Oriented	6	708	2082	59.0
1B	Wildflower – Business	140	Bus Flex	-	-	-	16.8
2	Wyndham Hill	570	Exist Resid	-	-	-	60.0
3	Country Meadows	33	SF Oriented	6	198	583	17.0
4	Public/Institutional	70	Public/Inst	-	-	-	14.0
5	Rinn Valley Ranch	140	Exist Resid	-	-	-	11.6
6	Resid., North of Wildflower	135	SF Oriented	6	810	2382	68.0
7	Comm., North of Wildflower	80	Bus Flex	-	-	-	9.6
8	Mendoza Open Space	114	Park/OS	-	-	-	104.0
	TOTALS	**1400**			**1716**	**5,047**	**360**

The total estimated future NPW demand for both the east and west sides of the interstate is approximately 1,495 AFY, not including the 25/52 East and WCR-19 Subareas.

5.3 NPW Demands Summary

Table 5-8 summarizes the current and estimated short-term and long-term NPW irrigation demands for parks and open spaces through buildout of the Frederick planning area. The estimated buildout demand is approximately 2,116 AFY, which is slightly higher than the 1,960 AFY projected in Frederick's Long-Term Water Resources Plan (LTWRP).

Table 5-8 NPW Irrigation Demands Summary

Description	Est. NPW Demand (AFY)
Existing NPW System	452
Short-Term Future Demand	143
Future Build-out, East of I25	1,161
Future Build-out, West of I25	360
Total	**2,116**

6.0 WATER QUALITY

6.1 Background

Milavec Reservoir is Frederick's primary water source for non-potable irrigation of selected parks and open spaces. The reservoir has experienced some blue-green algae issues over recent years. The warm, stagnant, and nutrient-rich water of the lake is conducive for algal growth. Several strategies are being utilized to prevent blue-green algae growth, and the Town is currently performing more detailed water quality analyses through other ongoing studies.

The main source of water to Milavec Reservoir is the Lower Boulder Ditch, which is a diversion from Boulder Creek. A source of water and nutrients into Milavec Reservoir is the City of Boulder's wastewater plant effluent discharge into Boulder Creek. Runoff from fertilized lands may also be contributing nutrients to the creek. High levels of nutrients, specifically phosphorous and nitrogen, promote algae growth in the reservoir. The Town is actively working to prevent and address algae when present.

6.2 Water Quality for NPW Systems

With respect to the Town's Non-Potable Water (NPW) infrastructure, minimizing algae transfer to the piping and irrigation systems is important to avoid clogging pipes, irrigation

sprinklers, and drip irrigation emitters. Larger sediment can also clog these components.

Water from Milavec Reservoir is conveyed to the NPW system by the East and West Milavec Pump Stations, and through a gravity pipeline to Bella Rosa Golf Course. The East Milavec Pump Station pumps water to the pond at Centennial Park where it is stored prior to being pumped by the Centennial Park Pump House. The West Milavec Pump Station pumps water to the irrigation pond at Frederick High School, but also directly to parks and open spaces. The gravity pipeline to the golf course conveys water to the Finley North and South ponds at the golf course prior to being pumped by a pump house at each pond.

Town staff has not reported issues with algae being transferred from the Milavec Reservoir to the Centennial Park pond or golf course ponds. These ponds allow solids to settle prior to being pumped to irrigation systems. The West Milavec Pump Station has a filtration system that removes particles larger than 300 microns (0.3 milimeter), which helps prevent irrigation emitters from clogging.

6.3 Current Water Treatment Strategies

The Town has implemented the following methods of water treatment at Milavec Reservoir.

6.3.1 Aeration and Water Circulation

Solar-powered floating water circulators and aeration of the water are two measures the Town uses to manage algal blooms at Milavec Lake. Air is generated by two aeration blowers inside the decommissioned treatment building on the east side of Milavec Reservoir, and injected into the water through air pipes. The Town also injects air into the Centennial Park pond, and aerates and circulates water at the Finley North Pond at Bella Rosa Golf Course with a fountain feature in the middle of the pond.

Most recently, the Town installed an ultrasonic treatment system at Milavec Reservoir to further improve algae control. Ultrasonic devices reduce algal blooms by emitting ultrasonic waves that kill the algae. This system is being monitored by Town staff for its effectiveness. Chemical addition is not a preferred treatment strategy due to concerns of potential harmful effects on fish and other aquatic life in the lake.

6.3.2 Filtration

The West Milavec Pump Station has a filtration system that filters water pumped from the lake into the existing NPW distribution system. These filters help minimize the solids and algae that is conveyed to the irrigation systems at parks and open spaces.

6.3 Recommendations

It is recommended that the Town continue with current water treatment practices and monitor the effectiveness of the ultrasonic system.

Reducing nutrients flowing into Milavec Reservoir will help with algae control. The Town should continue working with upstream stakeholders and partners to reduce nutrients. The City of Boulder is planning upgrades to its wastewater treatment facility to meet new CDPHE regulations for nutrients. These upgrades are aimed at reducing phosphorous concentrations in the effluent discharged to Boulder Creek.

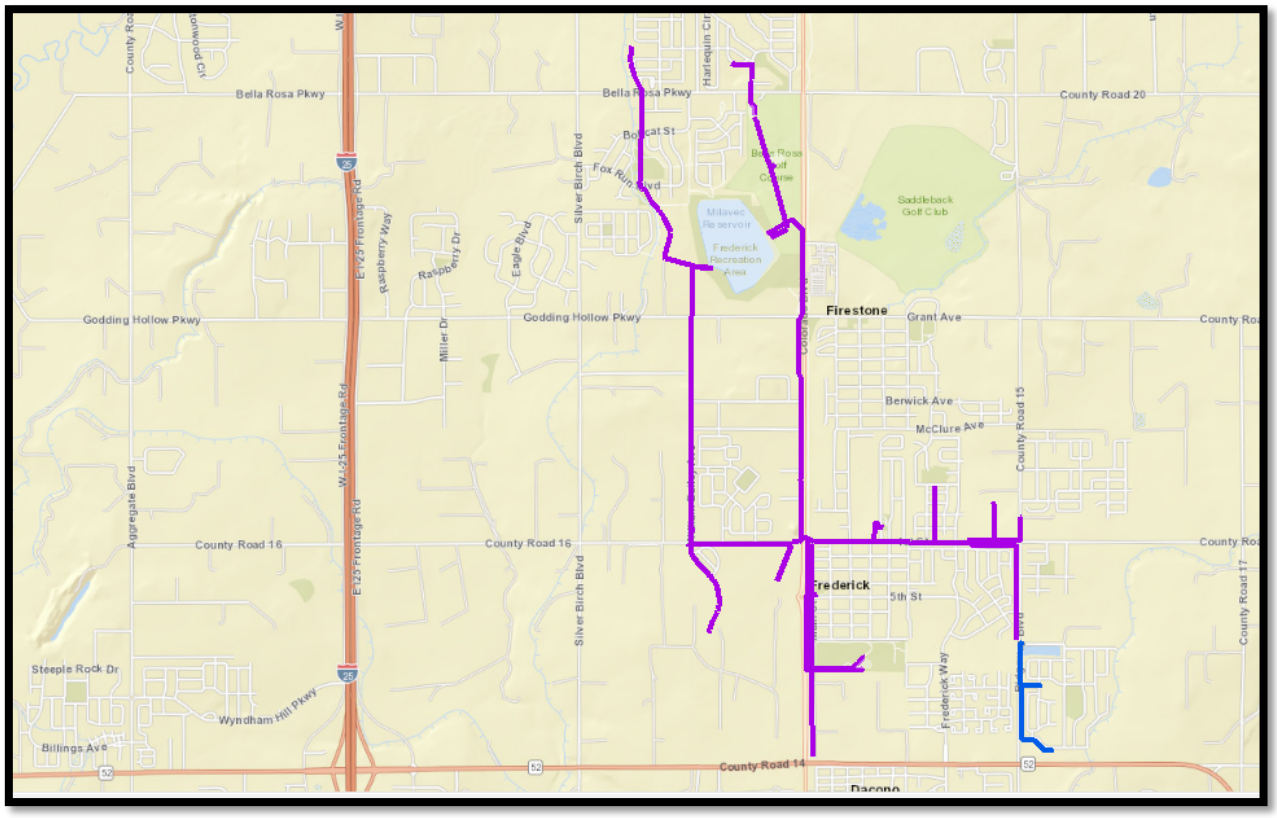
Working with landowners along the Lower Boulder Ditch to use lower amounts of fertilizers on yards and gardens can also reduce nutrient loading to Milavec Reservoir. A natural vegetation buffer at the reservoir's inflow ditches is another nutrient control measure that can be considered.

Many chemicals, algaecides, and herbicides on the market help control algae but are not recommended. These chemicals risk exposing the lake to other toxins in the short term which can negatively impact other water quality parameters and plant and aquatic life.

7.0 GIS MAPPING AND HYDRAULIC MODELING

7.1 GIS Map Update

The Town provided an existing non-potable water system map in ArcGIS format. Based on information and discussions with the Town, updates and corrections were made to the existing GIS files. Waterline sizes and locations were updated using maps and construction record information provided by the Town. Additionally, the Town furnished information for a recently constructed 8-inch non-potable waterline running south on Ridgeway Boulevard, from Tipple Parkway, and this line was added to the GIS map. Larger scale printouts of the entire existing GIS mapping are provided in the appendix.



Frederick Non-Potable Water System, GIS Map Update, Screenshot Sample

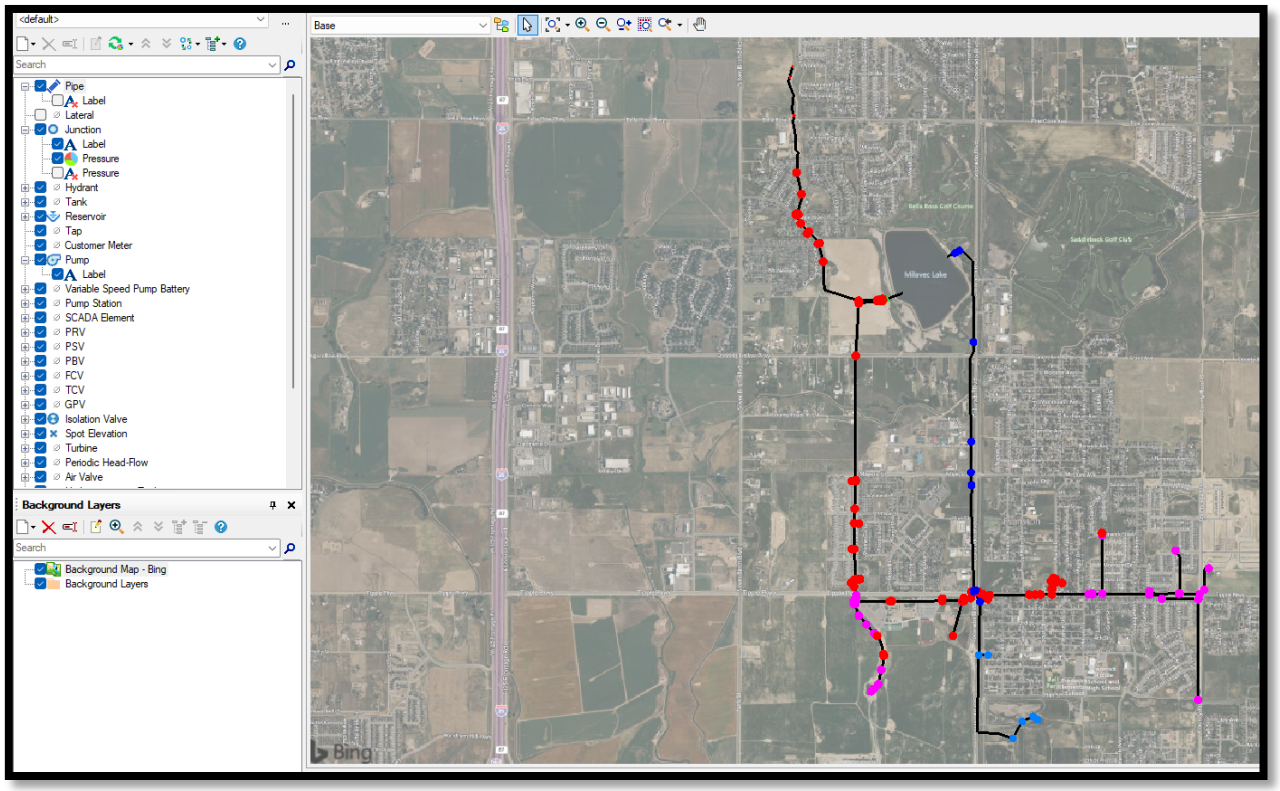
7.2 Hydraulic Model

7.2.1 Description

A computer-based hydraulic model is an important analysis tool for water systems. Forsgren developed the Town's NPW WaterGEMS model using the updated GIS Map data and NPW demands based on 2022 meter usage, which included daily and some limited hourly meter data. This model includes the systems pressurized by the East and West Milavec Reservoir pumping stations, but does not include the golf course pump houses and irrigation piping

(beyond the scope of this report). The gravity pipes to the Bella Rosa Golf Course ponds are also not included since the WaterGEMS analysis is most beneficial for pressurized piping. The East and West Milavec Pump Stations were modeled using pump and operating information provided by the Town.

Based on review of the meter data, a peaking factor of eight times the average daily demand is utilized in the model to estimate the peak-hour demand for users directly connected to the NPW system. The Town does not currently limit the days or times for NPW irrigation. For the Future Conditions Hydraulic Model and based on direction from Town staff, it is assumed future developments will be required to construct ponds to store the NPW received from the system prior to being pumped for irrigation. This allows for reduced peak instantaneous demands delivered from the Town's system for future conditions.



Frederick Non-potable Water System, Existing Model Screenshot

7.2.2 Current Conditions Hydraulic Model

The Current Conditions Hydraulic Model is based on existing infrastructure and metered irrigation demands for each user. Two scenarios were run with the current model based on criteria shown in Table 7-1. Pressures throughout the distribution system for those scenarios were above the acceptable minimum standard of 20 psi at the point of use. Therefore, no pump upgrades are needed to meet current demands.

Table 7-1 NPW Hydraulic Model Demand Scenarios

Scenario No.	Demand Scenario	Non-Potable Water Demands
1	Average Daily	Based on 2022 Meter Usage
2	Peak Hour	8 x Avg. Daily

A higher peaking factor was applied to the West Pump Station portion of the system as a sensitivity test to attempt to replicate the low water availability in the eastern portion of the system during high demand times as reported by Town staff. Even at this extreme peak factor, the hydraulic model maintained acceptable pressures. Therefore, it is recommended that the Town conduct field investigations to confirm mapping accuracy, and ensure valves are fully open and no line blockages exist to resolve the reported low water availability for users on the east end of the system.

7.2.3 Short-Term Improvements & Buildout Conditions Hydraulic Model

A hydraulic model for future conditions is a planning tool that aids in sizing infrastructure with adequate capacity to irrigate parks and open spaces within the Town's planning boundary. Information from the Town's Comprehensive Plan, pending Comprehensive Plan Update, 2008 Raw Water Master Plan, 10-Year Water Resources Plan and Land Use Map were analyzed to understand where and how areas of expected growth can best be served by existing and future infrastructure.

Future conditions were modeled in two phases. To accommodate the Town's short-term transition of most of the existing parks and open spaces from potable to non-potable irrigation, a Short-Term Improvements model was developed. For the second future phase, Buildout Conditions were modeled to include NPW demands created from future developments.

The timing of the future phases will likely overlap, and be progressive in nature, resulting in additional interim phases that are difficult to accurately predict. Therefore, the hydraulic models should be re-evaluated regularly to confirm NPW infrastructure for each future development is designed to meet the cumulative irrigation needs for their respective timings.

<u>Short-Term Improvements Hydraulic Model</u>

This model includes all existing demands while also incorporating selected potable water demands for parks and open spaces that will be transitioned to non-potable irrigation.

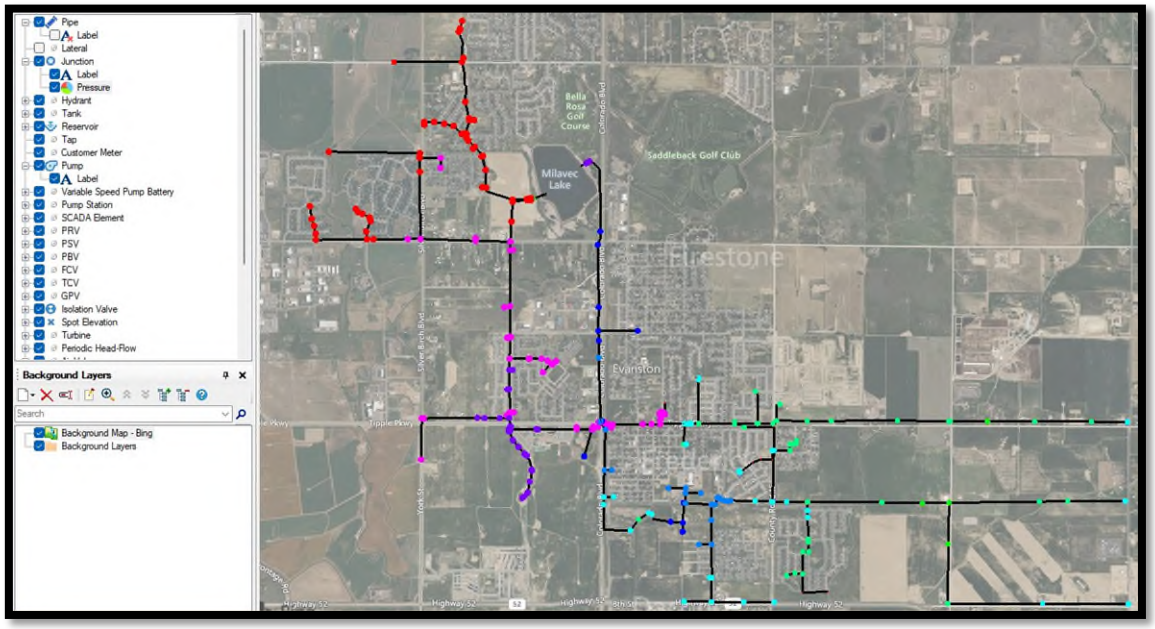
The Centennial Park pump house was upgraded in the model to meet Short-Term Conditions and to position it as a regional pump station in the ultimate Buildout Condition model. In the Short-Term model, the service area for the Centennial Park Pump Station expands east to the

Savannah neighborhood, and the pump station's NPW distribution system is interconnected with the existing NPW line on Ridgeway Boulevard to provide redundancy for the Tipple Parkway NPW system. To meet the Short-Term Conditions demand, the Centennial Park Pump Station is upgraded to a minimum 960 gpm capacity.

The same flow scenarios shown in Table 7-1 were used to analyze the Short-Term Conditions model. Although the main pump at the East Milavec Pump Station is large enough to meet the demands for this Short-Term model condition, it is recommended a second main pump be installed for redundancy, and a smaller pressure-sustaining pump be installed to meet smaller demands. The West Milavec Pump Station was upgraded in 2024 with two additional main pumps, so no upgrades are needed. With the recommended pump upgrades described above, required demands and pressures are met.

Buildout Conditions Hydraulic Model

The Buildout Conditions hydraulic model includes the demands in the Short-Term model, plus estimated irrigation demands for future development. This model was validated using the same flow scenarios described in Table 7-1 with one difference. Demands added due to future development were all assumed, based on discussions with Town staff, to have irrigation ponds as was recommended in the 2008 Raw Water Master Plan. Therefore, a lower peak-hour demand factor of 1.5 times the Average Daily demand is applied since the water can be stored prior to being pumped from the pond, providing flow equalization for the system.

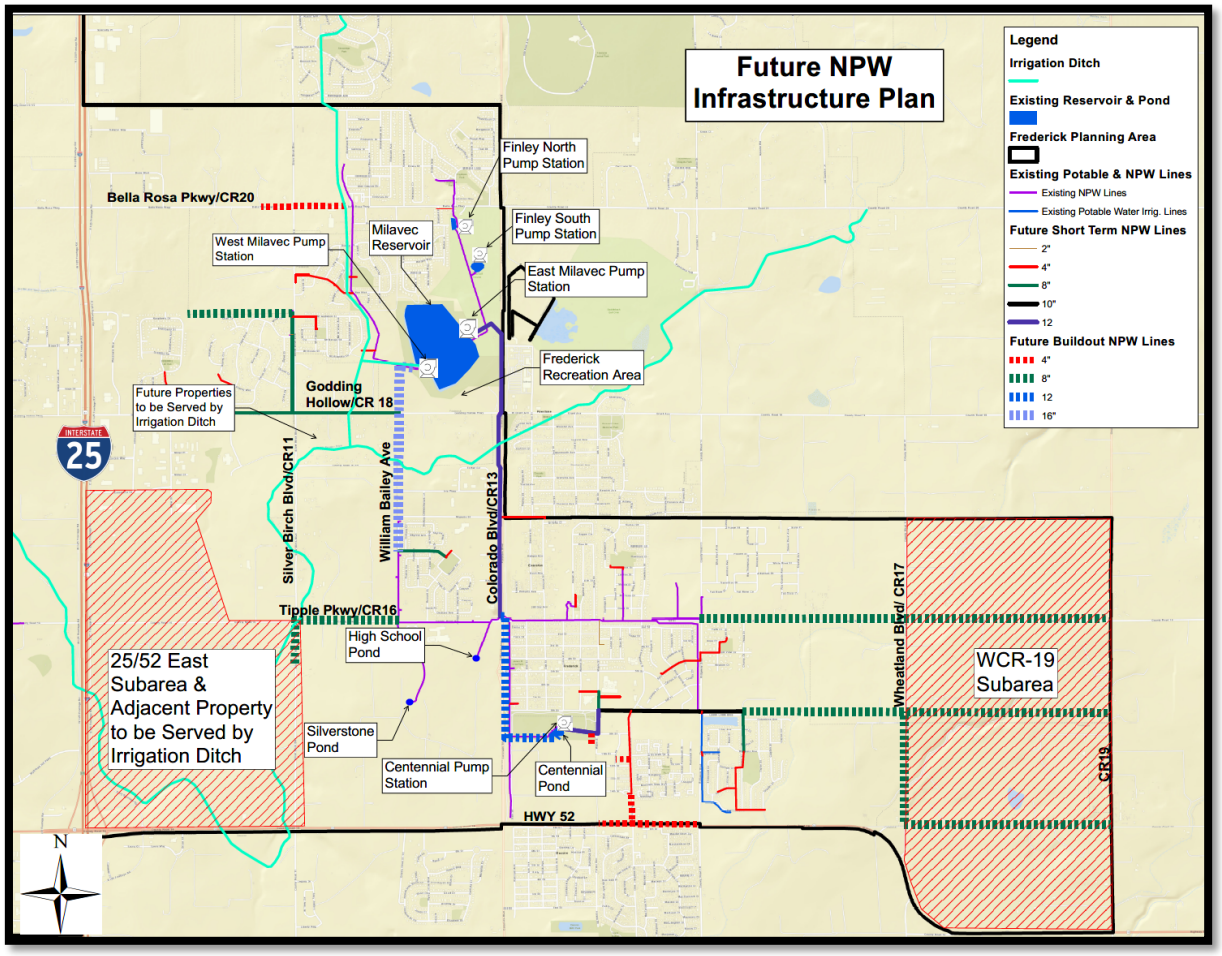


Frederick Non-potable Water System, Buildout Conditions Model Screenshot

To serve buildout described in Section 5, NPW main extensions are planned as development occurs within the Town's planning boundaries on the east side of I-25. These NPW

extensions and associated demands were added to the model to develop the Buildout Conditions model. Major future infrastructure improvements are shown in Figure 7.1. See the Appendix for a full-size copy of the Figure 7.1 map.

Figure 7.1 Future Buildout NPW Infrastructure Plan



With much of the future growth occurring within the eastern portion of the Town planning boundary, the Centennial Park Pump Station and the East Milavec Pump Station (that transfers water from Milavec Reservoir to the pond at Centennial Park) both require upgrades to meet buildout conditions. The capacity of the East Milavec Pump Station is upgraded from its current capacity of 850 gpm to 1542 gpm, and the Centennial Park Pump Station is also upgraded to 1542 gpm to meet the outputs calculated by the model.

The existing 8-inch NPW line along Colorado Boulevard between the East Milavec Pump Station and Tipple Parkway is upgraded to 12-inch diameter. As demands increase towards buildout, it will also be necessary to upgrade the 8-inch pipe to 12-inch south of Tipple Parkway and extending to the Centennial Park irrigation pond. Additionally, as demands increase and approach buildout, the valve sizes inside the West Milavec Pump Station need to

be replaced with larger valves, and the existing 10-inch NPW line, from the West Milavec Pump Station which extends south to Grimson Street, will be upgraded to a 16-inch line. Alternatively, a parallel 12-inch NPW line could be installed. With these recommended piping and pump upgrades, required demands and pressures in the Buildout Conditions model were met.

Table 7-2 below provides a summary of the recommended NPW infrastructure improvements identified through the hydraulic model simulations. There will likely be interim phases between the Short-Term and Buildout conditions. Therefore, the timing of development and NPW demands for the associated parks and open spaces should be carefully evaluated to determine if additional infrastructure upgrades are needed to accommodate each development.

Table 7-2 Summary of NPW Infrastructure Improvements

Demand Scenario	East Milavec Pump Station	West Milavec Pump Station	Centennial Park Pump Station	Distribution Piping Modifications
Current	None required	[1]None required	None required	None required
Short-Term	Add main 960-gpm pump and pressure sustaining pump	None	Increase capacity to 960 gpm	[2]NPW line extensions to existing parks and open spaces
Buildout	Increase capacity to 1542 gpm	Increase pipe and valve sizes	Increase capacity to 1542 gpm	[2]Upgrade Colorado Blvd NPW line from 8" to 12", upgrade NPW line from West Milavec Pump Station to Grimson St from 10" to 16", extend NPW lines to future growth areas

[1]The West Milavec Pump Station was upgraded in 2024 with installation of two additional 1340-gpm pumps to supplement the one existing 1345-gpm pump. This table is based on these three pumps being operational.
[2]Although the existing 8-inch NPW line on Colorado Boulevard is adequate to meet Short-Term demands, this pipe north of Tipple Pkwy has been recommended as a Short-Term infrastructure upgrade. Therefore, when this pipe is replaced in the Short-Term it will be upgraded to 12-inch diameter to meet Buildout demands.

7.3 Pressure Zones

Frederick's current NPW system is divided into four pressure zones. The Bella Rosa Golf Course is supplied by gravity from Milavec Reservoir to the Finley North and South Ponds, creating a gravity or low-pressure zone. The other three pressure zones are created by the discharge piping from the East and West Milavec Pump Stations, and the Centennial Park Pump House. The West Milavec and Centennial Park Pump Station pressure zones are expanded for the Short-Term and Buildout conditions. Properties adjacent to the Lower Boulder Ditch are planned to be served with raw water directly from the ditch to irrigation ponds. Pressure zones for the Short-Term and Buildout NPW systems are shown in Figures 7.2 and 7.3.

Figure 7.2 Short-Term Improvements Model – Pressure Zones

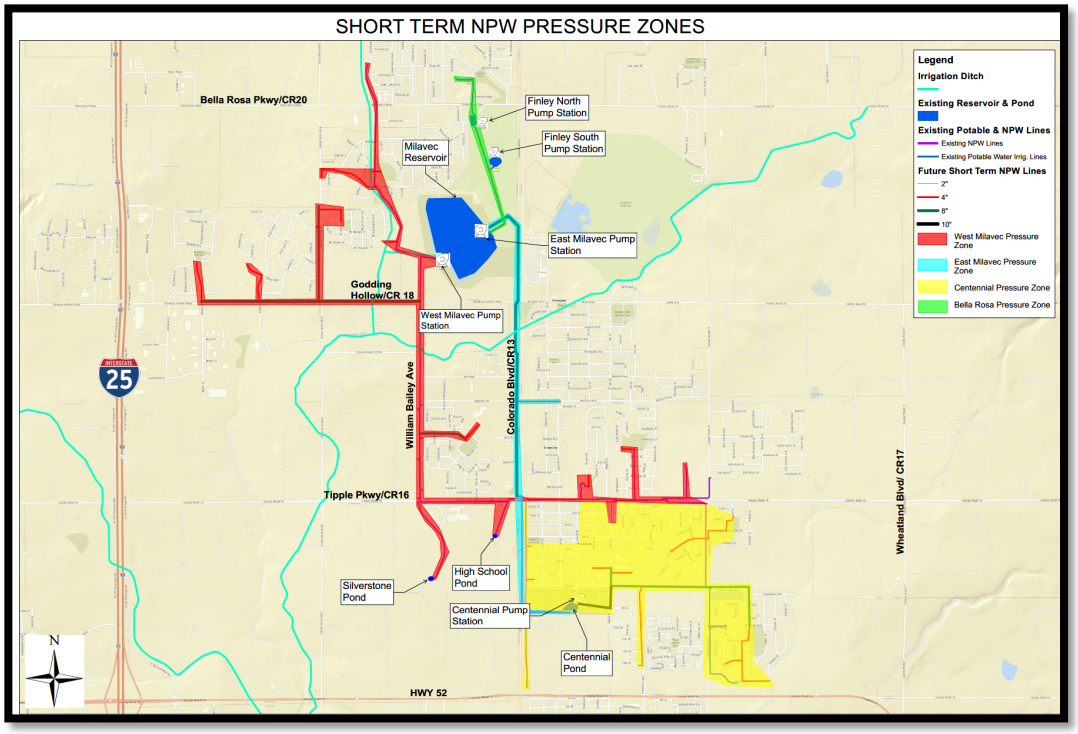
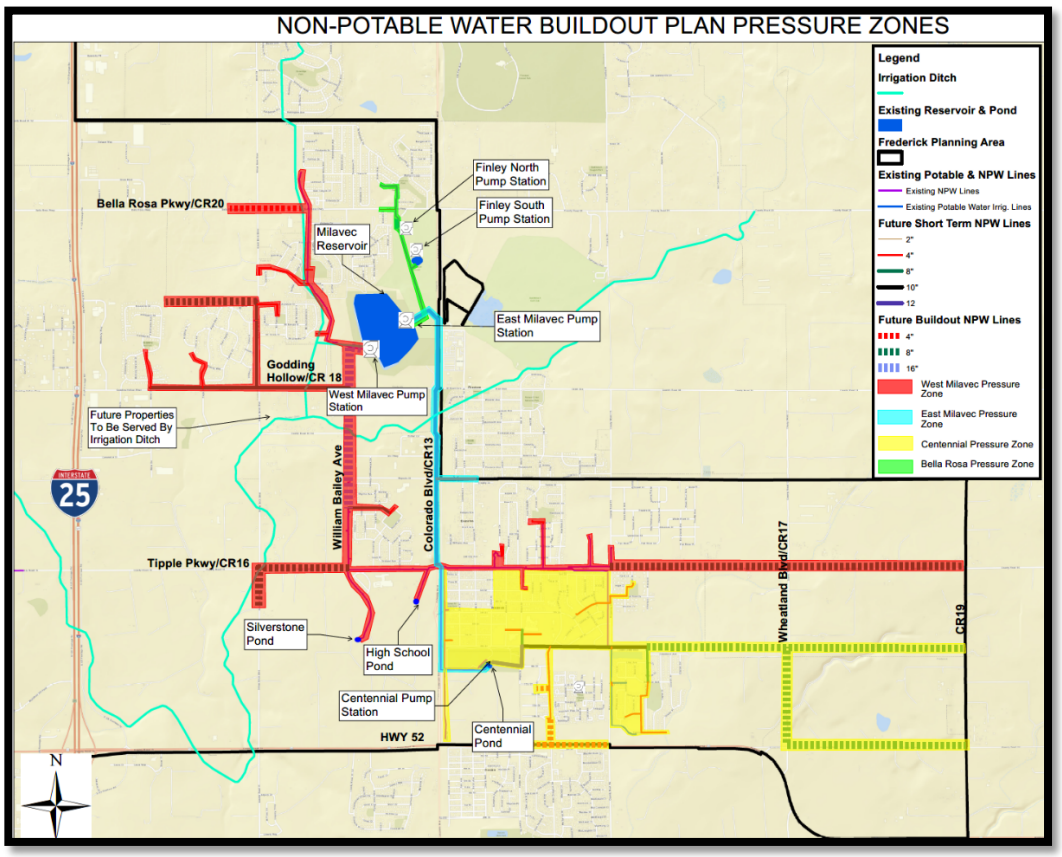


Figure 7.3 Buildout Model – Pressure Zones



8.0 CAPITAL IMPROVEMENTS PLAN

The planned NPW system expansions shown in Figure 7.2 for Future Build-Out will be dependent on the timing of development planning and construction. To achieve the Town's goal to irrigate additional existing parks and open spaces with NPW instead of potable water, a Short-Term Capital Improvements Plan (CIP) has been developed to expand NPW to the 30 property areas identified in Figure 5.1 of Section 5. The timing of the Short-Term CIP will depend on funding availability.

8.1 Short-Term Capital Improvements Plan

The Short-Term CIP includes 22 projects as shown in the map in Figure 8.1. All NPW infrastructure projects are east of I-25. A full-size copy of the map is included in the Appendix. Refer to Table 8-1 for project names corresponding to the project numbers in Figure 8.1.

Figure 8.1 Short-Term NPW Capital Improvements Projects

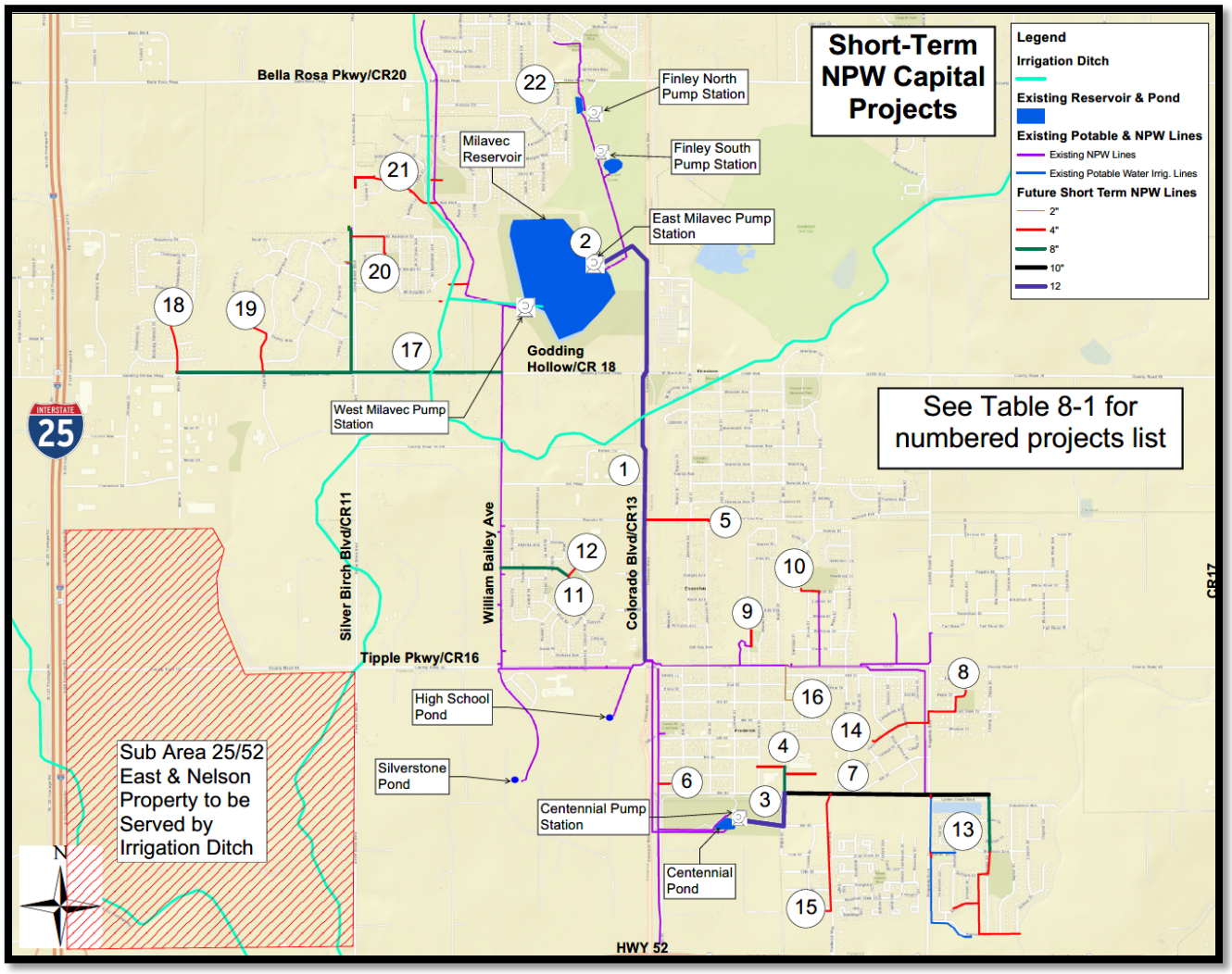


Table 8-1 Short-Term Capital Improvements Projects

Project No.	Project Name	Location
1	Colorado Blvd NPW Pipe Replacement	Colorado Blvd, north of Tipple Pkwy
2	East Milavec Pump Station Upgrade	Milavec Reservoir, Fred. Rec Area
3	Centennial Park PS Upgrade & North NPW Line	Centennial Park
4	Thunder Valley Area Athletic Fields	Thunder Valley & Carbon Valley Rec Fields
5	Village at Frederick	McClure Avenue, east of Colorado Blvd
6	Grove Townhomes	East of Main Street
7	Centennial Park to Ridgeway Blvd NPW	East of Centennial Park, to Ridgeway Blvd
8	Angel View Estates	East of Ridgeway Blvd
9	Firefighters Park	Aspen Drive
10	Coal Ridge Estates	Warwick Street
11	Countryside	Russell Circle
12	Rocky Mountain Christian Church	Majestic Street
13	Savannah	Leyden Creek Blvd/Ralston Street
14	Maplewood Filing #5	Spruce Court
15	Carriage Hills	14th Street
16	Maplewood Filing #2	Maple Street
17	West Milavec NPW Transmission Main	Godding Hollow Road
18	Raspberry Hill	Miller Drive
19	Eagle Valley	Eagle Blvd
20	Summit View Estates	Silver Birch Blvd
21	Fox Run	Fox Run Blvd
22	Moore Farm Open Space	Bella Rosa Parkway

Notes:

1. Refer to Figure 8.1 for project map with corresponding project numbers.

8.2 Short-Term Capital Projects

The projects listed in Table 8-1 have been divided into four tiers, primarily based on locations within the service area, and in some cases the proximity of the properties to existing NPW lines. Preliminary Opinions of Probable Cost (POPC) are provided for each project, along with their respective estimated NPW demand. Detailed POPCs are provided in the Appendix.

8.2.1 Tier 1 Projects

The Tier 1 projects include upgrades to existing infrastructure and extension of NPW to the athletic fields at the Thunder Valley K-8 school, the adjacent preschool, and the nearby ballfield on Locust Street. These fields have a high irrigation demand and are in close proximity to Centennial Park, allowing them to be cost-effectively connected to NPW. Other Tier 1 projects extend NPW to open spaces at the Village at Frederick and Grove Townhomes.

Existing infrastructure upgrades include replacement of the 8-inch Colorado Boulevard NPW line with a 12-inch line, and upgrades to the East Milavec and Centennial Park Pump Stations. The Centennial Park Pump Station Upgrade may be partially funded by the developer of Miners Park Town Centre, located south of Centennial Park. The developer is considering the relocation of the pond and pump station, which would require the construction of a new pump station building.

Table 8-2 below lists the recommended Tier 1 projects and their respective estimated costs and irrigation demands.

**Table 8-2 Tier 1 NPW Projects,
Preliminary Opinions of Probable Costs and Irrigation Demands**

Project No.	Project	Preliminary Opinion of Probable Cost	NPW Demand (AFY)
1	Colorado Blvd AC Pipe Replacement	$3,340,000	N/A
2	East Milavec Pump Station Upgrade	$710,000	N/A
3	Centennial Park Pump Station Upgrade & North NPW Line	$2,167,000	N/A
4	Thunder Valley Athletic Fields	$337,000	21.2
5	Village at Frederick	$643,000	1.4
6	Grove Townhomes	$162,000	2.8
	TOTAL	**$7,359,000**	**25.4**

8.2.2 Tier 2 Projects

An important Tier 2 project is a proposed transmission main, supplied by the Centennial Park Pump Station, that extends east from Centennial Park to Ridgeway Boulevard, connecting to the Town's existing 8-inch NPW line on Ridgeway Boulevard. This Ridgeway Boulevard connection allows NPW to supplied north to Tipple Parkway, improving reliability for the existing Tipple Parkway NPW line that has experienced some past issues with supplying adequate irrigation. This transmission main will supply NPW to both Tier 2 and Tier 3 projects.

Other Tier 2 projects extend NPW lines to existing parks and open spaces on the east side of Frederick, and also to Countryside Park and Rocky Mountain Christian Church from the existing NPW line on William Bailey Avenue. Table 8-3 below lists the recommended Tier 2 projects and their respective estimated costs and irrigation demands.

Table 8-3 Tier 2 NPW Projects,
Preliminary Opinions of Probable Costs and Irrigation Demands

Project No.	Project	Preliminary Opinion of Probable Cost	NPW Demand (AFY)
7	Centennial Park to Ridgeway Blvd	$1,073,000	N/A
8	Angel View Estates	$382,000	2.7
9	Firefighters Park	$103,000	2.9
10	Coal Ridge Estates	$200,000	13.1
11	Countryside	$967,000	10.0
12	Rocky Mountain Christian Church	$115,000	12.3
	TOTAL	**$2,840,000**	**41.0**

8.2.3 Tier 3 Projects

Tier 3 projects extend NPW to properties in the eastern portion of the service area, with the largest irrigation demand being parks and open spaces in the Savannah residential development. To reduce project costs, Town staff suggested an existing potable water line on Ridgeway Boulevard that is currently dedicated to irrigation of open spaces in Savannah be repurposed as a NPW line. This is recommended provided Town staff field verifies that there are no drinking water service connections on this line.

If it is confirmed there are no service connections, the pipe should be physically disconnected from the potable water system and instead connected to the NPW system. Some open spaces within the Savannah project are not currently irrigated but are included for NPW irrigation as recommended by Town staff due to their potential for future irrigation. Other Tier 3 projects include NPW line extensions to Carriage Hills, and Maplewood Filings No. 2 and No. 5.

Table 8-4 lists the recommended Tier 3 projects and their respective estimated costs and irrigation demands.

**Table 8-4 Tier 3 NPW Projects,
Preliminary Opinions of Probable Costs and Irrigation Demands**

Project No.	Project	Preliminary Opinion of Probable Cost	NPW Demand (AFY)
13	Savannah	$1,727,000	28.2
14	Maplewood Filing No. 5	$390,000	2.1
15	Carriage Hills	$738,000	2.2
16	Maplewood Filing No. 2	$269,000	1.2
	TOTAL	**$3,124,000**	**33.7**

8.2.4 Tier 4 Projects

The projects included in Tier 4 are supplied with NPW from the West Milavec Pump Station, and extend to the northern portion of the service area, north of Godding Hollow Road. There is currently no NPW infrastructure west of William Bailey Avenue. The largest Tier 4 project is a NPW transmission main connects to the existing NPW main at the intersection of William Bailey Avenue and Godding Hollow Road, and extends west along Godding Hollow Boulevard to the Raspberry Hill development. This transmission main also supplies NPW to the Eagle Valley and Summit View Estates developments. Other Tier 4 projects connect to existing NPW lines to provide irrigation water to Fox Run and Moore Farm open spaces. Table 8-5 lists the recommended Tier 4 projects and their respective estimated costs and irrigation demands.

**Table 8-5 Tier 4 NPW Projects,
Preliminary Opinions of Probable Costs and Irrigation Demands**

Project No.	Project	Preliminary Opinion of Probable Cost	NPW Demand (AFY)
17	West Milavec NPW Transmission Main	$1,941,000	N/A
18	Raspberry Hill	$518,000	13.9
19	Eagle Valley	$550,000	7.0
20	Summit View Estates	$1,345,000	6.5
21	Fox Run	$663,000	9.7
22	Moore Farm	$285,000	6.0
	TOTAL	**$5,302,000**	**43.1**

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 Master Plan Summary

East Milavec Pump Station

Based on feedback from Town staff and review of pipe ages, most of the Town's NPW infrastructure appears to be in sound condition, with relatively long remaining useful pipeline lives and minimal history of pipe failures. The only NPW line recommended for replacement in the short-term is the 8-inch pipe between the East Milavec Pump Station and Tipple Parkway. It is recommended this older pipe be replaced with a new 12-inch pipe to accommodate higher water demands forecasted for the future. Upgrades to the East Milavec Pump Station and Centennial Pump House are recommended. These piping and pump station improvements are incorporated into the recommended Short-Term Capital Improvements Plan.

The hydraulic model indicates adequate pressures are met throughout the NPW system. Town staff reported issues with meeting irrigation demands at the east end of Tipple Parkway, but the hydraulic model produced adequate pressure results. Follow-up discussions with Town staff indicate that a blockage was discovered and eliminated, and that the system operation has improved. It is recommended the Town continue to monitor this situation.

Water planning studies conducted by the Town in recent years identify a need to preserve potable water supplies by utilizing more NPW for irrigation of parks and open spaces. The Town's 2022 Water Efficiency Plan includes a goal of converting 76 AFY from potable to non-potable water irrigation by 2030. This Master Plan recommends Short-Term Capital Improvements to deliver NPW to additional properties throughout Town that far exceeds this 76 AFY goal.

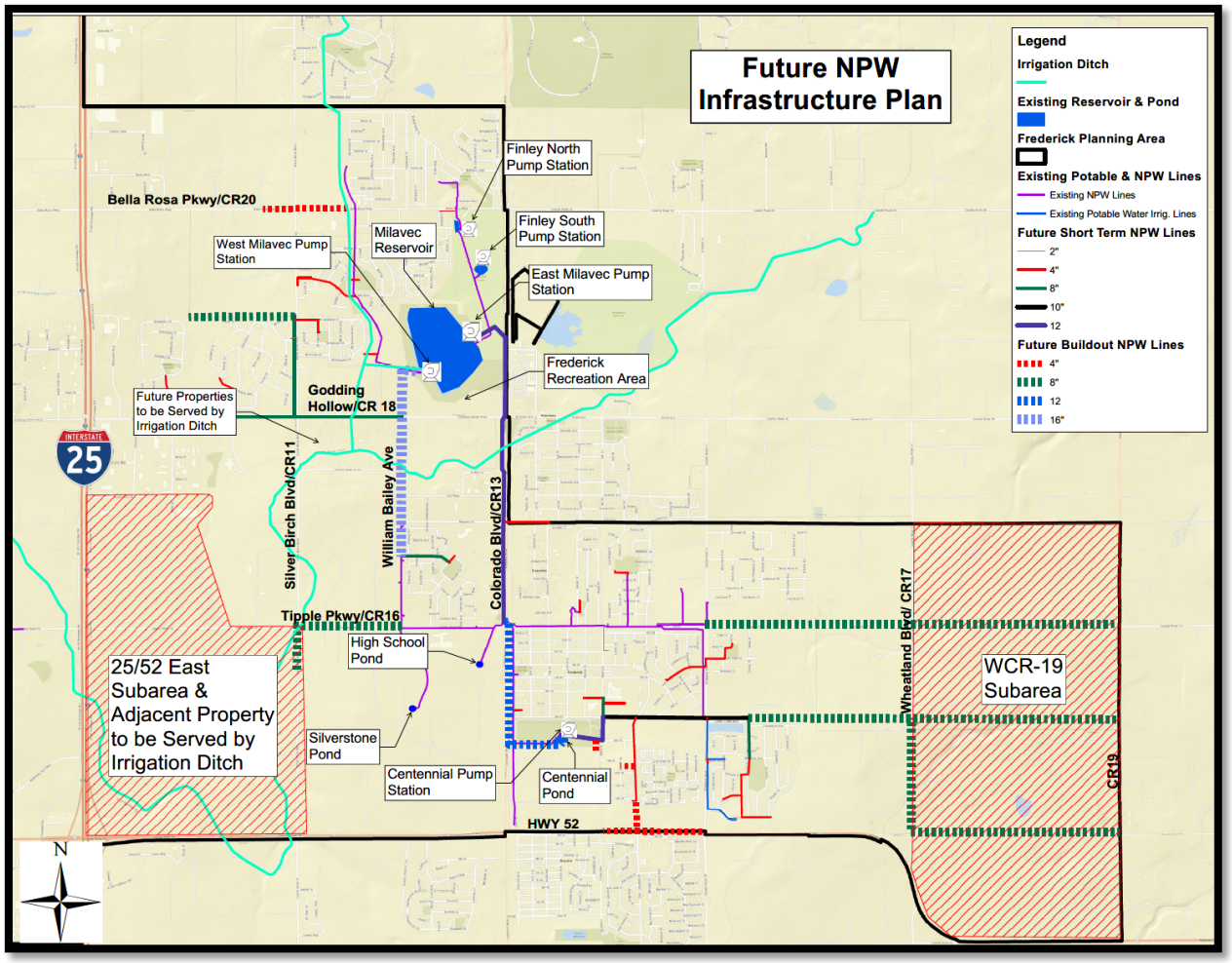
Future growth within Frederick's planning area will result in construction of additional parks and open spaces in accordance with Town requirements. Through buildout, anticipated around the year 2070, an irrigation demand of over 1,500 AFY is estimated for future development, which includes 1,161 AFY east of I-25, and 360 AFY on the west side of the interstate. Table 9-1 provides a summary of the current, short-term, and buildout NPW demands. It is recommended that these future parks and open spaces be irrigated with NPW instead of potable water.

Table 9-1 NPW Irrigation Demand Summary

Description	Est. NPW Demand (AFY)
Existing NPW System	452
Short-Term Future Demand	143
Future Build-out, East of I25	1,161
Future Build-out, West of I25	360
Total	**2,116**

General locations for future Short-Term and Build-out NPW lines east of I-25 are shown in Figure 9.1. Land close to the Lower Boulder Ditch east of I-25 is proposed to be served by diversions from the ditch. Properties on the west side of I-25 are to be served directly from several existing irrigation ditches, and will therefore not require construction of new infrastructure.

Figure 9.1 Future Buildout NPW Infrastructure Plan



A Short-Term Capital Improvements Plan is provided in Section 8, with estimates of project costs totaling approximately $18.63 million to deliver an estimated 146 AFY of NPW to irrigate parks and open spaces. Table 9-2 provides a summary of the estimated costs and NPW demands. The timing of the Short-Term Improvements will depend on availability of funding.

Table 9-2 Short-Term Capital Improvements
Total Estimated Costs and NPW Demands

Project Group	Preliminary Opinion of Probable Cost	NPW Demand (AFY)
Tier 1 Projects	$7,359,000	25.4
Tier 2 Projects	$2,840,000	41.0
Tier 3 Projects	$3,124,000	33.7
Tier 4 Projects	$5,302,000	43.1
TOTAL	**$18,625,000**	**143.2**

The timing of other recommended future infrastructure through buildout of the planning area will driven by development. Town planning and engineering staff will be able to utilize the information in this Master Plan to require that developers construct NPW lines as shown, and adequately sized to sustain future development.

9.2 Cost-Effectiveness of NPW Infrastructure Expansion

To determine the cost-effectiveness of the Short-Term Improvements projects that convert potable irrigation to NPW, estimated costs can be compared to the cost of purchasing Colorado-Big Thompson (C-BT) water units, which is the Town's primary potable water supply. The current cost of one C-BT unit is approximately $70,000, and is equivalent to 0.6 AFY. The total estimated NPW demand of 143.2 AFY is therefore equivalent to 238.67 C-BT units, which have a current value of approximately $16,706,900. This value is less than the total estimated cost of the Short-Term Improvements projects, but the cost of C-BT units will likely increase with inflation, which will bring the two values closer.

Also, the first two Tier 1 projects (Projects No. 1 and 2) can be considered maintenance projects and when these projects are excluded from the cost comparison, the total estimated costs decrease to $14,575,000, which is significantly less than the $16,706,900 value of the equivalent C-BT units. There is also the potential for a portion of the Centennial Park Pump Station Upgrade (Project No. 3) to be funded by the developer of Miner's Park Town Centre, which would further reduce the Town's costs for the projects.

A more detailed analysis was performed to evaluate each NPW line extension project on an individual basis to determine its cost-effectiveness comparing equivalent C-BT value to quantity of irrigation water. There are six projects estimated to cost greater than the current $70,000 per C-BT unit cost. The Town may wish to consider alternatives to constructing these NPW line extensions,

such as turf replacement or xeriscape landscaping modifications to reduce or eliminate potable water usage. Table 9-3 below provides C-BT unit cost comparisons for the projects.

Table 9-3 Short-Term Capital Improvements
Cost Comparison to Equivalent C-BT Units

No.	Project	Est. Cost (Million $)	Demand (AFY)	Est. Equiv C-BT Units	Approx. Equiv C-BT Cost (Million $)	Est. Cost per Equiv. C-BT Unit
Tier 1						
1	Colorado Blvd Pipe Replacement	$3.34	0	0	N/A	
2	Milavec East Pump St. Upgrade	$0.71	0	0	N/A	
3	Centennial PS & North NPW Line	$2.17	0	0	N/A	
4	Thunder Valley Sports Fields	$0.34	21.2	35.33	$2.47	$9,623
5	Village at Frederick	$0.64	1.4	2.33	$0.16	$274,286
6	Grove Townhomes	$0.16	2.8	4.67	$0.33	$34,286
	Subtotal	**$7.36**	**25.4**	**42.33**	**$2.96**	
Tier 2						
7	Centennial Park to Ridgeway	$1.07	0	0	N/A	
8	Angel View Estates	$0.38	2.7	4.50	$0.32	$84,444
9	Firefighters Park	$0.10	2.9	4.83	$0.34	$20,690
10	Coal Ridge Estates	$0.20	13.1	21.83	$1.53	$9,160
11	Countryside	$0.97	10.0	16.67	$1.17	$58,200
12	Rocky Mt Christian Church	$0.12	12.3	20.50	$1.44	$5,854
	Subtotal	**$2.84**	**41.0**	**68.33**	**$4.78**	
Tier 3						
13	Savannah	$1.73	28.2	47.00	$3.29	$36,809
14	Maplewood Filing 5	$0.39	2.1	3.50	$0.25	$111,429
15	Carriage Hills	$0.74	2.2	3.67	$0.26	$201,818
16	Maplewood Filing 2	$0.27	1.2	2.00	$0.14	$135,000
	Subtotal	**$3.13**	**33.7**	**56.17**	**$3.94**	
Tier 4						
17	West Milavec NPW Transm Main	$1.94	0		N/A	
18	Raspberry Hill	$0.52	13.9	23.17	$1.62	$22,446
19	Eagle Valley	$0.55	7.0	11.67	$0.82	$47,143
20	Summit View Estates	$1.35	6.5	10.83	$0.76	$124,615
21	Fox Run	$0.66	9.7	16.17	$1.13	$40,825
22	Moore Farm	$0.29	6.0	10.00	$0.70	$29,000
	Subtotal	**$5.31**	**43.1**	**71.90**	**$5.03**	
	GRAND TOTALS	**$18.64**	**143.2**	**238.67**	**$16.71**	**$78,101**

Notes:

1. One C-BT unit = 0.6 AF, at current cost of $70,000 per C-BT unit.
2. Individual projects with costs greater than $70,000 per C-BT unit denoted in red.

9.3 Public Engagement

An on-line public survey was developed to allow citizens the opportunity to voice their input into this Non-Potable Water Infrastructure Master Plan. Table 9-3 summarizes the public's priority issues and describes how this Master Plan generally addresses each topic.

Table 9-3 Summary of Public Input

Topic	How Topic is Addressed in Master Plan
Utilize NPW for irrigation	Recommends expanding NPW system to irrigate existing and future parks and open spaces.
Water Quality	Recommends continuing efforts to improve water quality at Milavec Reservoir, and recommends filtration be added at the Centennial Pump Station.
Affordability of water	NPW infrastructure for parks and open spaces in future developments are recommended to be paid for by the developers.
Low-water landscaping	Master Plan irrigation demand estimates are based on using more native grasses and landscaping for future parks and open spaces.

9.4 Potential Funding Sources

NPW infrastructure may not be eligible for grant and low-interest loan programs that have historically been used for potable water and wastewater projects. Funding options for NPW infrastructure may be limited to issuance of municipal bonds. The Town is currently in the process of completing a water rate study that is expected to incorporate the costs for Short-Term NPW Capital Improvements.

9.5 Recommendations

Preserving Frederick's potable water supply is critical to sustainability. The Short-Term Capital Improvements to expand the Town's NPW system will provide a significant amount of potable water savings. With the rapid pace of development in Frederick, it is important that both potable and non-potable water system improvements are planned to reliably meet both present and future needs. This Non-Potable Water Infrastructure Master Plan will be a valuable tool for Town staff to reference in their review of new development requests to ensure that new infrastructure provides long-term reliability, while also being consistent with the Town's land use and comprehensive plan goals.

Future non-potable water infrastructure recommended and shown in this Master Plan is intended to provide minimum requirements for future infrastructure to aid the Town in future development reviews. One important design criteria item is the requirement that future developments construct irrigation ponds to reduce peak irrigation demands delivered by the Town's NPW infrastructure. The peak demands in the Master Plan are based on these future ponds being constructed to provide the storage needed to reduce peak demands delivered by the Town's main pump stations.

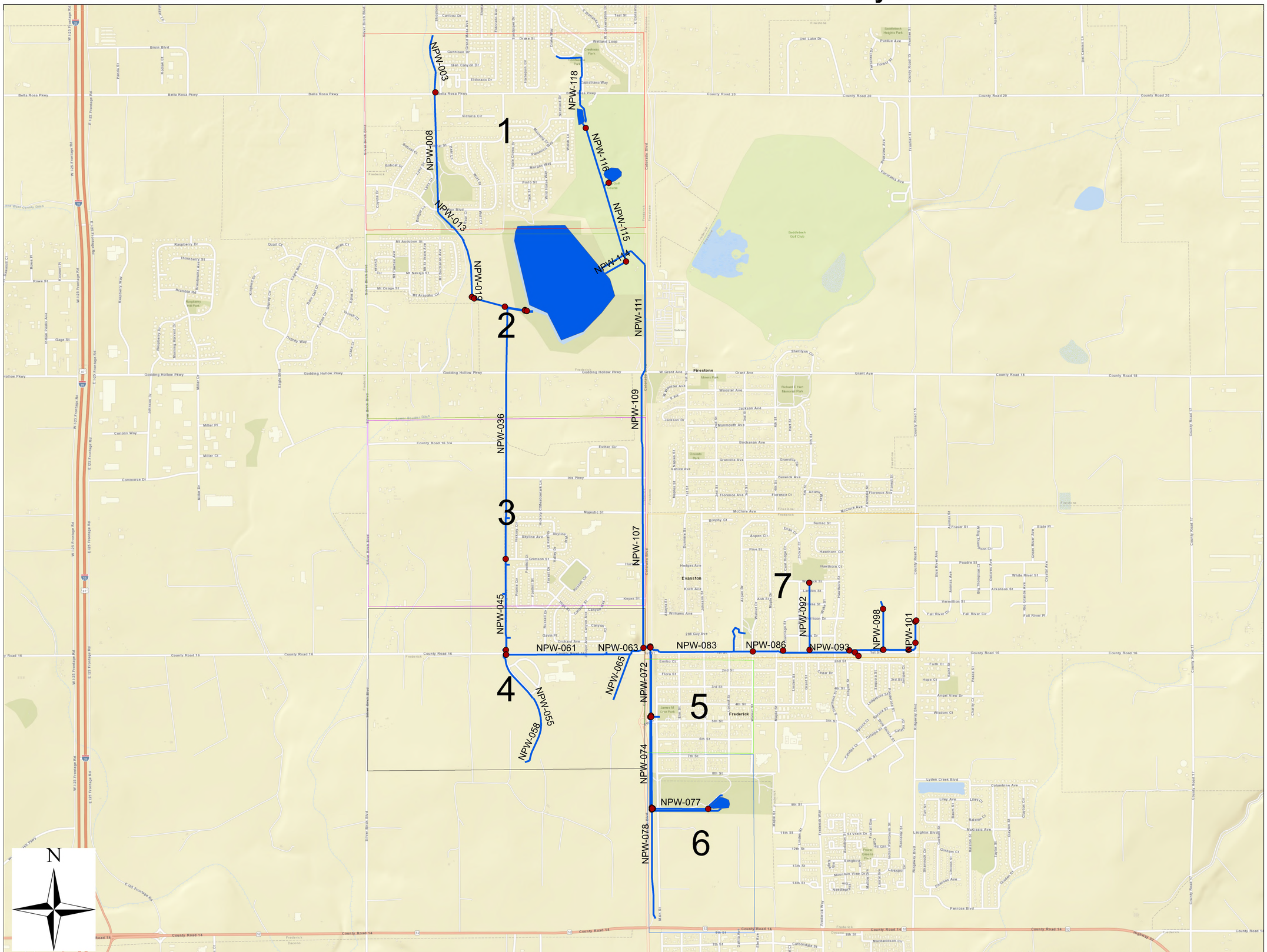
It is the responsibility of developers to design and construct the necessary NPW infrastructure based on the most recent available information at the time of development, and in accordance with all Town of Frederick policies, guidelines, codes, rules, and regulations. It is also recommended that developers be responsible for the associated costs of the NPW infrastructure.

Centennial Park, Chainsaws and Chuckwagons Festival

APPENDICES

APPENDIX A

Town of Frederick Non-Potable Water System Grid



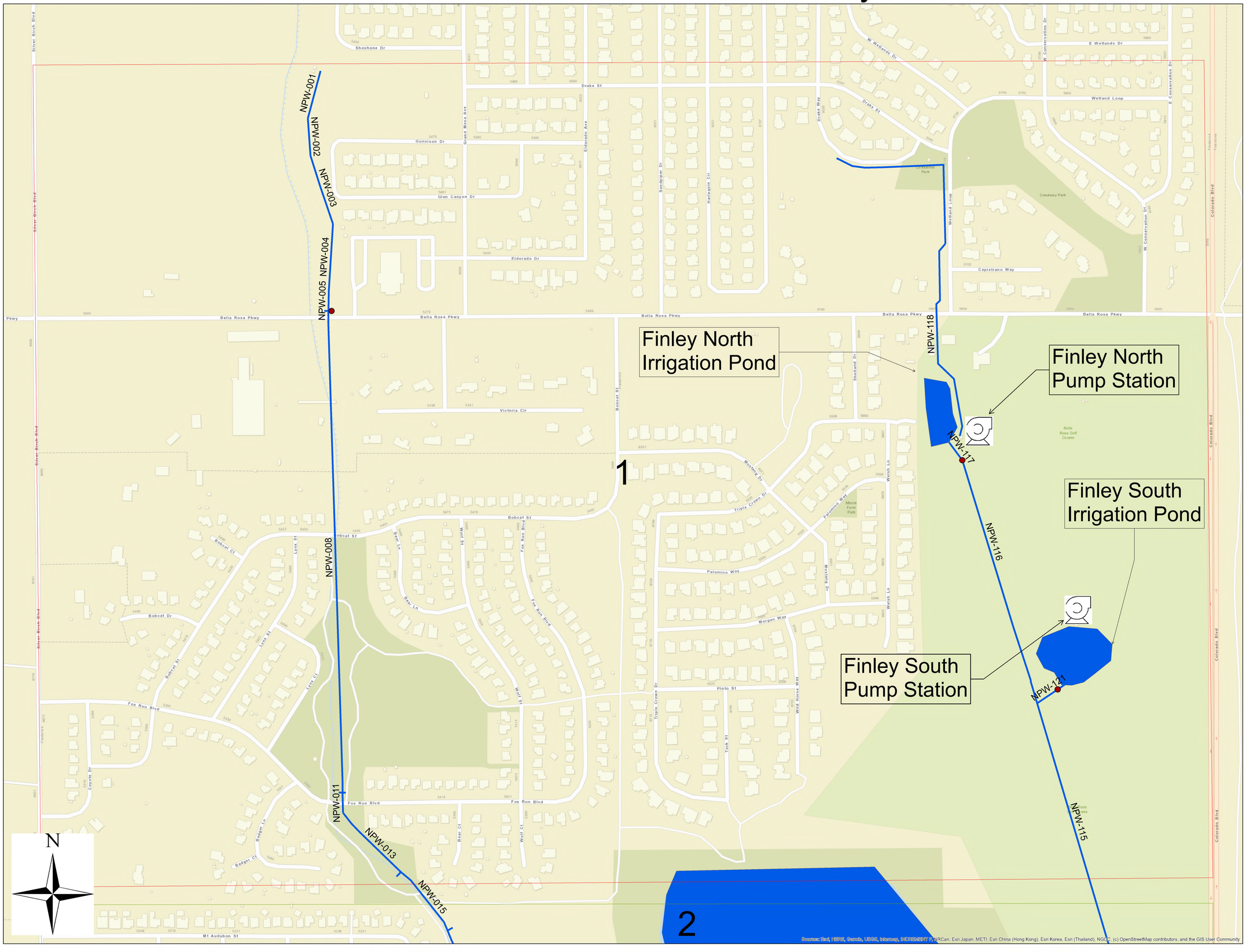
Legend

Raw Water Valves

Non-Potable Water Lines

Map Index

Town of Frederick Non-Potable Water System Grid



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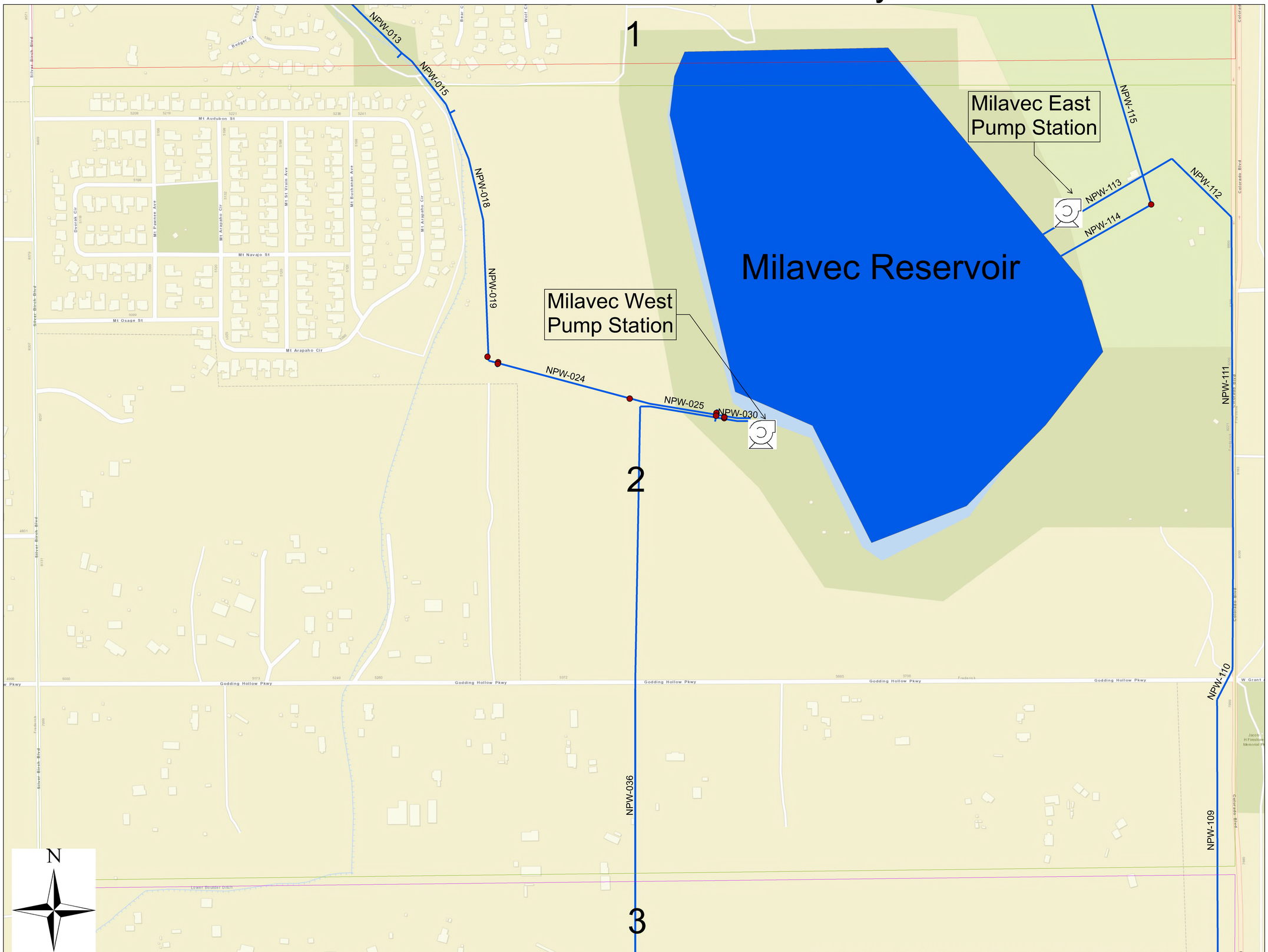
Raw Water Valves

Non-Potable Water Lines

Town of Frederick Non-Potable Water System Grid



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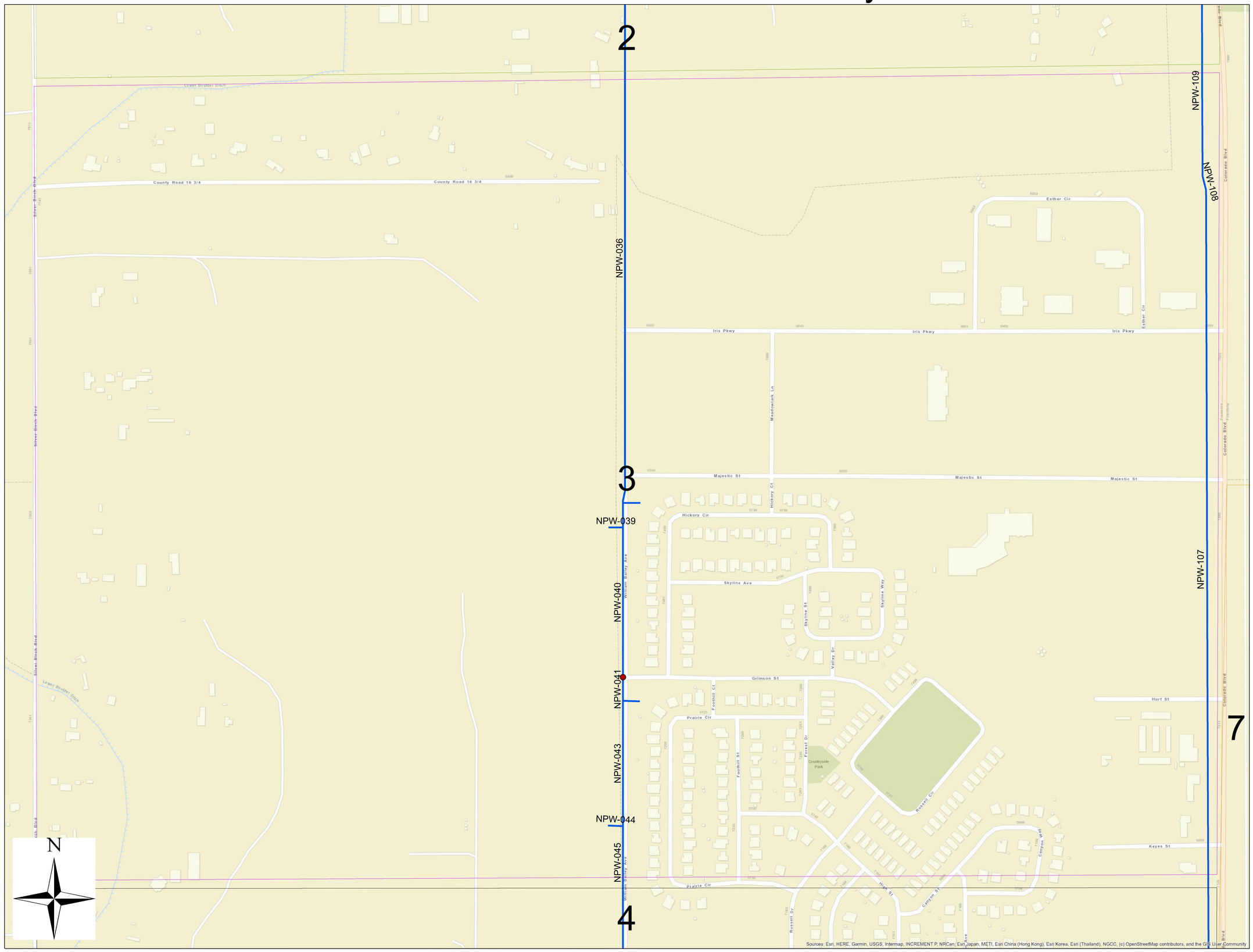
Raw Water Valves

Non-Potable Water Lines

Town of Frederick Non-Potable Water System Grid



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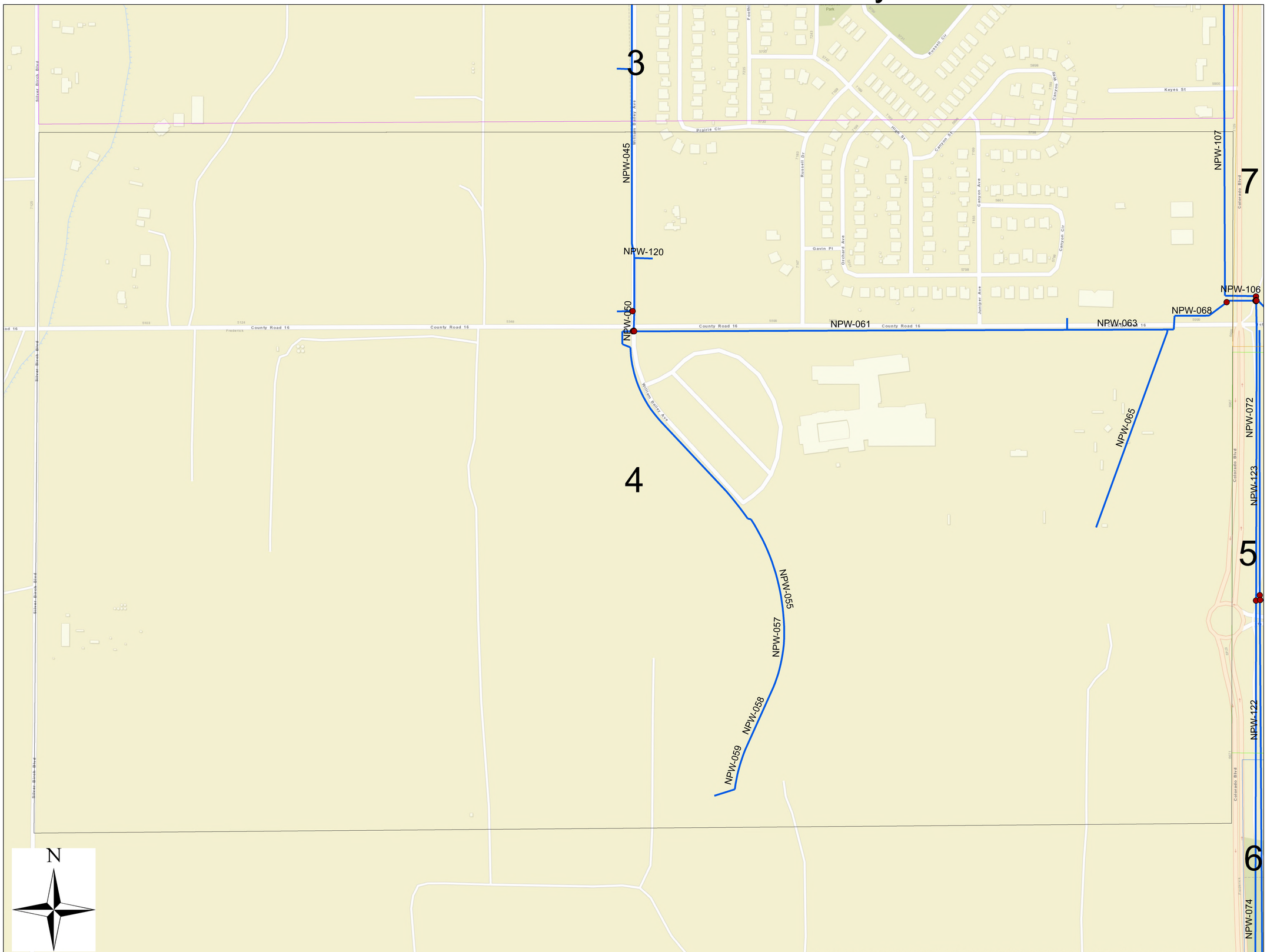
Raw Water Valves

Non-Potable Water Lines

Town of Frederick Non-Potable Water System Grid



Legend

Raw Water Valves

Non-Potable Water Lines

Town of Frederick Non-Potable Water System Grid

7

4

5

6

NPW-072

NPW-123

NPW-073

NPW-074

NPW-122

Emilio Ct

Flora St

2nd St

3rd St

4th St

5th St

6th St

Elm St

Oak St

Locust St

Walnut St

Main St

Colorado Blvd

James M Crist Park

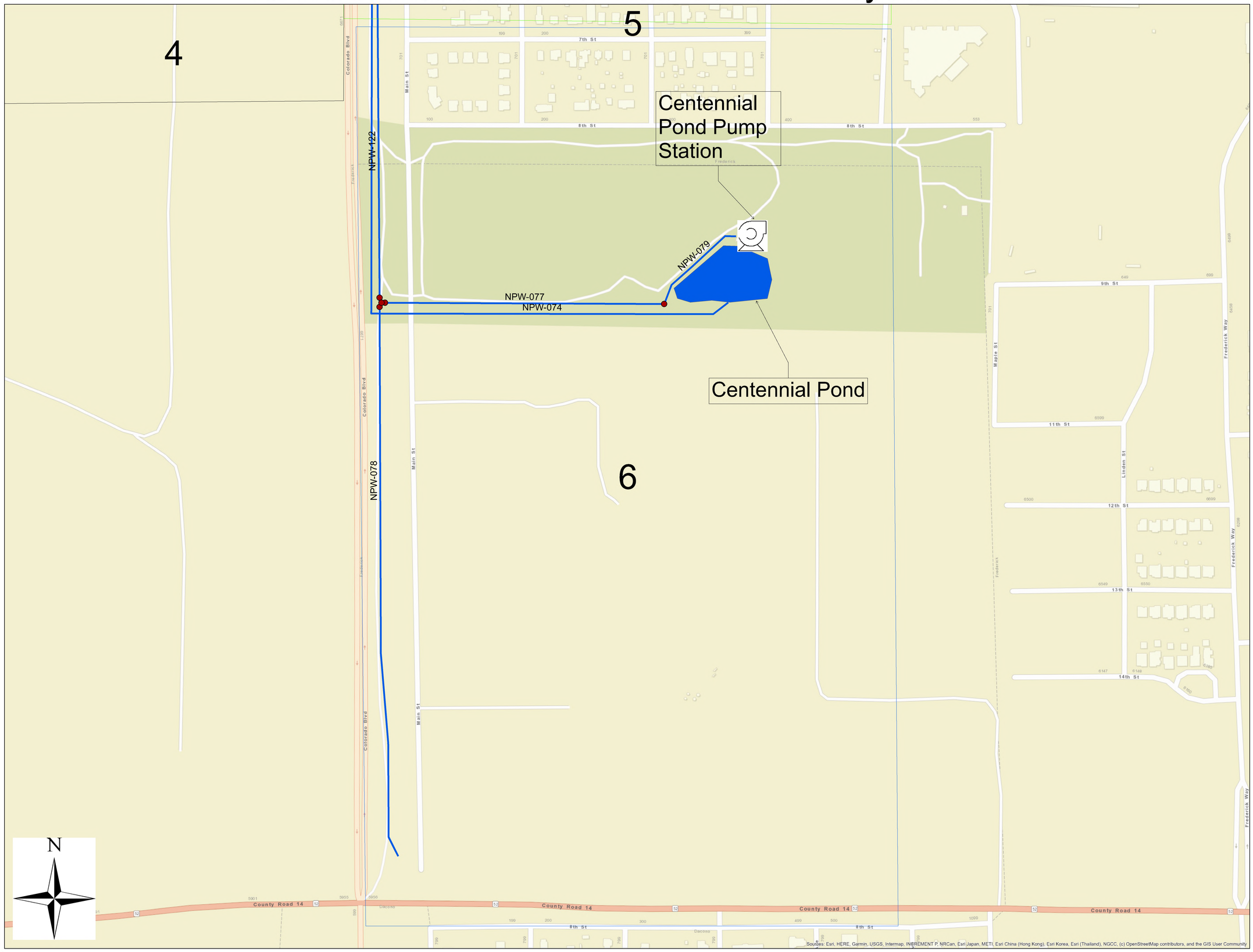
N

Legend

Raw Water Valves

Non-Potable Water Lines

Town of Frederick Non-Potable Water System Grid



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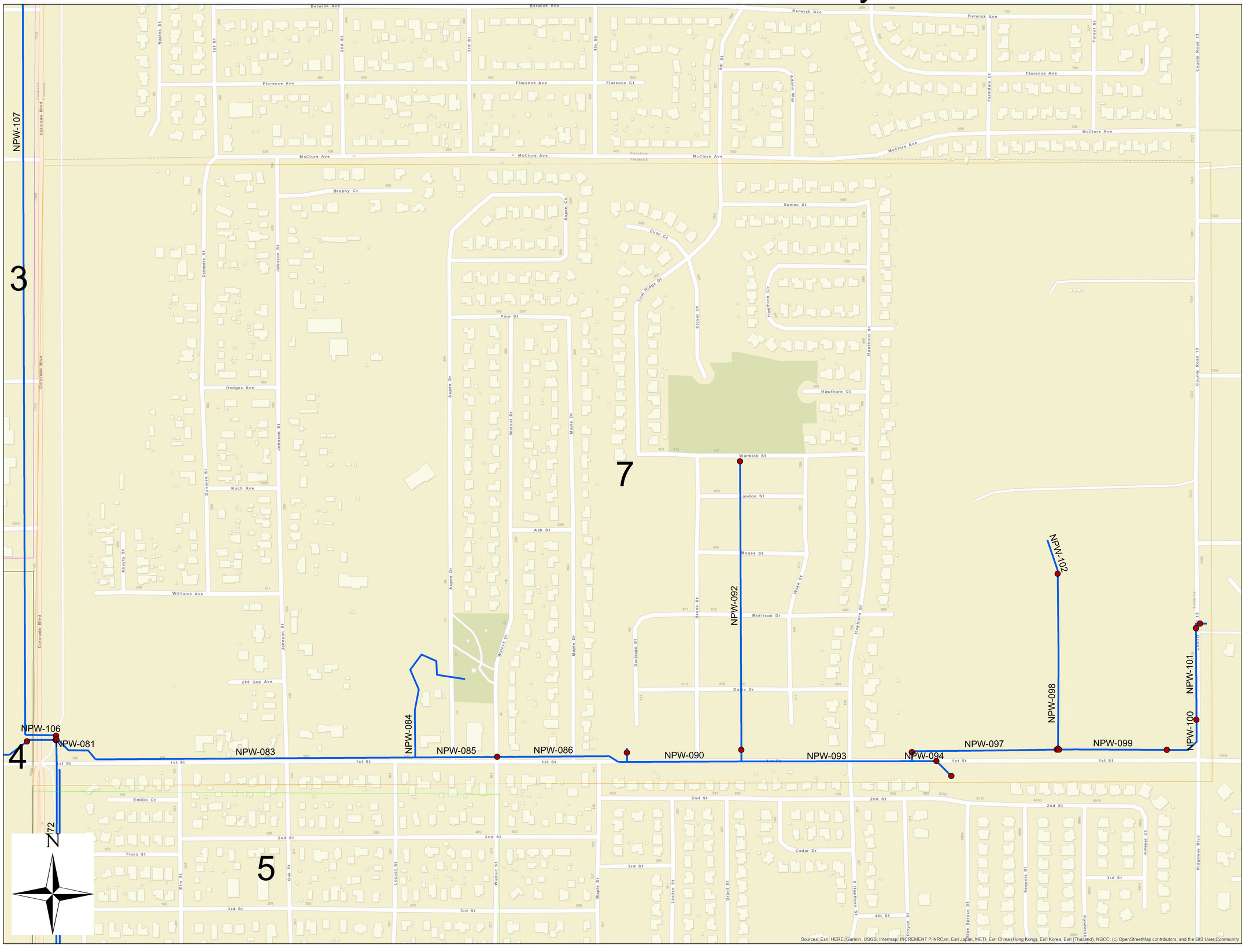
Raw Water Valves

Non-Potable Water Lines

Town of Frederick Non-Potable Water System Grid



Legend

Raw Water Valves

Non-Potable Water Lines

APPENDIX B

Town of Frederick Non-Potable Water System Condition Assessment
September 2024

Pipe Ratings

Pipe Data							Reliability Ratings			
System Type	Line Segment	Size	Material	Approx. Installation Date	Age (yrs)	Remaining Useful Life (yrs)	Pipe Condition	Criticality	Vulnerability	Total Rating
Pressurized	NPW-001	4"	PVC	2017	7	93	1	2	1	**4**
Pressurized	NPW-002	4"	PVC	2017	7	93	1	2	1	**4**
Pressurized	NPW-003	4"	PVC	2017	7	93	1	2	1	**4**
Pressurized	NPW-004	4"	PVC	2017	7	93	1	2	1	**4**
Pressurized	NPW-005	4"	PVC	2017	7	93	1	2	1	**4**
Pressurized	NPW-006	6"	PVC	2017	7	93	1	1	1	**3**
Pressurized	NPW-007	6"	PVC	2017	7	93	1	1	1	**3**
Pressurized	NPW-008	6"	PVC	2017	7	93	1	3	1	**5**
Pressurized	NPW-009	4"	PVC	2017	7	93	1	2	1	**4**
Pressurized	NPW-010	4"	PVC	2017	7	93	1	2	1	**4**
Pressurized	NPW-011	8"	PVC	2017	7	93	1	3	1	**5**
Pressurized	NPW-012	8"	PVC	2017	7	93	1	3	1	**5**
Pressurized	NPW-013	8"	PVC	2017	7	93	1	3	1	**5**
Pressurized	NPW-014	8"	PVC	2017	7	93	1	2	1	**4**
Pressurized	NPW-015	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-016	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-017	4"	PVC	2017	7	93	1	1	1	**3**
Pressurized	NPW-018	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-019	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-020	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-021	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-022	6"	PVC	2017	7	93	1	1	1	**3**
Pressurized	NPW-023	6"	PVC	2017	7	93	1	1	1	**3**
Pressurized	NPW-024	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-025	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-026	6"	PVC	2017	7	93	1	1	1	**3**
Pressurized	NPW-027	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-028	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-029	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-030	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-031	4"	PVC	2017	7	93	1	1	1	**3**
Pressurized	NPW-032	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-033	6"	PVC	2017	7	93	1	1	1	**3**
Pressurized	NPW-034	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-035	10"	PVC	2017	7	93	1	4	1	**6**
Pressurized	NPW-036	10"	PVC	2008	16	84	1	4	1	**6**
Pressurized	NPW-037	10"	PVC	2008	16	84	1	4	1	**6**
Pressurized	NPW-038	10"	PVC	2008	16	84	1	4	1	**6**
Pressurized	NPW-039	Unknown	PVC	Unknown	Unkn	Unknown	1	1	1	**3**
Pressurized	NPW-040	10"	PVC	2008	16	84	1	4	1	**6**
Pressurized	NPW-041	10"	PVC	2008	16	84	1	4	1	**6**
Pressurized	NPW-042	Unknown	PVC	Unknown	Unkn	Unknown	1	1	1	**3**
Pressurized	NPW-043	10"	PVC	2008	16	84	1	4	1	**6**
Pressurized	NPW-044	Unknown	PVC	Unknown	Unkn	Unknown	1	1	1	**3**
Pressurized	NPW-045	10"	PVC	2008	16	84	1	4	1	**6**
Pressurized	NPW-046	10"	PVC	2008	16	84	1	4	1	**6**

Pressurized	NPW-047	10"	PVC	2008	16	84	1	4	1	**6**
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Pressurized	NPW-050	10"	Unknown	Unknown	Unkn	Unknown	1	4	1	**6**
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Pressurized	NPW-055	8"	Unknown	2020	4	Unknown	1	3	1	**5**
Pressurized	NPW-056	8"	Unknown	2020	4	Unknown	1	3	1	**5**
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Pressurized	NPW-065	4"	PVC	2012	12	88	1	3	1	**5**
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Pressurized	NPW-067	8"	PVC	2008	16	84	1	3	0	**4**
Pressurized	NPW-068	8"	PVC	2008	16	84	1	3	0	**4**
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Pressurized	NPW-070	8"	PVC	2008	16	84	1	3	0	**4**
Pressurized	NPW-071	8"	PVC	2008	16	84	1	3	0	**4**
Pressurized	NPW-072	8"	PVC	Unknown	Unk	Unknown	1	3	0	**4**
Pressurized	NPW-073	4"	PVC	2002	22	78	1	2	1	**4**
Pressurized	NPW-074	8"	PVC	2008	16	84	1	4	0	**5**
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Pressurized	NPW-076	6"	PVC	2008	16	84	1	1	0	**2**
Pressurized	NPW-077	6"	PVC	2008	16	84	1	2	0	**3**
Pressurized	NPW-078	4"	PVC	Unknown	Unk	Unknown	1	2	2	**5**
Pressurized	NPW-079	6"	PVC	2008	16	84	1	2	0	**3**
Pressurized	NPW-080	8"	PVC	2008	16	84	1	3	1	**5**
Pressurized	NPW-081	8"	PVC	2008	16	84	1	3	1	**5**
Pressurized	NPW-082	8"	PVC	2008	16	84	1	3	1	**5**
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Pressurized	NPW-084	4"	PVC	2013	11	89	1	2	0	**3**
Pressurized	NPW-085	8"	PVC	2008	16	84	1	3	0	**4**
Pressurized	NPW-086	8"	PVC	2008	10	90	1	3	0	**4**
Pressurized	NPW-087	8"	PVC	2014	10	90	1	3	0	**4**
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Pressurized	NPW-092	8"	PVC	2017	7	93	1	1	0	**2**
Pressurized	NPW-093	8"	PVC	2014	10	90	1	3	0	**4**
Pressurized	NPW-094	8"	PVC	2014	10	90	1	3	0	**4**
Pressurized	NPW-095	8"	PVC	2014	10	90	1	3	0	**4**
Pressurized	NPW-096	6"	PVC	2018	11	89	1	3	0	**4**
Pressurized	NPW-097	8"	PVC	2018	6	94	1	3	0	**4**
Pressurized	NPW-098	8"	PVC	2018	6	94	1	2	0	**3**
Pressurized	NPW-099	8"	PVC	2020	4	96	1	3	0	**4**

Pressurized	NPW-100	8"	PVC	2020	4	96	1	3	0	**4**
Pressurized	NPW-101	8"	PVC	2020	4	96	1	2	0	**3**
Pressurized	NPW-102	8"	PVC	2018	6	94	1	2	0	**3**
Pressurized	NPW-103	8"	PVC	2020	4	96	1	2	0	**3**
Pressurized	NPW-104	8"	PVC	2020	4	96	1	2	0	**3**
Pressurized	NPW-105	8"	PVC	2002	22	78	1	4	1	**6**
Pressurized	NPW-106	8"	PVC	2002	22	78	1	4	1	**6**
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Pressurized	NPW-108	8"	AC	1978	46	24	2	4	3	**9**
Pressurized	NPW-109	8"	AC	1978	46	24	2	4	3	**9**
Pressurized	NPW-110	8"	AC	1978	46	24	2	4	3	**9**
Pressurized	NPW-111	8"	AC	1978	46	24	2	4	3	**9**
Pressurized	NPW-112	8"	AC	1978	46	24	2	4	3	**9**
Pressurized	NPW-113	8"	AC	1978	46	24	2	4	3	**9**
Gravity	NPW-114	8"	PVC	2004	20	80	1	3	0	**4**
Gravity	NPW-115	8"	PVC	2004	20	80	1	3	0	**4**
Gravity	NPW-116	8"	PVC	2004	20	80	1	3	0	**4**
Gravity	NPW-117	8"	PVC	2004	20	80	1	3	0	**4**
Pressurized	NPW-118	4"	PVC	2011	13	87	1	2	0	**3**
Pressurized	NPW-119	6"	PVC	2018	6	94	1	3	1	**5**
Pressurized	NPW-120	Unknown	Copper	2018	6	44	1	1	1	**3**
Pressurized	NPW-121	Unknown	PVC	2004	20	80	1	3	1	**5**
Pressurized	NPW-122	4"	PVC	2008	16	84	1	2	0	**3**
Pressurized	NPW-123	2"	PVC	2008	16	84	1	1	0	**2**
Pressurized	NPW-124	8"	PVC	2020	4	96	1	3	0	**4**

Town of Frederick Non-Potable Water System Condition Assessment
September 2024

Pump Stations and Equipment

Equipment	# of Units	Installation Date	Age (yrs)	Remaining Useful Life (yrs)
East Milavec Pump Station				
60 HP Vertical Turbine Pump	1	2017	7	13
20 HP Vertical Turbine Pump	1	2009	15	5
West Milavec Pump Station				
150 HP Vertical Turbine Pump	1	2016	8	12
7.5 HP Pressure Sust. Pump	1	2016	8	12
Filtomat Filters	2	2016	8	17
Milavec Reservoir Water Treatment				
SolarBee Mixers	3	2020	4	6
Air Injection	2	Unknown	Unkn	Unknown
Centennial Park Pump Station				
40 HP Vertical Turbine Pump	1	2003	21	-

APPENDIX C

NON-POTABLE WATER BUILDOUT PLAN

Future NPW Infrastructure Plan

Finley North Pump Station

Finley South Pump Station

East Milavec Pump Station

West Milavec Pump Station

Milavec Reservoir

Frederick Recreation Area

Bella Rosa Pkwy/CR20

Godding Hollow/CR 18

Future Properties to be Served by Irrigation Ditch

INTERSTATE 25

Silver Birch Blvd/CR11

William Bailey Ave

Colorado Blvd/CR13

Tipple Pkwy/CR16

High School Pond

Silverstone Pond

Centennial Pump Station

Centennial Pond

25/52 East Subarea & Adjacent Property to be Served by Irrigation Ditch

HWY 52

Wheatland Blvd/ CR17

WCR-19 Subarea

CR19

N

Legend

Irrigation Ditch

Existing Reservoir & Pond

Frederick Planning Area

Existing Potable & NPW Lines

- Existing NPW Lines
- Existing Potable Water Irrig. Lines

Future Short Term NPW Lines

- 2"
- 4"
- 8"
- 10"
- 12

Future Buildout NPW Lines

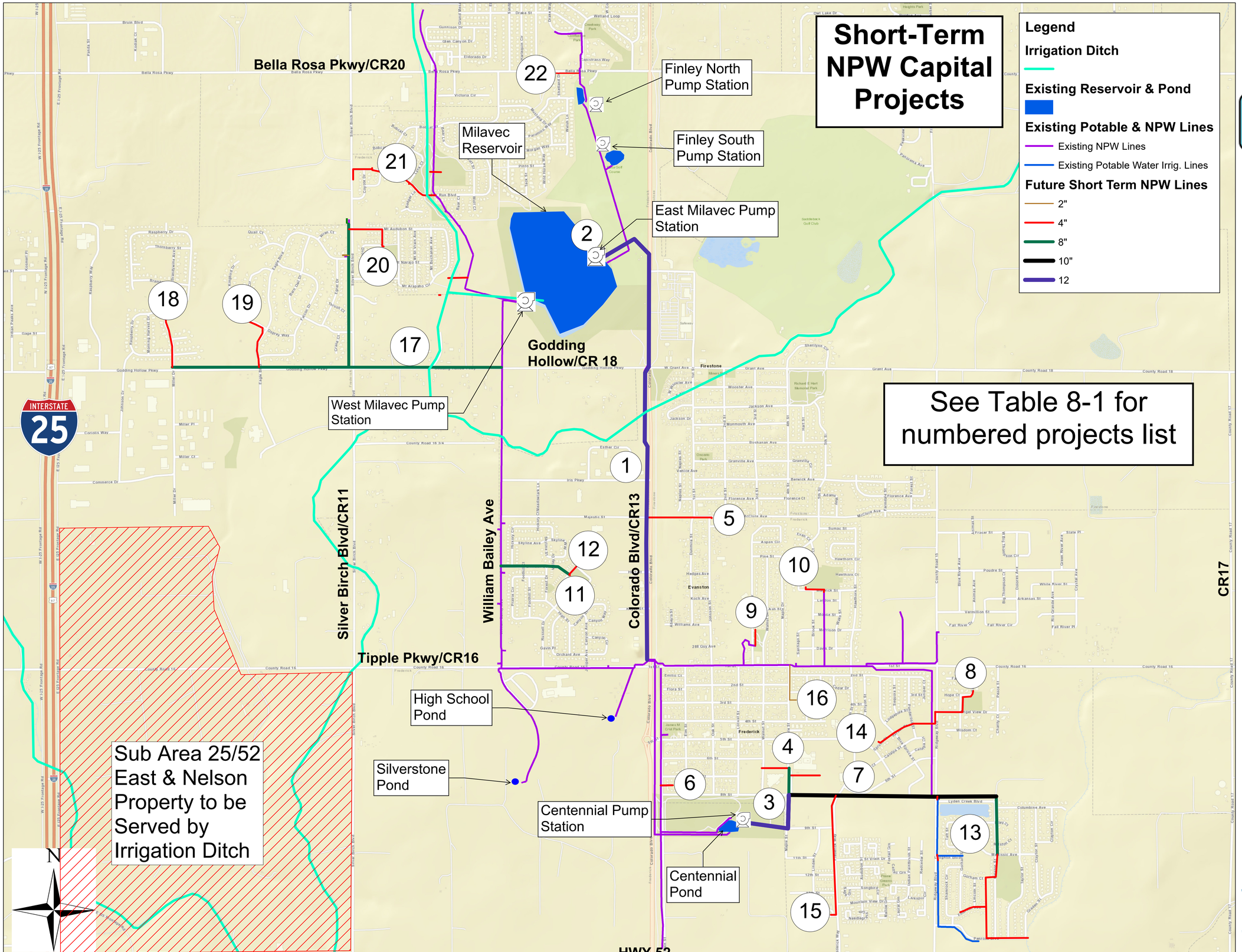
- 4"
- 8"
- 12
- 16"

FREDERICK COLORADO

FORSGREN Associates Inc.

APPENDIX D

SHORT TERM NON-POTABLE WATER CAPITAL PROJECTS



FREDERICK COLORADO

FORSGREN Associates Inc.

APPENDIX E

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #1

Preliminary Opinion of Probable Costs

Colorado Blvd NPW Pipe Replacement

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$200,000	$200,000
2	12" NPW Line	7800	LF	$200	$1,560,000
3	12" Valve	4	LF	$4,500	$18,000
4	Grout existing 8" AC Pipe	200	LF	$20	$4,000
5	Road Crossing (jack & boring)	160	LF	$1,700	$272,000
6	Asphalt Repair	200	SY	$120	$24,000
7	Concrete Repair	10	CY	$800	$8,000
8	Erosion & Sediment control	1	LS	$30,000	$30,000
9	Traffic control	1	LS	$40,000	$40,000
10	Potholing	30	EA	$800	$24,000
11	Material Testing	1	LS	$20,000	$20,000
	Sub Total				**$2,200,000**
	Construction Contingency (30%)			30%	$660,000
	Engineering & Permitting (20%)			20%	$440,000
	Environmental & Geotechnical			$20,000	$20,000
	Easements & ROWs			$20,000	$20,000
	Project Total				**$3,340,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #2

Preliminary Opinion of Probable Costs

East Milavec Pump Station Upgrade

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$43,000	$43,000
2	Backup NPW Pump and Pressure Sustaining Pump	1	EA	$200,000	$200,000
3	Piping and valves	1	LS	$50,000	$50,000
4	Reconfiguration of existing equipment and piping	1	LS	$50,000	$50,000
5	Interior building improvements	1	LS	$30,000	$30,000
5	Electrical	1	LS	$50,000	$50,000
6	Controls and telemetry	1	LS	$50,000	$50,000
	Sub Total				**$473,000**
	Construction Contingency (30%)			30%	$141,900
	Engineering & Permitting (20%)			20%	$94,600
	Environmental & Geotechnical			$0	$0
	Easements & ROWs			$0	$0
	Project Total				**$710,000**

Notes:

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3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #3

Preliminary Opinion of Probable Costs

Centennial Park Pump St Upgrade & North NPW Line

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$57,100	$57,100
2	Centennial Park Pump Station Upgrade	1	LS	$800,000	$800,000
2	12" NPW Line	2000	LF	$210	$420,000
3	12" Valve	2	EA	$4,500	$9,000
4	Asphalt Repair	800	SY	$120	$96,000
6	Concrete Repair	3	CY	$800	$2,400
7	Traffic control	1	LS	$5,000	$5,000
8	Potholing	10	EA	$800	$8,000
9	Erosion & Sediment Control	1	LS	$10,000	$10,000
10	Material Testing	1	LS	$20,000	$20,000
	Sub Total				**$1,427,500**
	Construction Contingency (30%)			30%	$428,300
	Engineering & Permitting (20%)			20%	$285,500
	Environmental & Geotechnical			$15,000	$15,000
	Easements & ROWs			$10,000	$10,000
	Project Total				**$2,167,000**

Notes:

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3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.
5. North NPW extension to south of Thunder Valley K-8 school for NPW connections.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #4

Preliminary Opinion of Probable Costs

Thunder Valley Sports Fields NPW Extensions

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$19,800	$19,800
2	4" NPW Line	1200	LF	$120	$144,000
3	4" Valve	2	EA	$2,500	$5,000
3	Meter Vault	4	EA	$3,000	$12,000
4	Asphalt Repair	80	SY	$120	$9,600
5	Concrete Repair	10	CY	$800	$8,000
6	Erosion & Sediment control	1	LS	$5,000	$5,000
7	Potholing	5	EA	$800	$4,000
8	Traffic Control	1	LS	$5,000	$5,000
9	Materials testing	1	LS	$5,000	$5,000
	Sub Total				**$217,400**
	Construction Contingency (30%)			30%	$65,300
	Engineering & Permitting (20%)			20%	$43,500
	Environmental & Geotechnical			$5,000	$5,000
	Easements & ROWs			$5,000	$5,000
	Project Total				**$337,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #5

Preliminary Opinion of Probable Costs

Village at Frederick NPW Extension

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$37,700	$37,700
2	4" NPW Line	1200	LF	$120	$144,000
3	Road Crossing	100	LF	$1,000	$100,000
4	4" Valve	2	EA	$2,500	$5,000
5	Meter Vault	1	EA	$3,000	$3,000
6	Asphalt Repair	800	SY	$120	$96,000
7	Erosion & Sediment Control	1	LS	$10,000	$10,000
8	Traffic Control	1	LS	$10,000	$10,000
9	Potholing	5	EA	$800	$4,000
10	Materials Testing	1	LS	$5,000	$5,000
	Sub Total				**$414,700**
	Construction Contingency (30%)			30%	$124,500
	Engineering & Permitting (20%)			20%	$83,000
	Environmental & Geotechnical			$10,000	$10,000
	Easements & ROWs			$10,000	$10,000
	Project Total				**$643,000**

Notes:

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3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #6

Preliminary Opinion of Probable Costs

Grove Townhomes NPW Extension

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$9,200	$9,200
2	4" NPW Line	300	LF	$120	$36,000
3	4" Valve	2	EA	$2,500	$5,000
3	Meter Vault	1	EA	$3,000	$3,000
4	Asphalt Repair	30	SY	$120	$3,600
5	Concrete Repair	20	CY	$800	$16,000
6	Erosion & Sediment control	1	LS	$10,000	$10,000
7	Potholing	10	EA	$800	$8,000
8	Traffic Control	1	LS	$5,000	$5,000
9	Materials testing	1	LS	$5,000	$5,000
	Sub Total				**$100,800**
	Construction Contingency (30%)			30%	$30,300
	Engineering & Permitting (20%)			20%	$20,200
	Environmental & Geotechnical			$5,000	$5,000
	Easements & ROWs			$5,000	$5,000
	Project Total				**$162,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #7

Preliminary Opinion of Probable Costs

Centennial Park to Ridgeway Blvd NPW Transmission Line

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$62,600	$62,600
2	10" NPW Line	2600	LF	$200	$520,000
3	10" Valve	2	EA	$4,000	$8,000
4	Asphalt Repair	150	SY	$120	$18,000
5	Concrete Repair	15	CY	$800	$12,000
6	Traffic control	1	LS	$20,000	$20,000
7	Potholing	10	EA	$800	$8,000
8	Erosion & Sediment Control	1	LS	$20,000	$20,000
9	Material Testing	1	LS	$20,000	$20,000
	Sub Total				**$688,600**
	Construction Contingency (30%)			30%	$206,600
	Engineering & Permitting (20%)			20%	$137,800
	Environmental & Geotechnical			$20,000	$20,000
	Easements & ROWs			$20,000	$20,000
	Project Total				**$1,073,000**

Notes:

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2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #8

Preliminary Opinion of Probable Costs

Angel View Estates NPW Extension

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$21,900	$21,900
2	4" NPW Line	1100	LF	$120	$132,000
3	4" Valve	2	EA	$2,500	$5,000
4	Meter Vault	1	EA	$3,000	$3,000
5	Asphalt Repair	340	SY	$120	$40,800
6	Erosion & Sediment Control	1	LS	$10,000	$10,000
7	Traffic Control	1	LS	$10,000	$10,000
8	Potholing	10	EA	$800	$8,000
9	Materials Testing	1	LS	$10,000	$10,000
	Sub Total				**$240,700**
	Construction Contingency (30%)			30%	$72,300
	Engineering & Permitting (20%)			20%	$48,200
	Environmental & Geotechnical			$10,000	$10,000
	Easements and ROWs			$10,000	$10,000
	Project Total				**$382,000**

Notes:

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2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #9

Preliminary Opinion of Probable Costs

Firefighters Park NPW Extension

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$5,900	$5,900
2	4" NPW Line	300	LF	$120	$36,000
3	4" Valve	2	EA	$2,500	$5,000
4	Meter Vault	1	EA	$3,000	$3,000
5	Erosion & Sediment Control	1	LS	$5,000	$5,000
6	Traffic Control	1	LS	$3,000	$3,000
7	Potholing	5	EA	$800	$4,000
8	Materials Testing	1	LS	$3,000	$3,000
	Sub Total				**$64,900**
	Construction Contingency (30%)			30%	$19,500
	Engineering & Permitting (20%)			20%	$13,000
	Environmental & Geotechnical			$5,000	$5,000
	Project Total				**$103,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #10

Preliminary Opinion of Probable Costs

Coalridge Estates NPW Extension

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$11,900	$11,900
2	4" NPW Line	500	LF	$120	$60,000
3	4" Valve	2	EA	$2,500	$5,000
4	Meter Vault	1	EA	$3,000	$3,000
5	Asphalt Repair	270	SY	$120	$32,400
6	Concrete Repair	2	CY	$800	$1,390
7	Erosion & Sediment Control	1	LS	$3,000	$3,000
8	Traffic Control	1	LS	$5,000	$5,000
9	Potholing	5	EA	$800	$4,000
10	Materials Testing	1	LS	$5,000	$5,000
	Sub Total				**$130,690**
	Construction Contingency (30%)			30%	$39,300
	Engineering & Permitting (20%)			20%	$26,200
	Environmental & Geotechnical			$0	$0
	Easements & ROWs			$3,000	$3,000
	Project Total				**$200,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #11

Preliminary Opinion of Probable Costs

Countryside NPW Extension

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$58,300	$58,300
2	8" NPW Line	1800	LF	$180	$324,000
3	4" NPW Line	250	LF	$120	$30,000
4	8" Valve	2	EA	$3,500	$7,000
5	4" Valve	2	EA	$2,500	$5,000
6	Meter Vault	3	EA	$3,000	$9,000
7	Asphalt Repair	1400	SY	$120	$168,000
8	Concrete Repair	2	CY	$800	$1,588
9	Erosion & Sediment Control	1	LS	$10,000	$10,000
10	Traffic Control	1	LS	$10,000	$10,000
11	Potholing	10	EA	$800	$8,000
12	Materials Testing	1	LS	$10,000	$10,000
	Sub Total				**$640,888**
	Construction Contingency (30%)			30%	$192,300
	Engineering & Permitting (20%)			20%	$128,200
	Environmental & Geotechnical			$5,000	$5,000
	Easements & ROWs			$0	$0
	Project Total				**$967,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #12

Preliminary Opinion of Probable Costs

Rocky Mountain Christian Church NPW Extension

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$6,500	$6,500
2	4" NPW Line	300	LF	$120	$36,000
3	4" Valve	2	EA	$2,500	$5,000
4	Meter Vault	1	EA	$3,000	$3,000
5	Asphalt Repair	30	SY	$200	$6,000
6	Concrete Repair	3	CY	$800	$2,400
7	Erosion & Sediment Control	1	LS	$5,000	$5,000
7	Potholing	5	EA	$800	$4,000
8	Materials Testing	1	LS	$3,000	$3,000
	Sub Total				**$70,900**
	Construction Contingency (30%)			30%	$21,300
	Engineering & Permitting (20%)			20%	$14,200
	Environmental & Geotechnical			$3,000	$3,000
	Easements & ROWs			$5,000	$5,000
	Project Total				**$115,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #13

Preliminary Opinion of Probable Costs

Savannah NPW Extension

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$83,400	$83,400
2	10" NPW Line	1100	LF	$200	$220,000
3	8" NPW Line	900	LF	$180	$162,000
4	4" NPW Line	2200	LF	$120	$264,000
5	10" Valve	1	EA	$4,500	$4,500
5	8" Valve	1	EA	$3,500	$3,500
5	4" Valve	2	EA	$2,500	$5,000
6	Meter Vault	5	EA	$3,000	$15,000
7	Asphalt Repair	2500	SY	$120	$300,000
8	Concrete Repair	10	CY	$800	$8,000
9	Erosion & Sediment Control	1	LS	$20,000	$20,000
10	Traffic Control	1	LS	$20,000	$20,000
11	Potholing	15	EA	$800	$12,000
12	Materials Testing	1	LS	$20,000	$20,000
	Sub Total				**$1,137,400**
	Construction Contingency (30%)			30%	$341,300
	Engineering & Permitting (20%)			20%	$227,500
	Environmental & Geotechnical			$20,000	$20,000
	Easements & ROW Acquisition			$10,000	$10,000
	Project Total				**$1,727,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.
5. Entire Savanah neighborhood slated to be slurry sealed in 2025. Coordinate project timeline with asphalt repair

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #14

Preliminary Opinion of Probable Costs

Maplewood FG #5 NPW Extension

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$22,800	$22,800
2	4" NPW Line	1200	LF	$120	$144,000
3	4" Valve	2	EA	$2,500	$5,000
4	Meter Vault	1	EA	$3,000	$3,000
5	Asphalt Repair	400	SY	$120	$48,000
6	Concrete Repair	5	CY	$800	$4,000
7	Erosion & Sediment control	1	LS	$10,000	$10,000
7	Potholing	5	EA	$800	$4,000
8	Traffic Control	1	LS	$5,000	$5,000
9	Materials testing	1	LS	$5,000	$5,000
	Sub Total				**$250,800**
	Construction Contingency (30%)			30%	$75,300
	Engineering & Permitting (20%)			20%	$50,200
	Environmental & Geotechnical			$3,000	$3,000
	Easements & ROWs			$10,000	$10,000
	Project Total				**$390,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #15

Preliminary Opinion of Probable Costs

Carriage Hills NPW Extension

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$44,100	$44,100
2	4" NPW Line	2400	LF	$120	$288,000
3	4" Valve	2	EA	$2,500	$5,000
4	Meter Vault	1	EA	$3,000	$3,000
5	Asphalt Repair	800	SY	$120	$96,000
6	Concrete Repair	20	CY	$800	$16,000
7	Erosion & Sediment control	1	LS	$10,000	$10,000
7	Traffic Control	1	LS	$5,000	$5,000
8	Potholing	10	EA	$800	$8,000
9	Materials testing	1	LS	$10,000	$10,000
	Sub Total				**$485,100**
	Construction Contingency (30%)			30%	$145,600
	Engineering & Permitting (20%)			20%	$97,100
	Environmental & Geotechnical			$5,000	$5,000
	Easements & ROWs			$5,000	$5,000
	Project Total				**$738,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #16

Preliminary Opinion of Probable Costs

Maplewood FG #2 NPW Extension

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$15,700	$15,700
4	2" NPW Line	800	LF	$100	$80,000
5	2" Valve	2	EA	$1,500	$3,000
6	Meter Vault	1	EA	$3,000	$3,000
7	Asphalt Repair	320	SY	$120	$38,400
8	Concrete Repair	10	CY	$800	$8,000
9	Erosion & Sediment control	1	LS	$10,000	$10,000
10	Potholing	5	EA	$800	$4,000
11	Traffic Control	1	LS	$5,000	$5,000
12	Materials testing	1	LS	$5,000	$5,000
	Sub Total				**$172,100**
	Construction Contingency (30%)			30%	$51,700
	Engineering & Permitting (20%)			20%	$34,500
	Environmental & Geotechnical			$5,000	$5,000
	Easements & ROWs			$5,000	$5,000
	Project Total				**$269,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #17

Preliminary Opinion of Probable Costs

West Milavec NPW Transmission Main (Godding Hollow Rd)

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$114,000	$114,000
2	8" NPW Line	5900	LF	$160	$944,000
3	8" Valve	4	EA	$3,500	$14,000
4	Asphalt Repair	700	SY	$120	$84,000
5	Concrete Repair	5	CY	$800	$4,000
6	Erosion & Sediment control	1	LS	$20,000	$20,000
7	Traffic control	1	LS	$30,000	$30,000
8	Potholing	30	EA	$800	$24,000
9	Material Testing	1	LS	$20,000	$20,000
	Sub Total				**$1,254,000**
	Construction Contingency (30%)			30%	$376,200
	Engineering & Permitting (20%)			20%	$250,800
	Environmental & Geotechnical			$10,000	$10,000
	Easements & ROWs			$50,000	$50,000
	Project Total				**$1,941,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.
5. Cost opinion based on 8" NPW main being constructed primarily outside of pavement on Godding Hollow Road.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #18

Preliminary Opinion of Probable Costs

Raspberry Hill NPW Extension

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$30,500	$30,500
2	4" NPW Line	1300	LF	$120	$156,000
3	4" Valve	2	EA	$2,500	$5,000
4	Meter Vault	3	EA	$3,000	$9,000
5	Asphalt Repair	870	SY	$120	$104,400
6	Concrete Repair	3	CY	$800	$2,400
7	Erosion & Sediment Control	1	LS	$10,000	$10,000
8	Traffic Control	1	LS	$5,000	$5,000
9	Potholing	10	EA	$800	$8,000
10	Materials Testing	1	LS	$5,000	$5,000
	Sub Total				**$335,300**
	Construction Contingency (30%)			30%	$100,600
	Engineering & Permitting (20%)			20%	$67,100
	Environmental & Geotechnical			$10,000	$10,000
	Easements & ROWs			$5,000	$5,000
	Project Total				**$518,000**

Notes:

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2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #19

Preliminary Opinion of Probable Costs

Eagle Valley NPW Extension

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$32,700	$32,700
2	4" NPW Line	1300	LF	$120	$156,000
3	2" NPW Line	100	LF	$100	$10,000
4	4" Valve	2	EA	$2,500	$5,000
5	2" Valve	2	EA	$1,500	$3,000
6	Meter Vault	3	EA	$3,000	$9,000
7	Asphalt Repair	870	SY	$120	$104,400
8	Concrete Repair	2	CY	$800	$1,600
9	Erosion & Sediment Control	1	LS	$10,000	$10,000
10	Traffic Control	1	LS	$10,000	$10,000
11	Potholing	10	EA	$800	$8,000
12	Materials Testing	1	LS	$10,000	$10,000
	Sub Total				**$359,700**
	Construction Contingency (30%)			30%	$108,000
	Engineering & Permitting (20%)			20%	$72,000
	Environmental & Geotechnical			$5,000	$5,000
	Easements & ROWs			$5,000	$5,000
	Project Total				**$550,000**

Notes:

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2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.
5. Eagle Valley is slated to be crack sealed in 2027. Coordinate project timeline with asphalt repair.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #20

Preliminary Opinion of Probable Costs

Summit View Estates NPW Extension

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$79,700	$79,700
2	8" NPW Line	2500	LF	$180	$450,000
3	4" NPW Line	1200	LF	$120	$144,000
4	8" Valve	2	EA	$3,500	$7,000
5	4" Valve	2	EA	$2,500	$5,000
6	Meter Vault	2	EA	$3,000	$6,000
7	Asphalt Repair	870	SY	$120	$104,400
8	Concrete Repair	5	CY	$800	$4,000
9	Erosion & Sediment Control	1	LS	$20,000	$20,000
10	Traffic Control	1	LS	$20,000	$20,000
11	Potholing	20	EA	$800	$16,000
12	Materials Testing	1	LS	$20,000	$20,000
	Sub Total				**$876,100**
	Construction Contingency (30%)			30%	$262,900
	Engineering & Permitting (20%)			20%	$175,300
	Environmental & Geotechnical			$10,000	$10,000
	Easements & ROWs			$20,000	$20,000
	Project Total				**$1,345,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.
5. Summit View Estates is slated to be patched in 2025 and cracked sealed in 2026. Coordinate project timeline with asphalt repair.
6. Mill and Overlay scheduled for 2028 for all Silver Birch Blvd within Frederick.
7. Probable Cost Opinion based on NPW line being installed outside of pavement on Silver Birch Blvd.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #21

Preliminary Opinion of Probable Costs

Fox Run NPW Extension

October 2024

FORSGREN Associates Inc.

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$39,600	$39,600
2	4" NPW Line	2000	LF	$120	$240,000
3	4" Valve	2	EA	$2,500	$5,000
4	Meter Vault	3	EA	$3,000	$9,000
5	Asphalt Repair	830	SY	$120	$99,600
6	Concrete Repair	5	CY	$800	$4,000
7	Erosion & Sediment control	1	LS	$10,000	$10,000
7	Traffic Control	1	LS	$10,000	$10,000
8	Potholing	10	EA	$800	$8,000
9	Materials testing	1	LS	$10,000	$10,000
	Sub Total				**$435,200**
	Construction Contingency (30%)			30%	$130,600
	Engineering & Permitting (20%)			20%	$87,100
	Environmental & Geotechnical			$5,000	$5,000
	Easements & ROWs			$5,000	$5,000
	Project Total				**$663,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

Town of Frederick - Non-Potable Water Infrastructure Master Plan

MAP REF. #22

Preliminary Opinion of Probable Costs

Moore Farm NPW Extension

October 2024

Item No.	Line Item Description	Quantity	Unit	Unit Price	Line Item Cost
1	Contractor Mobilization & General Conditions	1	LS	$16,700	$16,700
2	4" NPW Line	800	LF	$120	$96,000
4	4" Valve	2	EA	$2,500	$5,000
5	Meter Vault	1	EA	$3,000	$3,000
6	Asphalt Repair	360	SY	$120	$43,200
7	Erosion & Sediment Control	1	LS	$5,000	$5,000
8	Traffic Control	1	LS	$5,000	$5,000
9	Potholing	5	EA	$800	$4,000
10	Materials Testing	1	LS	$5,000	$5,000
	Sub Total				**$182,900**
	Construction Contingency (30%)			30%	$54,900
	Engineering & Permitting (20%)			20%	$36,600
	Environmental & Geotechnical			$5,000	$5,000
	Easements & ROWs			$5,000	$5,000
	Project Total				**$285,000**

Notes:

1. This Preliminary Opinion of Probable Costs is Class 4 AACE for Study or Feasibility level, with accuracy range as defined by AACE.
2. Costs based on current dollars as of the date of the probable cost opinion.
3. Construction Contingency based on current project development stage.
4. The Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor(s) methods of determining prices or over competitive bidding or market conditions. The Engineer cannot and does not guarantee that actual costs will not vary from this Conceptual Opinion of Probable Costs.

APPENDIX F

APPENDIX F: Frederick - Non potable Water Demands- future development - NPW Infrastructure Master Plan - October 2024

Assumptions and Criteria

Estimated Population per Dwelling Unit

Multi-Family = 2.3 capita/edu
Single-Family = 2.94 capita/edu (per US Census data)

***Irrigation Water Use**

High irrigation use 2.5 AFY
Medium irrigation use 1.6 AFY
Low irrigation use 0.8 AFY
*(from Town Water Dedication Ordinance)

Open Space and Park Areas Criteria

Open space = 17 ac x # of residents/1000, 10 acre minimum (per Town, expected code change)
Pocket Parks = 8.5 ac x # of residents/1000, min. 1/4 acre, max 2 acres (per Town, expected code change)
Open Space, low irrigation use, 0.8 AFY (from Town ordinance for Water Dedication)
Pocket Parks: 50% high irrig use (2.5 AFY) and 50% medium irrig use (1.6 AFY), from Town Ordinance for Water Dedication.
Also, of the 50% medium irrig use, half of this area will be gravel or mulch with no irrigation.
For Adaptable Neighborhd and Multi-Family, modified formulas to 15% for open space area, and 25% of calculated park area

Development Density Criteria

Per Comp Plan Update, Adaptable Neighborhood, 4 to 24 DU/AC, preferred mix of 50% Single Family Detached, 35% Single Family Attached, 15% Multi-Family. Overall, 2.85 people/DU
Per Comp Plan Update, "Single Family Oriented", 2 to 12 DU/AC, preferred mix of 80% Single Family Detached, 20% Single Family Attached.

Adaptable Neighborhood = 9.6 du/ac
Single Family Oriented = 6 du/ac
Agric/Estate - 0.2 du/ac
Downtown Hub residential = 11.5 du/ac
Multi-family = 20 du/ac
Multi-family at Downtown Hub = 24 du/ac
Commercial and Business Flex, Open space = 15% of area

TABLE F-1, Future Demands EAST of I-25

Area No.	Description/Land Use	Approx. Area (AC)	EDU's per acre	EDU's	# of residents	Open Space (AC)	Open Space Irrigation (AFY)	Pocket Parks (AC)	Pocket Parks Irrigation (AFY)	Street ROW/Gateway Buffer Area (AC)	Street ROW/Gateway Buffer Irrigation (AFY)	Total Irrigation Demand (AFY)
1	Hepp Farm-Adapt Nbhd	150	9.6	1440	4104	23	18	9	15	1.1	0.9	33.9
2	Skyline Ridge-Adapt Nbhd	58	9.6	557	1587	9	7	4	6	0.9	0.7	13.7
3	Haley Land Co.-Adapt Nbhd	100	9.6	960	2736	15	12	6	10	1.8	1.4	23.4
4	WCR 11 & WCR 20 (Silver Birch Rd & Bella Rosa Pkwy)-Ad Nbd	80	9.6	768	2189	12	10	5	8	1.8	1.4	19.4
5	WCR 11 & WCR 18 (Silver Birch Rd & Godding Hollow, north of Godding Hollow-SF Orient	57	6	342	1006	17	14	9	15	2.3	1.9	30.9
6	Meadowlark Bus Park (undev.)	9	-	-	-	1.4	1.1	-	-	-		1.1
7A	Tops Business Park (comm)	15	-	-	-	2.3	1.8	-				1.8
7B	Tops Bus. Park (Multi-Family)	15	20	300	690	2.3	1.8	2	3	1.8	1.4	6.2
8	Grant Annexation	95	6	570	1676	28	23	15	25		-	48.0
9A	WCR 11 & WCR 18 (Silver Birch Rd & Godding Hollow, south of Godding Hollow)-Adaptable Neighborhood	143	9.6	1373	3913	21	18	9	15	4.2	3.4	36.4
9B	WCR 11 & WCR 18 (Silver Birch Rd & Godding Hollow, south of Godding Hollow) - Business Flex	66				9.9	7.9	-	-	0.6	0.5	8.4
9C	WCR 11 & WCR 18 (Silver Birch Rd & Godding Hollow, south of Godding Hollow) - Mixed Use - Commercial	7.5				1.1	0.9			0.9	0.7	1.6
9D	WCR 11 & WCR 18 (Silver Birch Rd & Godding Hollow, south of Godding Hollow) - Mixed Use - Multi-Family	7.5	20	150	345	1.1	0.9	1	2	0.3	0.2	3.1
10	**Silver Birch Rd-light indust	8	-	-		1.2	1.0	-	-	0.2	0.1	1.1
11	**Kickbush Annexation	72	6	432	1271	22	18	11	19	0.9	0.7	37.7
12	**Goracke Annexation	2	9.6	19	55	0.30	1	0.25	1	0.3	0.2	2.2
13	**25/52 East Subarea	643	-	-	-						-	155.2
14	**Nelson Annexation	285	9.6	2736	7798	43	35	17	35	2.8	2.3	72.3
15	Silver Birch Blvd/Tipple Pkwy	100	9.6	960	2736	15	12	6	10	3.0	2.4	24.4
16	Silverstone future residential	180	9.6	1728	4925	27	22	11	18	0.8	0.7	40.7
17A	Silverstone Mixed-Use, Comm	46				7	6			1.8	1.4	7.4
17B	Silverstone-Resid-DT Hub	138	11.5	1587	3650	21	16.6	8	14	1.8	1.4	32.0
18A	Miners Park-Resid, DT Hub	56	11.5	644	1481	8	7	3	6	0.7	0.6	13.6
18B	Minters Park-Comm, DT Hub	31				5	4			2.9	2.3	6.3
19	Carriage Hills Filing 1	21	6	126	371	6	6	4	7		-	13.0
20	Carriage Hills Market Place	17	9.6	163	465	3	3	1.00	2	0.9	0.7	5.7
21	East of Carriage Hills Market	13	9.6	125	356	2	2	1.00	2	1.1	0.9	4.9
22	Josephine Roche Annex	91	6	546	1606	27	22	14	24		-	46.0
23A	Brunemeier Annex-SF Orient	72	6	432	1271	22	18	11	19			37.0
23B	Brunemeier Annex-Adapt Nbd	33	9.6	317	903	15	13	8	14		-	27.0
24	Johnson Farm/Spindle (west)	147	6	882	2594	44	36	23	38		-	74.0
25	*WCR-19 Subarea	1255						-	-		-	115.5
26	Hidden Creek	142	-	852	2505	43	69	22	37		-	106.0
27	South of Hidden Creek	26	9.6	250	712	4	4	2	3	1.7	1.4	8.4
28	East of Hidden Creek	142	9.6	1363	3886	21	35	9	15		-	50.0
29A	Fred Rec Area - west-native	50	-			50	40.0				-	40.0
29B	Fred Rec Area - west-turf	3	-			0		3	8		-	7.5
30	Thunder Valley-east ball field	1.92					5					4.8
	TOTALS	**4377.92**		**19621**	**54831**	**530**	**490**	**210**	**370**	**30**	**30**	**1,161**

Notes: *See separate tables for 25-52 East Subarea and WCR-19 Subarea
** Properties planned to be supplied directly from irrigation ditch
**Properties fed directly from ditch = 268.48 AFY

TABLE F-2
25-52 East Subarea, Future NPW Demands

No.	Development Type	Approx. Area (AC)	EDU's per acre	EDU's	# of equiv residents	Open Space (AC)	Open Space Irrigation (AFY)	Pocket Parks (AC)	Pocket Parks Irrigation (AFY)	Street ROW/Gateway Buffer Area (AC)	Street ROW/Gateway Buffer Irrigation (AFY)	Total Irrigation Demand (AFY)
A	Residential, Single Fam	100	6	600	1764	30	24	15	25	2.8	2.2	51
B	Residential, Multi-family	50	20	1000	2300	8	6	5	9			15
C	Commercial	140	-	-		21.0	17	-	-			17
D	Offices	126	-	-		18.9	16	-	-			16
E	Industrial	192	-	-		28.8	24					24
F	Public/Civic	12	-	-		1.8	2	1	1			3
G	Recreation	23				12	10	12	19			29
	TOTALS	**643**					**100**	**32**	**54**			**155**

TABLE F-3
WCR-19 Subarea, Future NPW Demands

WCR-19 Subarea, 1280 AC **1255 AC** (per Comprehensive Plan Update map 4-19-24)
Per Town on 6/5/24, assume approx 25% of area on east end is Commercial/Industrial, and the rest is Estate/Agric

No.	Development Type	Approx. Area (AC)	EDU's per acre	EDU's	# of equiv residents	Open Space (AC)	Open Space Irrigation (AFY)	Pocket Parks (AC)	Pocket Parks Irrigation (AFY)	Street ROW/Gateway Buffer Area (AC)	Street ROW/Gateway Buffer Irrigation (AFY)	Total Irrigation Demand (AFY)
A	Residential, Estate/Agric.	879	0.2	176	517	9	8	5	11	8.5	6.8	26
B	Open space buffer	63				63	51	-	-			51
C	Commercial /Industrial	314	-	-		47	38			0.9	0.7	39
	TOTALS	**1255**					**100**	**5**	**11**			**115**

TABLE F-4, Future Demands WEST of I-25

WEST OF I-25

Area No.	Description	Approx. Area (AC)	EDU's per acre	EDU's	# of residents	Open Space (AC)	Open Space Irrigation (AFY)	Pocket Parks (AC)	Pocket Parks Irrigation (AFY)	Street ROW/Gateway Buffer Area (AC)	Street ROW/Gateway Buffer Irrigation (AFY)	Total Irrigation Demand (AFY)
1A	Wildflower - SF Oriented	118	6.0	708	2082	35	29	18	30		-	59.0
1B	Wildflower - Business Flex	140				21	17		-		-	16.8
2	Wyndham Hill	570					-	-	-		-	60.0
3	Country Meadows	33	6.0	198	583	10	8	5	9		-	17.0
4	Public/Institutional	70				18	14		-		-	14.0
5	Rinn Valley Ranch	140				2.0	1.6	6	10		-	11.6
6	SF Oriented-N. of Wildflower	135	6	810	2382	40	33	21	35		-	68.0
7	Business Flex-N. of Wildflower	80				12	9.6		-			9.6
8	Mendoza Open Space	114				100	80	14	24		-	104.0
	TOTALS	**1400**		**1716**	**5047**	**240**	**190**	**60**	**110**	**-**	**-**	**360**