Aldrich + Elliott
WATER RESOURCE ENGINEERS

TOWN OF KILLINGTON, VERMONT

New Public Water System Study
Preliminary Engineering Report
RF3-459

August 2022

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APPENDICES

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1. PROJECT PLANNING

1.1. Introduction

The Town of Killington initiated a water system study back in 2012 to evaluate creation of a new public water system but the project did not proceed ahead at that time. The proposed water system consisted of: two wells, pumping, transmission, water storage reservoir, and distribution piping. The study was prepared by Aldrich + Elliott, and the report is the "Town of Killington, Water System Feasibility Study" dated September 2013.

1.2. Location

The Town of Killington is located in Rutland County, Vermont, and is located at the junction of Vermont Routes 4 and 100. Killington is primarily a seasonal resort area that includes the Killington and Pico Ski areas and the Green Mountain Golf Course. A location map for the Town is shown on **Figure 1** in **Appendix A**.

1.3. Environmental Resources Present

An Act 250 Land Use Permit has been obtained by SP Land for the supply, storage, and transmission main components of this project. A copy of the Administrative Amendment is provided in Appendix I1. This permit included addressing any permit requirements due to environmental resource impacts and these permits are listed in Condition #5 of the Administrative Amendment. Amendment of this permit will be required if there are any changes made to the design of these new water system components.

The majority of the new distribution mains will follow the Killington Road and Route 4. As the new infrastructure will be located within the public right-of-way, there will be very limited impacts to environmental resources.

An Environmental Report has been prepared for the entire project and submitted to Water Investment Division staff for processing. Because of the size of this document, a copy is not provided here.

1.4. Population Trends

Most of the water system customers will be located at the Killington Ski Resort, along Killington Road and on Route 4. Since this is a resort area, many of these customers are non-residential so the population projections really do not apply here.

The 2020 census population for the Town of Killington CDP is 797 and the 2000 census population estimate was 811. Population data and projections for the Town are included in Table 1.1 below.

Table 1.1
Town of Killington Population

	2010 Census[1]	Census 2020[2]	Projection 2030[2]
Town of Killington CDP	811	797	754

Notes:
1. US Census Data
2. Vermont Population Projections – 2010 – 2030, Jones & Schwarz, August 2013, State of Vermont Agency of Commerce and Community Development.

The median household income in the Town of Killington from the 2018 American Community Survey 5-year Estimate is $64,231 which is slightly above the statewide average.

1.5. Community Engagement

Public engagement for the Town of Killington is accomplished through publicly warned Selectboard meetings and public votes. As part of the bond vote process, the project will be discussed at warned Selectboard meetings, as well as at a public informational meeting prior to the bond vote. Documents relating to the bond vote will be available from the Town office.

1.6. Reference Documents

The following reference documents were used in the preparation of this report. Some of these documents are provided in the Appendices for reference purposes.

- Sherburne Fire District No. 1 Wastewater Collection System Contract No. 2 As-Built drawings dated June 1983.
- Sherburne Fire District No. 1 Forcemain and Outfall Contract No. 3 As-Built drawings dated July 1983.
- Valley Well's Water Project Basis of Design Report dated December 14, 2005, prepared by Dufresne & Associates.
- Killington Valley Well Water System Description dated October 10, 2011.
- Contract 2011-1, Well Metering House and High Service Pump Station (Permit Set) Drawings and Specifications dated October 13, 2011 and prepared by Dufresne Group.
- Contract 2011-2, Shagback Mountain Water Storage Tank (Permit Set) Drawings and Specifications dated October 13, 2011 and prepared by Dufresne Group.
- Valley Well Transmission Main (Permit Set) Drawings dated January 1, 2012 and prepared by Marsh Engineering Inc.

- Phase 1 Village Master Plan for Act 250 Permitting Drawings dated March 7, 2013 and prepared by VHB.
- Town of Killington, Water System Feasibility Study dated September 2013 and prepared by Aldrich + Elliott.
- State of Vermont Land Use Permit Administrative Amendment Case No.1R0980 dated January 23, 2017.
- Drinking Water and Groundwater Protection Division Public Community Water System Source Permit dated May 14, 2019.
- Drinking Water and Groundwater Protection Division Public Water System Construction Permit for Project #C-2809-12.3 dated September 9, 2020.

2. EXISTING CONDITIONS

2.1. Location Map

Figure 1 in **Appendix A** shows a project location map.

2.2. History

This project started in 2005 to provide domestic water supply to a proposed Centex Destination Properties development on the east side of Killington Mountain. Final build out was to serve 2,500 three bedroom condominium units with an estimated average day demand 1,012,500 gpd. This development project did not start construction and was halted about 2008, then planning was restarted in 2010 by a different developer, SP Land.

A project description prepared by Dufresne Group is provided in Appendix B, but more details are provided in the following sections, and the overall layout is shown on Figure 2 in Appendix A. Design of the new water system components and the permits were obtained from about 2011-2013. In 2012, the Town initiated a feasibility study to determine if the Town should participate in the new water system project. Due to the high costs and limited funding, the Town chose not to move forward with the project but the development project also did not move forward. In 2021, the Town began discussions with SP Land regarding partnering on the new public water system project with the Town taking the lead to build and operate a new public water system.

2.3. Condition of Existing Facilities

As there is currently no existing public water system, condition of existing facilities is not applicable. However, several existing properties along Killington Road have water quality issues which have accelerated the need for the Town to create a new public water system. More detail on these existing water systems is provided in Section 3.0, Need for Project.

2.4. Financial Status of Existing Facilities

Since this is a new public water system for the Town and a water department has not been established, the financial status is not discussed here, but is discussed in detail for the new water system in Section 9.0, Proposed Project.

2.5. Water/Energy/Waste Audits

As this is study is to establish a new public water system, no water or energy audits have been performed.

3. NEED FOR PROJECT

3.1. Health, Sanitation, and Security

In the Water Supply Rules, there are four categories of water systems:

- Public Community water systems;
- Public Non-Transient Non-Community (NTNC) water system;
- Public Transient Non-community (TNC) water system;
- Bottled water systems.

A public water system means any system(s) or combination of systems owned or controlled by a person, that provides drinking water through pipes or other constructed conveyances to the public and that has at least fifteen (15) service connections or serves an average of at least twenty-five (25) individuals daily for a at least sixty (60) days out of the year.

The definitions under Subchapter 21-2 are as follows:

- Public Community Water System – Serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.
- Public Non-Community Water System
    - Non-Transient: Serves at least 25 of the same persons daily for more than six months of the year. Example: schools.
    - Transient: Examples: restaurants, motels, campgrounds.

Under the Water Supply Rules, the Maximum Contaminant Levels are specified in Section 6.12, Table 6-1. For the purposes of this study, only those contaminants that are identified as a water quality concern are discussed, and shown in Table 3.1.

Table 3.1
Water Supply Rules
Primary Contaminant Standards (From Table 6-1)

Contaminant	Standard MCL	MCL Goal
8. Radionuclides		
Gross Alpha Particle	15 pCi/l	Zero
Combined Radium-226 and Radium-228	5 pCi/l [(1)]	Zero
Uranium	20 ug/l	Zero
9. Per-and polyfluoroalkyl substances (PFAS)		
PFHxS	0.000020 mg/l	Zero
PFHpA	0.000020 mg/l	Zero
PFNA	0.000020 mg/l	Zero
PFOS	0.000020 mg/l	Zero
PFOA	0.000020 mg/l	Zero

Notes:
1. The combined radium-226 and radium-228 value is determined by the addition of the results of the analysis for radium-226 and radium-228.
2. The MCL is 0.000020 mg/l for any combination of these PFAS, PFOA, PFOS, PFHxS, PFHpA, and PFNA.

Per Section 6.13, Secondary Standards in the Water Supply Rules, these standards can be applied differently between existing and new public community, domestic bottled, and public non-transient non-community water systems. For these existing water systems, they may be required to monitor and comply with the Secondary Standards when the Secretary determines that monitoring and compliance is necessary to protect public welfare. The only Secondary Contaminant Standard applicable here is Manganese as shown in Table 3.2.

Table 3.2
Water Supply Rules
Secondary Contaminant Standards (From Table 6-3)

Contaminant	Standard
Manganese	0.05 mg/l

3.2. Water Systems with Water Quality Concerns

One of the major purposes of this project is to provide safe drinking water to existing public water systems which have water quality concerns. The initial list of water systems is provided in Table 3.3 and the DWGPD has assisted with providing this information. A copy of the DWGPD list is provided in Appendix C, and the location of these properties is shown on Figure 3 in Appendix A.

Table 3.3
Existing Public Water Systems Identified with Water Quality Concerns

Water System Name	Location	Water Quality Concern
Chalet Killington	2685 Killington Road	PFAS
Killington Village Inn	2500 Killington Road	PFAS
Foundry	63 Summit Path	PFAS
Summit Lodge at Killington	200 Summit Road	PFAS
Killington Mountain School	2708 Killington Road	PFAS
Butternut Properties	63 Weathervane Drive	PFAS
Killington Mountain Lodge	2617 Killington Road	PFAS
Killington Center Inn	905 Killington Road	Manganese, combined radium
Hemlock Ridge	Hemlock Ridge Road	Combined radium
Mountain Green	135 East Mountain Road	Combined radium, hard water
Mad Hatters	40 Summit Path	Manganese

Additional detail is provided on these public water systems in the following narratives.

3.2.1. Chalet Killington

The Chalet Killington water system operates under WSID Number VT 0000402 and is located at 2685 Killington Road. The water quality concern for this water system is PFAS as the MCL has been exceeded.

The food and lodging license is based on 125 lodging spaces and 80 restaurant seats for an approved demand of 8,650 gpd.

3.2.2. Killington Village Inn

The Killington Village Inn water system operates under WSID Number VT 0000756 and is located at 2500 Killington Road. The water quality concern for this water system is PFAS as the MCL has been exceeded.

The calculated average day is based on 45 students and 4 employees for 4,650 gpd. The system now serves 118 sleeping spaces and a restaurant/bar with 80 seats at 2 meals per day.

3.2.3. Foundry

The Foundry water system operates under WSID Number VT0000918 and is located at 63 Summit Path. The water quality concern for this water system is PFAS.

The average day demand under WW-1-0082 is 4,200 gpd to serve 140 restaurant seats (140 seats x 30 gpd/seat). Documentation provided from Sherburne FD #1 demonstrates 183 seats since 2003 but they currently operate with 160 seats.

3.2.4. Summit Lodge at Killington

The Summit Lodge at Killington water system operates under WSID Number VT0001436 and is located at 200 Summit Road. The water quality concern for this water system is PFAS and the MCL has been exceeded.

This lodge is permitted under WW permit WW-1-0082; Certificate of Compliance #1R0537. The food and lodging license #1436 is for 180 restaurant seats and #4716 for 150 lodging spaces. The calculated average day demand from the Food and Lodging License is (180 restaurant seats x 30 gpd) + (150 lodging spaces x 50 gpd) = 12,000 gpd.

3.2.5. Killington Mountain School

Killington Mountain School water system operates under WSID Number VT0002396 and is located at 2708 Killington Road. The water quality concern for this water system is PFAS and the MCL has been exceeded.

This water system has a source permit approval for 4.6 gpm and approved demand of 6,624 gpd.

3.2.6. Butternut Properties

Butternut Properties water system operates under WSID Number VT0002603 and is located at 63 Weathervane Drive. The water quality concern for this water system is PFAS but the MCL has not been exceeded.

This water system serves Butternut Inn and Pancake House and was converted from an inn and restaurant to housing for the Castleton University hospitality program with 23 students/staff in 2019. There are plans to expand to greater than 25 students/staff so this water system will be reclassified to an NTNC for 2020/2021, permit in progress for an approved demand of 4,200 gpd.

3.2.7. Killington Mountain Lodge

Killington Mountain Lodge water system operates under WSID Number VT0003263 and is located at 2617 Killington Road. The water quality concern for this water system is PFAS but the MCL has not been exceeded. Recent sample results for PFAS were approximately 17 ppt.

This water system serves 206 lodging spaces and 205 restaurant sets for an approved demand of 16,250 gpd.

3.2.8. Killington Center Inn

Killington Center Inn water system operates under WSID Number VT0009073 and is located at 905 Killington Center Inn. The water quality concern for this water system is manganese and combined radium.

The DWGP Division records indicate an approved yield has not been established for this water system. Historical operation indicates the source is adequate to meet the water use demands of the water system's existing users. Given the modifications to the water system without permits to date, however, a Construction Permit is required to address needed system improvements and review existing infrastructure (see Section II.B.1 of this Permit). The authorized average day demand of 6,000 gpd is based on the recognized 120 lodging spaces X 50 gallons/lodging space/day under Table A2-1 of the Rule.

3.2.9. Hemlock Ridge

Hemlock Ridge water system operates under WSID Number VT0005240 and is located at Hemlock Ridge Road. The water quality concern for this water system is combined radium, but the water system is working on installing radium treatment.

The water system serves a residential equivalent population of approximately 60 individuals through 24 service connections. The maximum daily demand (MDD) of the water system is permitted for 15 gallons per minute. This authorized rate equates to an average daily demand equal to 10,800 gallons when the source is being operated for 12-hours.

3.2.10. Mountain Green

The Mountain Green water system operates under WSID Number VT0005539 and is located at 125 East Mountain Road. The water quality concern for this water system is combined radium and hard water, but treatment is being used to comply with the radium MCL.

This water system has a permitted combined yield of 67 gpm or 48,420 gpd.

3.2.11. Mad Hatters

The Mad Hatters operates under WSID Number VT0021587 and is located at 40 Summit Path. The water quality concern for this water system is manganese which does not have an MCL.

The WW Permit, WW-1-0822, is for 130 gpd to serve 1 building with 2 employees and has an approved demand of 130 gpd.

3.3. Village Development

In addition to providing a new water source to several existing public water systems, the new Village development proposed by SP Land will also be supplied. Detailed information and estimates were provided by SP Land on the master plan development by phase. Table 3.4 summarizes the Phase I and II development, and additional information on the development projections and phasing schedule is provided in Appendix D.

SP Land also provided the development projections for Phases III to IX which are planned from 2030 to 2044. At build-out, they are planning a total of 1,935 units and 133,172 s.f. of commercial space. The water demands for these phases are discussed for the design year in Section 4.0.

Table 3.4
SP Land Phase I and II Development Projections

Use	Phase I 2024	Phase II 2026	Total
Residential			
Single Family Dwellings	9	10	19
Village Condominium	140	53	193
Village Hotel	0	155	187
Townhome	32	14	46
Residential Total Units	181	232	413
Commercial			
Restaurant	12,000	4,000	16,000
Dry Goods Retail	19,622	4,000	23,622
Hotel	0	25,450	25,450
Commercial Total Space	31,622	33,450	65,072

3.4. Water Quality Testing Results

The Village wells have received source approval, so the State required sampling of the two existing wells for PFAS. Access to the wells was coordinated by SP Land and the wells were sampled by Hoffer Consulting Inc. on August 19, 2021.

The sampling results are provided in the Appendix E for PW-1 and PW-2, and the results were non detect for PFAS. Based on these results, no changes are being incorporated in the proposed project for the wells to treat for PFAS.

4. PRELIMINARY DESIGN CRITERIA

4.1. Water Demands – Initial Years

It will take multiple years to construct the new infrastructure, including the distribution mains along Killington Road and Route 4. The initial year water demands are shown here for the first three years (2024 – 2026) of operation and include connection of:

- Existing Public Water System with Water Quality Issues
- SP Land development Phases I and II
- Killington Ski Resort properties
- Killington Road developed properties
- Elementary School

It is anticipated that the existing public water systems that currently have water quality concerns will connect. The projected initial year average day demand (ADD) of 125,000 gpd for these existing public water systems is summarized in Table 4.1.

Table 4.1
Existing Public Water Systems
Initial Year - Average Day Demands

Water System Name	Location	Average Day Demands (gpd)
Chalet Killington	2685 Killington Road	8,650
Killington Village Inn	2500 Killington Road	4,650
Foundry	63 Summit Path	4,200
Summit Lodge at Killington	200 Summit Road	12,000
Killington Mountain School	2708 Killington Road	6,624
Butternut Properties	63 Weathervane Drive	4,200
Killington Mountain Lodge	2617 Killington Road	16,250
Killington Center Inn	905 Killington Road	6,000
Hemlock Ridge	Hemlock Ridge Road	10,800
Mountain Green	135 East Mountain Road	48,420
Mad Hatters	40 Summit Path	130
	Total Use	121,924 125,000

For the SP Land Village development, a detailed summary of the projected average day demands is provided in Appendix G, and is summarized by phase using the Vermont Water Supply Rules design values. A total average day demand of 165,000 gpd is projected as summarized in Table 4.2 for Phases I and II. Phase I is scheduled to begin in 2024 and Phase II in 2026. These projected water demands exclude the new Snowshed and Ramshead Lodges.

Table 4.2
SP Land Phase I and II Village Development
Average Day Demand Projections

Establishment (1)	**Total**	**Projected ADD (gpd)**(2)
Residential		
Single Family Dwellings(3)	19 units	11,543
Village Condominium(3)	193 units	65,138
Village Hotel(3)	155 units	41,850
Townhome(3)	46	24,840
Commercial		
Restaurant	16,000 sf	13,028
Dry Goods Retail	23,622 sf	1,063
Hotel	25,450 sf.	6,073
	Total Use	163,533 165,000

Notes:
1. Based on total residential units and commercial space for Phase I and II as provided by SP Land.
2. The design values are per the Water Supply Rules, Table A2-1 and account for the 10% reduction.
3. Estimates provided for the average number of bedrooms by SP Land.
4. The projected water demands above are not included for the new Snowshed and Ramshead Lodges as it assumed that the use of the Snowden wells will be discontinued.

Contact was made to the Killington Ski resort to document the existing public water systems that they own and operate, and to get input on when and if they would be connected to the new public water system. Most of these existing systems will be addressed after the initial years, so are discussed in more detail in Section 4.2 A list of the systems with the approximate approved yield is summarized in Table 4.3 for the initial years, and could require up to 53,000 gpd if all are connected.

Table 4.3
Killington Ski Resort
Existing Public Water Systems

Use	Average Day Demands (gpd)
Grand Hotel (1)	42,197
Lodging Operations Building (1)	360
Clubhouse (1)	9,030
Old Wastewater Treatment Facility (1)	240
Medical Building (1)	1,168
Total	53,000

Notes:
1. The Grand Hotel, Lodging Operations Building, Clubhouse, Old Wastewater Treatment Facility and Medical Building are served by 5 existing wells.

The Town also wants to include serving the Elementary School in the initial years. Information provided by the school indicates 122 students and 23 staff. Water demands are included for 3,625 gpd using the Vermont Water Supply Rules design values.

A spreadsheet was prepared to develop a list of existing developed properties along Killington Road that do not have water quality issues or are not part of the Killington Ski Resort. This list is provided in Appendix Q, sorted by address. As limited detail was available on these properties, the Sherburne Fire District sewer accounts and number of equivalent residential units were used to estimate the water demands for several of these customers. For properties that were not connected to sewer, an allowance of 450 gpd is shown. A list of these accounts is provided in Appendix H, but includes all of the Sherburne Fire District customers. The estimated average day demand for the developed properties along Killington Road is 100,500 gpd, excluding the properties that have water quality issues.

For the initial years, the average day demand up to 447,125 gpd is summarized in Table 4.4, and assumes that all of SP Land Phase I and II, and the existing developed properties at the Ski Resort and along Killington Road connect.

Consistent with the Water Supply Rules, a maximum day demand peaking factor of 2.0 was used, so a maximum day demand of 895,000 gpd is projected. The Valley wells are approved for a combined yield of 496 gpm/714,240 gpd, so an increase in the capacity of these wells will be required to support this demand if all of these potential users connect. The initial years water demand will be used as the basis for developing a first years operation and maintenance budget and water rate billing structure in Section 9.0, Proposed Project.

Table 4.4
Initial Years
Average and Maximum Day Demands

Use [1]	Average Day Demand (gpd)	Maximum Day Demand (gpd) [2]
Existing Public Water Systems with Water Quality Concerns	125,000	250,000
SP Land Phases I and II	165,000	330,000
Killington Ski Resort	53,000	106,000
Elementary School	3,625	7,250
Killington Road Developed Properties	100,500	201,000
Total	447,125	895,000
Approved Well Yield		714,250

Notes:
1. The projected average day demands for each use shown above are developed using various methods as described in the report narrative.
2. Per the Water Supply Rules, a maximum day demand peaking factor of 2.0 is used.

4.2. Water Demands - Design Year

In addition to the uses included under the initial years water demands, the design year (2044) demands will consist of the following additional uses:

- SP Land Development – Phases III to IX
- Killington Ski Resort
- Affordable Housing
- Rt 4 developed properties

For the SP Land Village development, a detailed summary of the projected average day demands is provided in Appendix G, and is summarized by phase using the Vermont Water Supply Rules design values. An additional average day demand of 575,000 gpd is projected as summarized in Table 4.5 for Phases III through IX. At buildout, a total average day demand of 750,000 gpd is projected. Phase III is scheduled to begin in 2030 and Phase IX completed by 2044. This new development will result in a total of 1,935 residential units and 133,172 s.f. of commercial space.

Table 4.5
SP Land Phases III to IX Village Development
Average Day Demand Projections

Establishment [1]	**Total**	**Projected ADD (gpd)**[2]
Residential		
Single Family Dwellings[3]	44 units	26,732
Village Condominium[3]	217 units	73,238
Resort Condo [3]	681 units	229,838
Hotel [3]	283 units	76,410
Townhome[3]	297 units	148,838
Commercial		
Restaurant	9,500 sf	7,425
Dry Goods Retail	21,100 sf	950
Hotel [4]	37,500 sf.	10,101
	Total Use	574,247 575,000

Notes:
1. Based on total residential units and commercial space for Phase III through IX as provided by SP Land.
2. The design values are per the Water Supply Rules, Table A2-1 and account for the 10% reduction.
3. Estimates provided for the average number of bedrooms by SP Land.
4. The projected water demands are not included for the new Snowshed and Ramshead Lodges which are shown in Table 4.6.

For Killington Ski Resort (KPSRP), the status of the remaining water systems are as follows based on input from KPSRP, and are summarized in Table 4.6. The average day demand needed would be approximately 62,595 gpd.

- The Snowshed/Ramshed Lodges are served by existing wells. These existing lodges will be demolished during the Village development and the new lodges constructed will not be able to continue to use the existing Snowden wells as these wells will be discontinued. The total approved yield is approximately 40,000 gpd.
- The K1 Lodge is served by an individual well which will continue in operation.
- The Administration Building has a yield of approximately 1,500 gpd and is planned to be relocated during the Village development.

There are some properties located along the Killington Road that are owned by KPSRP, such as, Chalet Killington and Wobbly Barn restaurant. These properties are included under separately under the Killington Road existing developed properties.

Table 4.6
Killington Ski Resort
Existing Public Water Systems

Name	Average Day Demand (gpd)
Snowshed/Ramshead Lodges (1)	40,000
K1 Lodge	0
Administration (2)	1,500
Pinnacle	21,095
Total	62,595

Notes:
1. The Snowshed/Ramshead Lodges are served by their own well and for the new lodges, it is assumed that the Snowden wells will not be available.
2. The Administration Building is scheduled for relocation at a future date and will likely require connection to the new water system.

A summary of the total average day demands for the design year is provided in Table 4.7, and includes an affordable housing use. This use is anticipated at 2 locations, one on Nanack Way and off Route 4. Providing affordable housing has been identified as a critical need for local employees that work at the restaurants, lodges, ski resort, etc. The parcel off Nanack Way is proposed at 112 units and on Route 4, 56 units are proposed. The Water Supply Rules were used to estimate the water demand of 39,555 gpd for this new development based on information provided by Town.

At the design year, the total average day demand is projected up to 1,199,575 gpd assuming all of the uses shown are connected to the new public water system.

Using a 2.0 peaking factor to comply with the Water Supply Rules, a maximum day demand of 2,399,150 gpd will be required. To meet this 2044 design year demand, total well yields of about 1,600 to 1,700 gpm will be required to supply the needed water. However, the potential capacity limitation of the new water infrastructure (pumping, transmission, etc.) will need to be taken into account which has a designed capacity of 2,320,000 gpd based on the latest Basis of Design Summary provided by Dufresne Group. A copy of this Memo dated June 14, 2022 is provided in Appendix R.

Recent hydrogeological investigation performed by Hoffer Consulting for the Town indicate that the Valley Wells can support a withdrawal of over 2,000 gpm by installing two new larger-diameter production wells in conjunction with existing well PW-1D.

The Water Supply Rules and other sources are used to estimate the water demands, but these numbers tend to be conservative. Once the water system is placed into operation, and the water produced is metered, the maximum day demand can be carefully monitored and it is expected the demands will be lower than expected. This will allow the Town to reallocate some of the capacity and may reduce the approved well yields required at the design year.

Table 4.7
Initial and Design Years
Average Day Demand (ADD) Projections

Use [1]	**Initial Years ADD (gpd)**	**Future ADD (gpd)** [2]	**Design Year ADD (gpd)**
Existing Public Water Systems with Water Quality Concerns	125,000	0	125,000
SP Land Phases I through IX	165,000	575,000	740,000
Killington Ski Resort	53,000	62,595	115,595
Elementary School	3,625	0	3,625
Killington Road - Existing Developed Properties	100,500	10,000	110,500
Affordable Housing	0	39,555	39,555
Rt. 4 – Existing Developed Properties	0	15,300	15,300
Future Growth	0	50,000	50,000
Total	447,125	752,450	1,199,575

Notes:
1. The projected average day demands for each use shown above are developed using various methods as described in the report narratives.

5. ALTERNATIVES CONSIDERED – SUPPLY

5.1. Description

For the supply, only one alternative is being evaluated as State approvals and permits have been issued for the Valley Wells and booster pumping. However, these wells do not provide adequate supply for the design year, so the Town has investigated alternatives for additional supply. The location of the Valley Wells is shown on Figure 2 in Appendix A and a description is provided in Appendix B. An updated Basis of Design Summary was provided by Dufresne Group and it is noted in this document that the infrastructure (excluding the wells) is designed for an average day demand of 1,159,000 gpd and maximum day demand of 2,320,000 gpd. A copy of this Memo dated June 14, 2022, is provided in Appendix R.

The two Valley well sources along Route 4 are designated as PW-1D (WL001) and PW-2S (WL002). A Source Permit No. S-2389-09.4 was issued on May 14, 2019 to SP Land and a copy is provided in Appendix I. The Source Permit indicates the following approvals:

- 200' isolation zone for each well via a Limited Warranty Deed to SP Land Company LLC.
- Source water quality results for inorganic chemicals, volatile organic chemicals, synthetic organic chemicals, radionuclides, and groundwater under the direct influence of surface water determination
- Source water quantity for a total maximum withdrawal of 496 gpm (maximum day) and shall not exceed 714,240 gpd.

Recent hydrogeological investigation was performed by Hoffer Consulting for the Town. A source capacity evaluation was issued in June 2022 and concluded that the Area A in the vicinity of the Valley Wells can support a withdrawal of over 2,000 gpm with two new larger diameter production wells and existing well PW-1D. Areas B and C were investigated but determined to have little potential for high yielding production wells. These results are summarized in the Memo dated July 19, 2022.

Design for the supply and high service pump station was completed in October 2011 for permitting. This design was prepared by Dufresne Group and is titled "Contract 2011-1 Well Metering House and High Service Pump Station". The updated design contract will be referenced as Contract No. 1 in the following report sections. An updated Drinking Water and Groundwater Protection Division (DWGPD) Public Water System Construction Permit was reissued on September 9, 2020, for the wells and High Service pump station, and other new water system components. A copy of this permit is provided in Appendix I.

Water will be conveyed from these two existing wells using low head pumps through a new Well House located adjacent to the wells. The new Well House is about 700 s.f. Individual well production will be metered as the water passes through this building. Piping has been designed for the addition of a third water meter and upsizing the two proposed meters in the future when

additional wells will need to be developed. Backup power will be provided at this site for the well pumps.

From the Well House, the water will be conveyed through a 16" water transmission main about 4,000' to the High Service Pump Station. This new transmission main is discussed separately in Section 6.0. Water will enter the new High Service Pump Station building for flow metering and chemical addition. The main floor of the High Service pump station building is approximately 2,350 s.f. and is accessed by a new driveway from Route 4. Precast concrete retaining walls are proposed on both sides of the building to fit the existing topography. Chemical feed and storage systems are provided for adding sodium hypochlorite for disinfection and sodium hydroxide for pH control. Treated water will then enter a clear well located below the building main floor and is pumped about 1,450 vertical feet to a new storage reservoir via a 16" transmission main.

The high service pumps are vertical turbine high pressure units with variable frequency drive (VFD) control. Three pumps are scheduled to be installed in the first phase but space is provided for a total of four pumps.

5.2. Preliminary Design Criteria

The preliminary design criteria for the Valley Wells is summarized in Table 5.1. Information from the wells is taken from the Dufresne Group design drawings and specifications and DWGPD Source Permit. The average day capacity is based on the wells running an average of 12 hours per day to supply 357,120 gpd.

Table 5.1
Valley Wells
Preliminary Design Criteria

Item Description	Design Condition [(1)(2)]
Well PW-1D (WL001)	
Approved Yield @ Maximum Day Demand	391 gpm/ 563,040 gpd
Well Type	Gravel Well
Depth	96’ with 15’ screen
Diameter	6”
Total Available Head	65.7’
Type of Pump	Submersible
Design Capacity	391 gpm @ 45’
Motor	7.5 hp
Well PW-2S (WL002)	
Approved Yield @ Maximum Day Demand	105 gpm/ 151,200 gpd
Type	Gravel Well
Depth	43’ with 15’ screen
Diameter	6”
Total Available Head	17.3’
Type of Pump	Submersble
Design Capacity	105 gpm @ 40’
Motor	1.5 hp
Combined Yield	496 gpm/ 714,240 gpd

Notes:
1. Per the Source Permit.
2. Per the DG Contract 2011-1 technical specifications.

The preliminary design criteria for the high service pumps is summarized in Table 5.2. Space is provided for a total of 4 pumps to meet future water demands but only 2 pumps are being provided.

Table 5.2
High Service Pump Station
Preliminary Design Criteria

Item Description	**Design Condition** [1]
Pumps	
Number	2 (1 standby)
Type	Vertical Turbines
Design Capacity	700 gpm
Total Head	1,600’
Motor hp	400 hp

Notes:
1. Per the DG Contract 2011-1 technical specifications.

5.3. Conceptual Plans

Figure 2 in **Appendix A** indicates a conceptual layout for the wells, well house, and High Service pump station.

The plans and specifications for Contract No. 1 includes the Valley Wells and Well House, and High Service pump station were submitted for Permits. These documents are referenced throughout this report but are not included in the Appendices.

5.4. Environmental Impacts

Environmental impacts and specific permit requirements for the Valley Wells and Well House, and High Service pump station were addressed under the Act 250 Land Use Permit. A copy of the Administrative Amendment is provided in Appendix I.

State Drinking Water SRF funding is being used for this project, so an Environmental Report has been prepared and submitted to comply with the environmental review process.

5.5. Land Requirements

As noted in the Source Approval, SP Land owns the well site and the source protection area. In addition, SP Land owns the property for the High Service pump station. As part of the agreement between the Town and SP Land, the Town will need control by land acquisition of these sites for construction, and operation and maintenance.

5.6. Potential Construction Problems

The potential construction problems will be more of a concern with the construction of the High Service pump station. A precast concrete retaining wall is required for the sitework, so additional subsurface investigation will likely be required during the design update.

5.7. Sustainability Considerations

Since the design of this new infrastructure has already been completed and permits obtained, the sustainability considerations do not apply to this alternative, but will need to account for the search for additional water source capacity.

5.8. Cost Estimate

The estimated construction cost is $6,135,000 for the supply and High Service pump station under Contract No. 1 as summarized in Table 5.3. The permit set for Contract 2011-1 was used to develop the updated cost estimate. Detailed breakdowns of the construction cost estimates for this alternative can be found in Appendix J.

Table 5.3
Contract No. 1
Supply and High Service Pump Station
Estimated Construction Costs

Description	Estimated Cost (ENR 13000)[1]
Well House	$1,375,000
High Service Pump Station	$4,500,000
Preparation of Site and Misc. Work	$137,500
Bonds	$120,250
Total	$6,132,750
Use	$6,135,000

Notes:
1. ENR 13000 = July 2022

6. ALTERNATIVES CONSIDERED – STORAGE AND TRANSMISSION

6.1. Shagback Mountain Storage Reservoir

6.1.1. Description

Design for the new storage tank was completed in October 2011 for permitting. This design was prepared by Dufresne Group (DG) and is titled “Contract 2011-2 Shagback Mountain Water Storage Tank”. The updated design contract will be referenced as Contract No. 2 in the following report sections. An updated DWGPD Public Water System Construction Permit was reissued on September 9, 2020, for the storage tank, and other new water system components. A copy of this permit is provided in Appendix I.

Water will be pumped through a new 16” transmission main from the High Service pump station to the new storage tank located at approximate ground elevation 2634’. Under the first phase, a new 500,000 gallon storage tank is planned and the tank design is based on a prestressed concrete tank. The tank site was designed to accommodate two additional 500,000 gallon storage tanks under future phases.

Water from the tank will be conveyed by gravity in a new 16” transmission main to the distribution system starting at the Village development and continuing north along Killington Road.

6.1.2. Preliminary Design Criteria

Under the DG 2011 design criteria, this tank will supply domestic demands and fire flows. The average day demand is projected at 324,000 gpd and a fire flow volume of 90,000 gallons will be supplied, leaving a surplus of 86,000 gallons. The fire flow of 90,000 gallons would supply a fire flow of 750 gpm for a duration of 2.0 hours.

The preliminary design criteria for the Shaback Mountain storage tank is summarized in Table 6.1. Information for the storage tank is taken from the Dufresne Group design drawings and specifications. The tank must be sized to supply both the average day demand and fire flow. From the DG basis of design, this first tank can supply an average day demand up to 410,000 gpd which is not adequate for the initial years demand, but this will be evaluated further under the alternatives.

SP Land indicated that the tank site will be changing slightly to another adjacent parcel, however, this change in the site did not occur.

Table 6.1
Contract No. 2
Shagback Mountain Water Reservoir
Preliminary Design Criteria

Item Description	Design Condition [1]
Number	1
Type	Prestressed Concrete
Storage Volume	500,000 gallons
Diameter	58'-6"
Depth	21'
Maximum Water Level	2654.00'

Notes:
1. Per the DG Contract 2011-2 technical specifications.

6.1.3. Alternatives Evaluated

When evaluating the storage reservoir, the original design and permit issued is based on the 500,000 gallon storage tank. Space on the site is shown for up to two additional 500,000 gallon storage tanks to supply the average day demands for the future development phases. With the anticipated demands in the early years, evaluation of a larger storage tank in the first phase was warranted. The type of construction for the tank will remain the same, nor will the hydraulic grade be changed, it is only the increased volume and larger diameter that is evaluated.

Alternative No. 1 – 500,000 Gallon Storage Tank: Alternative No. 1 is based on the 500,000 gallon storage tank included in the Contract 2011-2 documents and the issued DWGPD Construction Permit. This tank will have a maximum water level of 2654.0' and diameter of 58'-6". Space will remain available for up to two additional 500,000 gallon storage tanks.

Alternative No. 2 – 750,000 Gallon Storage Tank: Alternative No. 2 is based on a larger 750,000 gallon storage tank which will provide an additional 250,000 gpd for average day demands. The maximum water level will remain at 2654.0' but the tank diameter will increase to 70'-0'' and a depth of 24'. Space will remain at the site for construction of a second 500,000 and/or 750,000 gallon tank. A passive mixing system is included to improve water quality during lower demand periods.

6.1.4. Conceptual Plans

Figure 2 in **Appendix A** indicates a conceptual layout for the new storage reservoir.

The plans and specifications for Contract 2011-2 include the 500,000 gallon storage reservoir submitted for Permits. These documents are referenced throughout this report but are not included in the Appendices. If the larger tank size is selected, the design plans will need to be updated.

6.1.5. Environmental Impacts

Environmental impacts and specific permit requirements for the new storage tank were addressed under the Act 250 Land Use Permit. A copy of the Administrative Amendment is provided in Appendix I. These permits will need to be updated for the change in tank site.

State Drinking Water SRF funding is being used for this project, so an Environmental Report has been prepared to include the storage reservoir and comply with the environmental review process.

6.1.6. Land Requirements

SP Land owns the parcel where the storage tank is located. As part of the agreement between the Town and SP Land, the Town will need control of this site by land acquisition for construction, and operation and maintenance, and this should include the additional area for the future storage reservoirs.

6.1.7. Potential Construction Problems

Ledge removal will be costly at this site and the most challenging construction problem. Additional geotechnical and subsurface investigation will need to be performed at the new site to better define the quantities for ledge removal and verify the foundation design criteria for the new tank.

6.1.8. Sustainability Considerations

Since the tank type was already selected and the design completed, there are limited sustainability considerations for this alternative.

6.1.9. Cost Estimates

The estimated construction costs for the Shagback storage reservoir alternatives are provided in Table 6.2. Detailed breakdowns of construction cost estimates for the alternatives can be found in Appendix J. The estimated construction costs range from $2,800,000 to $3,250,000. For the smaller tank, the cost is about $5.60 per gallon and decreases to about $4.33 per gallon

for the larger tank. Even though the larger tank is slightly more expensive, it will ultimately save the Town money.

Table 6.2
Shagback Mountain Water Storage Reservoir
Estimated Construction Costs

Alternative	Description	Estimated Cost (ENR 13000)[1]
No. 1	500,000 Gallon Storage Tank	$2,800,000
No. 2	750,000 Gallon Storage Tank	$3,250,000

Notes:
1. ENR 13000 = July 2022

6.2. Transmission

6.2.1. Description

Design for the new transmission main was completed in October 2011 for permitting. This design was prepared by Marsh Engineering Services and is titled “Killington Village Water System” and will be referenced as Contracts No. 3A and 3B. An updated DWGPD Public Water System Construction Permit was reissued on September 9, 2020, for the transmission main, and other new water system components. A copy of this permit is provided in Appendix I.

The transmission main consists of three main segments as it conveys water from the Valley wells and well house to the High Service pump station, then to the Shagback Mountain storage tank, and from the storage tank to the start of the distribution system.

- Water will be pumped approximately 3,800’ from the Valley well house to the High Service pump station through a new 20” diameter high density polyethylene pipe, and includes a 24” directional bore under the Ottauquechee River and Route 4.
- From the High Service pump station, water will be pumped approximately 9,800’ to the new water storage reservoir through a new 16” diameter ductile iron pipe, and includes a 24” directional bore under East Mountain Road. The initial 2,750’ section of this 16” ductile iron pipe is 16” lock joint designed for operating a high pressures.
- From the water storage tank, water will flow by gravity approximately 6,400’ in a new 16” diameter ductile iron pipe to the start of the distribution system at the Village development and along Killington Road.

6.2.2. Preliminary Design Criteria

The preliminary design criteria for the transmission mains is summarized in Table 6.3. Information for the transmission main is taken from the Marsh Engineering design drawings and specifications.

Table 6.3
Transmission Mains
Preliminary Design Criteria

Item Description	**Design Condition[1]**
From Valley Well House to High Service Pump Station	
Size	20”
Length	3,800’
Material	HDPE
Type	DR-11 (160 psi)
From High Service Pump Station to Storage Reservoir	
Size	16”
Length	9,800’
Material	Ductile iron
Type	K-11 (900 psi) and Class 52
From Storage Reservoir to Distribution System	
Size	16”
Length	6,400’
Material	Ductile iron
Type	Class 52

Notes:
1. Per the Marsh Engineering drawings.

6.2.3. Conceptual Plans

Figure 2 in **Appendix A** includes a conceptual layout for the transmission mains.

The plans and specifications for the Marsh Engineering Contract include the transmission main to the storage reservoir (Contract No. 3A) and out of the storage reservoir (Contract No. 3B) submitted for Permits. These documents are referenced throughout this report but are not included in the Appendices.

6.2.4. Environmental Impacts

Environmental impacts and specific permit requirements for the new transmission main were addressed under the Act 250 Land Use Permit. A copy of the Administrative Amendment is provided in Appendix I.

State Drinking Water SRF funding will be used for this project, so an Environmental Report has been prepared to include the storage reservoir and comply with the environmental review process.

6.2.5. Land Requirements

SP Land owns the land along the routes of the transmission mains. As part of the agreement between the Town and SP Land, the Town will need control of these areas with temporary and permanent easements for construction, and operation and maintenance.

6.2.6. Potential Construction Problems

Ledge removal will be costly along the route of the transmission main and the most challenging construction problem. No subsurface investigation was performed as part of the design drawings, so subsurface investigation will need to be performed to better define the quantities for ledge removal.

A 2,750’ section of the pipe from the High Service pump station is designed as K-11 ductile iron pipe rated for 900 psi. Due to the high pressures, this is a very specialized application with the pipe material supplied by a company called Von Roll located in Sweden. With the current supply chain issues and significant increases in material costs, there could be delivery delays and the material prices could increase significantly before this project goes to construction.

6.2.7. Sustainability Considerations

Since the design of the transmission mains has been completed, there are limited sustainability considerations for this alternative.

6.2.8. Cost Estimates

The estimated construction cost for the transmission mains are summarized in Table 6.4. The construction cost for the transmission main from the Well House to the Storage Reservoir under Contract No. 3A is $7,000,000. Contract No. 3B for the transmission main from the Storage Reservoir to the Village development is $2,500,000. Detailed breakdowns of the construction cost estimates for this alternative can be found in Appendix J.

Table 6.4
Transmission Mains
Estimated Construction Costs

Description	Estimated Cost (ENR 13000)[1]
Contract No. 3A – Valley Wells Transmission Main	$7,000,000
Contract No. 3B – Water Storage Transmission Main	$2,500,000
Total	$9,500,000

Notes:
1. ENR 13000 = July 2022

7. ALTERNATIVES CONSIDERED – DISTRIBUTION

7.1. Introduction

To supply domestic and fire flow demands, the Town wants to extend the distribution system along the entire length of Killington Road, to include a section of Route 4. For constructability purposes, the distribution system along Killington Road is split into the following segments:

- Killington Road South
- Killington Road Middle
- Killington Road North
- Killington Road North – Anthony Way to Rt 4
- Route 4

7.2. Preliminary Design Criteria

7.2.1. Pipe Materials

For most applications, pipe materials for water mains and service connections 4-inches in diameter or larger are typically either ductile iron (DI), polyvinyl chloride (PVC) or high density HDPE. An evaluation of these pipe materials is presented in Table 7.1. While DI is slightly stronger and more durable, the material is more expensive. PVC offers a good balance of cost, durability, so will be the pipe material used in the alternatives developed.

Table 7.1
Pipe Material Alternatives Evaluation

Ductile Iron	PVC
Advantages • Greater mechanical strength and durability • Resistant to petroleum and VOC contamination • Consistent with previous water main replacement projects in Springfield	Advantages • Lower Cost • More resistant to corrosion
Disadvantages • Higher Cost • Less resistant to corrosion	Disadvantages • Lower mechanical strength and durability • Cannot be used where petroleum or VOC contamination is present

It should be noted that in areas where subsurface petroleum contamination is present, only ductile iron pipe with nitrile gaskets can be used.

Water mains and service connections 2-inches in diameter or smaller are typically either copper or high-density polyethylene (HDPE). When properly selected and installed, HDPE is a very durable material that is significantly less expensive and easier to handle than copper, so will be used for the alternatives developed.

7.2.2. Pipe Sizes

The purpose of this project is to provide fire flows, so water mains serving fire hydrants will be a minimum eight inches in diameter or larger.

7.2.3. System Pressures

Standards for the design of distribution systems are provided in the Vermont Water Supply Rules Appendix A, Part 8, latest edition. The Water Supply Rule includes two key provisions for designing water mains:

- The system must be capable of meeting maximum day demands while maintaining a minimum 35 psi residual at all points in the distribution system.
- The system must be capable of providing the recommended fire flows while maintaining a minimum 20 psi residual at all points in the distribution system. The Water Supply Rule specifies a minimum 500 gpm fire flow for all fire hydrants, but most communities aim to provide higher fire flows especially in densely populated areas or areas with larger structures.

7.2.4. Valve Spacing

Gate valves are typically installed at regular distances to allow individual segments of water mains to be isolated for repair, testing, or maintenance. The Vermont Water Supply Rule recommends isolation valves be spaced no more than 500 feet apart in commercial areas or 800 feet in other areas, though distances of up to approximately 1,200 feet are used both in Springfield and other water systems in Vermont in relatively undeveloped areas.

Isolation valves are also typically included wherever a connection to an existing water main is made. The best operational flexibility is typically achieved with valves be provided in a three-way or four-way configuration depending on the number of water mains to be connected.

7.3. Alternatives

The alternatives are presented as segments of distribution piping in specific locations to provide service to areas that the Town has identified. The overall layout of the distribution piping is shown on Figure 6 in Appendix A. For clarity, each of these locations is broken down into separate construction contracts as follows:

- Contract No. 4 – Killington Road South
- Contract No. 5 – Killington Road Middle
- Contract No. 6A – Killington Road North
- Contract No. 6B – Killington Road North
- Contract No. 7 – Route 4

7.3.1. Killington Road South (Contract No. 4)

The 16” transmission main from the Shagback water storage tank will end near the existing Showshed Base Lodge which will be the start of the new Village development. Beginning at this location, a new 12” PVC distribution main will extend northeast approximately 2,000’ through property owned by the Ski Resort (West of the Killington Grand Resort) to East Mountain Road. The developer has requested that the new waterline not be installed through the Village development so this alignment has been changed to accommodate this request. From East Mountain Road, the waterline reduces to a 10” PVC distribution main, continues down Old Mill Road and goes cross country, west of the Pinnacle Condominiums and driveway to the Killington wastewater treatment facility. The new waterline will enter onto Killington Road near the Lookout and continue along the west side of Killington Road to about Ravine Road. Total length for this segment is approximately 7,200’ and ends about Ravine Road as shown on Figure 7 in Appendix A.

In addition to providing service to the Village development, this segment of the distribution main will allow for connection of these existing water systems along Killington Road that have water quality concerns:

- Mountain Green
- Chalet Killington
- Killington Village Inn
- Killington Mountain School
- Killington Mountain Lodge

At the request of the Town, curb stops and HDPE water services are provided to the edge of right-of-way for future connection of existing developed properties. Fire hydrants and isolation gate valves at intersections with major roadways are included.

Two pressure reducing vaults are proposed to maintain a workable pressure range. The location of one of the pressure reducing vaults will need to be coordinated with the new Village development distribution system. Pressures are high at the end of the transmission main, but

we understand this is necessary to serve some of the higher elevation users for the new development. Preferably, one of the PRV's would be located about the end of the transmission main vs East Mountain Road. In addition, flow meter structures are included for the Village development and water meters for the new water services to the existing water systems.

7.3.2. Killington Road Middle (Contract No. 5)

From about Ravine Road, the new 10" PVC distribution main will continue north on the west side of Killington Road approximately 9,000' to about Innsbruck Lane as shown on Figure 8 in Appendix A.

This segment of the distribution main will allow for connection of these existing water systems along Killington Road that have water quality concerns:

- Hemlock Ridge
- Foundry
- Summit Lodge at Killington
- Mad Hatters
- Butternut Properties
- Killington Center Inn

The Town requested extension of the new waterline to serve the Killington Elementary School. Alternative routes were assessed, but the most constructable route was to extend the new waterline through Hemlock Ridge as this location is on the list of water systems with water quality issues. A new 8" PVC waterline will be extended about 3,200' to the school.

At the request of the Town, curb stops and HDPE water services are provided to the edge of right-of-way for future connection of existing developed properties. Fire hydrants and isolation gate valves at intersections with major roadways are included.

One pressure reducing vault is proposed near Ravine Road to maintain a workable downstream pressure range. In addition, water meters for the new water services to the existing water systems are included.

7.3.3. Killington Road North (Contracts No. 6A and 6B)

This segment of waterline is split into two sections as they will be on different construction schedules as shown on Figure 9 in Appendix A.

- Beginning at Innsbruck Lane, the new 8" PVC distribution main will continue north on Killington Road approximately 4,450' to the intersection with Anthony Way.
- From the intersection of Anthony Way north to Route 4, the new 8" PVC waterline will continue north about 1,000' along Killington Road and a pipe installed during the roadway reconstruction project.

At the request of the Town, curb stops and HDPE water services are provided to the edge of right-of-way for future connection of existing developed properties. Fire hydrants and isolation gate valves at intersections with major roadways are included.

One pressure reducing vault is proposed near Innisbrook Lane and a second PRV near the intersection with Route 4 to maintain a workable downstream pressure range. This second PRV can possibly be eliminated but should be checked when the hydraulic model is updated. In addition, water meters for the new water services to the existing water systems are included.

7.3.4. Route 4

The Town requested that the new waterline extension be evaluated west along Route 4 to serve the existing developed properties. As this section of roadway is owned and maintained by Vtrans, new waterlines are proposed on both sides of Route 4 as shown on Figure 10 in Appendix A.

- From the intersection of Rt 4 and Killington Road, the new 8" PVC distribution main will extend west along the south side of Rt 4 approximately 2,400'. A jack and bore with sleeve will extend to the north side of Route 4.
- From the jack and bore, a new 8" PVC waterline will extend west about 700' on the north side of Route 4.

At the request of the Town, curb stops and HDPE water services are provided to the edge of right-of-way for future connection of existing developed properties. Fire hydrants and isolation gate valves at intersections with major roadways are included.

7.4. Hydraulic Analysis

The piping layout for the new distribution piping on Killington Road were input into the Bentley WaterCAD V8i model. The Shagback Storage Reservoir location has been determined, so static pressures in the new distribution system will be controlled by the water levels in the storage tank using the design water level of 2,654'. All flow from the reservoir will be via gravity through the new 16" transmission main. At the point where this new transmission main enters the Village area, a static pressure of about 200 psi is supplied. This pressure is higher than preferred but it is our understanding is that this high pressure is required to serve the future phases at the higher elevations in the Village development.

The hydraulic model was used to evaluate the domestic average day demand and fire flow scenarios. Under normal operating conditions, the preference is to supply a static pressure in the range of 40 to 120 psi. The model was used determine where pressure reducing valves are required and to verify the pipe sizes required for the initial and design year conditions. Additional information on the hydraulic modeling results is provided in Appendix P.

The distribution system is being split into four (4) separate pressure zones as shown on the figure in Appendix Q. These areas are described in more detail below and are summarized in Table 7.2.

- Pressure Zone #1: The area of the new Village development is served directly off the reservoir with a hydraulic grade line (HGL) of 2,654', and ends just north of the intersection with East Mountain Road where a pressure reducing vault is located. No pressure reduction is proposed in this zone so static pressures in this area are approximately 200 psi which is higher than preferred, so this will need to be coordinated with the design engineer for the Village development. The service area limit where minimum pressures can be maintained without pumping is approximate ground elevation 2,280'.
- Pressure Zone #2: This zone begins just north of East Mountain Road and extends north to about the plaza containing Wally's American Grill. The HGL is set at elevation 2,350', then a pressure reducing vault reduces the pressure entering zone #3. The service area limit where minimum pressures can be maintained without pumping is approximate ground elevation 2,250'.
- Pressure Zone #3: This zone continues north to about the intersection with West Hill Road. The HGL is set at elevation 2,000', then a pressure reducing vault reduces the pressure entering zone #4. The service area limit where minimum pressures can be maintained without pumping is approximate ground elevation 1,900'.
- Pressure Zone #4: This zone continues north to the intersection with Route 4. The HGL is set at elevation 1,950'. The service area limit where minimum pressures can be maintained without pumping is approximate ground elevation 1,850'.
- Pressure Zone #5: This additional pressure zone on Rt 4, west of Killington Road, can possibly be included in Pressure Zone #4 and maintain suitable working pressures.

During design, the hydraulic analysis will need to be updated and coordinated with the Village Development as follows:

- Locating a pressure reducing structure at the end of the transmission main is recommended and will need to be coordinated with the design engineer for the Village development.

Table 7.2
Pressure Zones

Pressure Zone No.	Service Area	Hydraulic Grade Line (HGL)	Highest Elevation Served (1)
1	Village Area to East Mountain Road	2,654'	2,280'
2	East Mountain Road to Wally's American Grill	2,350'	2,250'
3	Killington Road to West Hill Road Intersection	2,000'	1,900'
4	West Hill Road to Route 4 intersection and Rt 4	1,950'	1,850'

Notes:
1. Highest elevation served where minimum pressure can be maintained for domestic demands.

7.5. Conceptual Plans

Figures 6 through 10 in **Appendix A** include conceptual drawings for the distribution system.

7.6. Environmental Impacts

A majority of the new waterline will be located in the Town right-of-way along Killington Road and Rt 4, minimizing the environmental impacts.

7.7. Land Requirements

The majority of the new distribution main will be within the Town right-of-way to minimize the requirements for easements, however, some locations will require temporary and permanent easements as follows:

- Ski Resort: Once the new waterline alignment around the Village development is coordinated, temporary and permanent easements will be required for the new waterline.
- North of East Mountain Road: The new waterline is proposed to run cross country in this area to Killington Road, so temporary and permanent easements will be required.
- Hemlock Ridge: The waterline extension to the Elementary School will require temporary and permanent easements.

7.8. Potential Construction Problems

As a significant portion of the new waterline will be located within the Town right-of-way, separation from existing sewerlines and other buried utilities will be required.

Ledge removal will slow the waterline construction and subsurface investigation will need to be performed during the design to estimate quantities of rock removal.

Some areas of contaminated soils may be encountered as shown on Figure 4. During design, these areas will be investigated further and may require changes to the pipe materials, etc.

Traffic control will be required in most areas along Killington Road as traffic can be busy during events and other activities at the Killington ski area.

7.9. Sustainability Considerations

Sustainable materials have been selected for the pipe materials using PVC C900 for the distribution mains and HDPE for the services.

7.10. Cost Estimates

The estimated construction costs for the distribution system segments by construction contract are shown in Table 7.3 at a total of $9,146,000. Detailed breakdowns of the construction cost estimates for each location can be found in Appendix K.

Table 7.3
Distribution System
Estimated Construction Costs

Description		**Estimated Cost (ENR 13000)** [1]
Contract No. 4	Killington Road South	$2,516,000
Contract No. 5	Killington Road Middle[2]	$3,860,000
Contract No. 6A	Killington Road North	$1,305,000
Contract No. 6B	Killington Road – Rt 4 to Anthony Way	$310,000
Contract No. 7	Route 4	$1,155,000
	Total	$9,146,000

Notes:
1. ENR 13000 = July 2022
2. Killington Road Middle includes the waterline extension to the Elementary School.

8. SELECTION OF AN ALTERNATIVE

8.1. Life Cycle Cost Analysis

8.1.1. Supply

Since the design has been completed and permits obtained for the Valley wells, a life cycle cost analysis is not performed, but the Town started the process of searching for increased source capacity that will be required to supply the design year demands. This process included evaluating the two existing wells to increase the approved yields and identifying other potential sites in the area for addition of a third and/or fourth well. At Site A for the Valley wells, the aquifer can support a withdrawal of over 2,000 gpm with the installation of two new larger diameter production wells in conjunction with Well PW-1D. Sites B and C were investigated and did not identify the potential for high yielding production wells.

8.1.2. Storage Tank and Transmission

The original design and permitting is based on a 500,000 gallon prestressed concrete tank, but an increase in size to a 750,000 gallons was evaluated as an alternative. The concern here is that the smaller tank will not be adequate in the initial years to supply both domestic and fire flow demands, so the 750,000 gallon prestressed concrete tank is recommended. Space on-site is identified for the addition of one or more storage tanks to meet the future design year water demands.

The design and permits for the new transmission main have been completed, so no analysis was performed for these elements.

8.1.3. Distribution

The focus on the distribution mains is to provide service along Killington Road and then Route 4 so a life cycle analysis was not performed. PVC pipe was selected for the distribution mains as the material is less costly but this material provides other benefits over ductile iron.

8.2. Non-Monetary Factors

The primary objective of this project is to provide safe drinking water to those existing developed properties that have been identified with water quality issues which necessitates the need for this infrastructure to be owned and maintained by the Town of Killington as a new public water system.

9. PROPOSED PROJECT

9.1. Project Description

Since this is a new public water system that will be owned and operated by the Town of Killington, all of the following components are included in the proposed project:

- Supply
- Storage Reservoir
- Transmission
- Distribution

Each of these new components are discussed in more detail in the following narratives, and the improvements were split into separate construction contracts as shown in Table 9.1 below.

Table 9.1
List of Construction Contracts

Contract No.	Contract Name
1	Well Metering House and High Service Pump Station
2	Shagback Mountain Water Storage
3A	Valley Wells Transmission Main
3B	Water Storage Transmission Main
4	Killington Road South Distribution Main
5	Killington Road Middle Distribution Main
6A	Killington Road North Distribution Main
6B	Killington Road Rt 4 to Anthony Way Distribution Main
7	Route 4 Distribution Main

9.1.1. Supply – Valley Wells and High Service Pump Station

For the supply, State approvals and permits have been issued for the Valley Wells and booster pumping. The location of the Valley Wells and High Service Pump Station is shown on Figure 5 in Appendix A. Preliminary design criteria for the new wells is summarized in Section 9.2.

The two existing Valley well sources along Route 4 are designated as PW-1D (WL001) and PW-2S (WL002). A Source Permit No. S-2389-09.4 was issued on May 14, 2019 to SP Land and a copy is provided in Appendix I. The Source Permit indicates the following approvals for:

- 200’ isolation zone for each well via a Limited Warranty Deed to SP Land Company LLC,

- Source water quality results for inorganic chemicals, volatile organic chemicals, synthetic organic chemicals, radionuclides, and groundwater under the direct influence of surface water determination, and
- Source water quantity for a total maximum withdrawal of 496 gpm (maximum day) and shall not exceed 714,240 gpd.

Design for the supply and high service pump station was completed in October 2011 for permitting. This design was prepared by Dufresne Group and is titled “Contract 2011-1 Well Metering House and High Service Pump Station”. An updated DWGPD Public Water System Construction Permit was reissued on September 9, 2020, for the wells and High Service pump station, and other new water system components. A copy of this permit is provided in Appendix I. The design and permits are being updated for Contract No. 1 by Dufresne Group.

Water will be conveyed from these two existing wells using low head pumps through a new Well House located adjacent to the wells. The new Well House is about 700 s.f. Individual well production will be metered as the water passes through this building. Piping has been designed for the addition of a third water meter and upsizing the two proposed meters in the future when additional wells will need to be developed. Backup power will be provided at this site for the well pumps.

From the Well House, the water will be conveyed through a 16” transmission main about 4,000’ to the High Service Pump Station. Water will enter the new High Service Pump Station building for flow metering and chemical addition. The main floor of the High Service pump station building is approximately 2,350 s.f. and is accessed by a new driveway from Route 4. Precast concrete retaining walls are proposed on both sides of the building to fit the existing topography. Chemical feed and storage systems are provided for adding sodium hypochlorite for disinfection and sodium hydroxide for pH control. Treated water will then enter a clear well located below the building main floor and is pumped about 1,450 vertical feet to a new storage reservoir via a 16” transmission main.

The high service pumps are vertical turbine units with variable frequency drive (VFD) control. Two of four pumps are scheduled to be installed in this first phase but space is provided for a total of four pumps.

9.1.2. Shagback Mountain Storage Reservoir

Design for the new 500,000 gallon Shagback Mountain storage reservoir was completed in October 2011 for permitting. This design was prepared by Dufresne Group (DG) and is titled “Contract 2011-2 Shagback Mountain Water Storage Tank”. An updated DWGPD Public Water System Construction Permit was reissued on September 9, 2020, for a 500,000 gallon storage tank, and other new water system components. A copy of this permit is provided in Appendix I.

Water will be pumped through a new 16" transmission main from the High Service pump station to the new storage tank located at approximate ground elevation 2634'. Under the first phase, a new 750,000 gallon storage tank is planned and the tank design is based on a prestressed concrete tank. The tank site was designed to accommodate two additional 500,000 gallon storage tanks under future phases.

The tank site is shown on Figure 5 in Appendix A. For the larger 750,000 gallon water storage tank, the design drawings and DWGPD Public Water System Construction Permit will need to be updated. This update of the design and permits is being performed by Dufresne Group. The preliminary design criteria for the storage tank is summarized in Section 9.2.

Water from the tank will be conveyed by gravity in a new 16" transmission main to the start of the distribution system at the proposed Village development.

9.1.3. Transmission

Design for the new transmission main was completed in October 2011 for permitting. This design was prepared by Marsh Engineering Services and is titled "Killington Village Water System". An updated DWGPD Public Water System Construction Permit was reissued on September 9, 2020, for the transmission main, and other new water system components. A copy of this permit is provided in Appendix I.

The transmission main consists of three main segments as it conveys water from the Valley wells and Well House to the High Service pump station, then to the Shagback Mountain storage tank, and from the Storage Tank to the start of the distribution system. This pipe route is shown on Figure 5 in Appendix A, and preliminary design criteria is summarized in Section 9.2.

- Under Contract No. 3A, water will be pumped approximately 3,800' from the Valley well house to the High Service pump station through a new 20" diameter high density polyethylene pipe, and includes a 24" directional bore under the Ottauquechee River and Route 4.
- Also under Contract No. 3A, water from the High Service pump station will be pumped approximately 9,800' to the water storage reservoir through a new 16" diameter ductile iron pipe, and includes a 24" directional bore under East Mountain Road. The initial 2,750' section of this 16" ductile iron pipe is 16" lock joint designed for operating a high pressures.
- Under Contract No. 3B, water from the water storage tank will flow by gravity approximately 6,400' in a new 16" diameter ductile iron pipe to the start of the distribution system along Killington Road.

9.1.4. Distribution

The 16" transmission main from the Shagback storage tank will end near the existing Showshed Base Lodge and the distribution main is split into four major segments as shown on Figure 6 in Appendix A:

- Contract No. 4 - Killington Road South
- Contract No. 5 - Killington Road Middle
- Contracts No. 6A and 6B - Killington Road North
- Contract No. 7 - Route 4

Under Contract No. 4, a new 12" PVC distribution main will extend north around the proposed Village development to East Mountain Road, then reduces to a 10" PVC distribution main down Old Mill Road. The new waterline will not follow the Killington Road but will go cross country, east of the Pinnacle Condominiums and west of the golf course to the Lookout on Killington Road. From Killington Road, the 10" PVC waterline continues to about the intersection with Ravine Road. The route for the new waterline is shown on Figure 7 in Appendix A, and the total length for this segment is approximately 7,200'.

In addition to providing service to the Village development, this segment of the distribution main will allow for connection of these existing water systems along Killington Road that have water quality concerns:

- Mountain Green
- Chalet Killington
- Killington Village Inn
- Killington Mountain School
- Killington Mountain Lodge

Two pressure reducing vaults are proposed to maintain a workable pressure range. One of these PRV's should be located at the end of the transmission main but will need to be coordinated with the design engineer for the Village development. In addition, flow meter structures are included for the Village development and water meters for the new water services to the existing water systems.

Under Contract No. 5, beginning at Ravine Road, the new 10" PVC distribution main will continue north on Killington Road approximately 9,000' to Innsbruck Lane as shown on Figure 8 in Appendix A.

This segment of the distribution main will allow for connection of these existing water systems along Killington Road that have water quality concerns:

- Hemlock Ridge
- Foundry
- Summit Lodge at Killington
- Mad Hatters

- Butternut Properties
- Killington Center Inn

Two pressure reducing vaults are proposed to maintain a workable pressure range. In addition, water meters are included for the new water services to the existing water systems.

The Town requested extension of the new waterline to serve the Elementary School which is included in Contract No. 5 and is shown on Figure 8 in Appendix A. A new 8" PVC waterline will be extended from Killington Road, west along Miller Brook Road to the intersection with Hemlock Ridge Road, then continue along Hemlock Ridge Road to the school. Total length of this new 8" PVC waterline is about 3,200'.

Beginning at Innsbruck Lane, the new 8" PVC distribution main will continue north on Killington Road approximately 5,450' to the intersection with Route 4 as shown on Figure 9 in Appendix A. This segment is split into two separate contracts, Contract No. 6A and 6B. Contract No. 6A extends from Ravine Road to Anthony Way, and Contract No. 6B includes the remaining 1,000' of main from Anthony Way to the Route 4 intersection. The Town requested this segment broken out so that the new pipe can be installed earlier in conjunction with the roadway reconstruction project.

Under Contract No. 7, new distribution main is included along Route 4 to serve the existing development and a proposed affordable housing project. This alignment is shown on Figure 10 in Appendix A. Approximately 2,400' of new 8" PVC distribution main will extend from the intersection with Killington Road southwest along Route 4. A new 16" sleeve installed by jack and bore will extend to the north side of Route 4 and a new 4" PVC water main will serve the existing developed properties.

For all of the 8" to 12" distribution mains, fire hydrants will be spaced along the route for fire protection and isolation gate valves at major intersections are included. Curb stops and HDPE water services are included to the edge of right-of-way for existing developed properties along Killington Road at the request of the Town.

9.2. Preliminary Design Criteria

As part of the design updated by Dufresne Group, a Basis of Design Summary was issued on June 14, 2022, and a copy of this document is provided in Appendix R. Excluding the capacity of the existing Valley Wells, the new components can provide an average day demand of 1,159,000 gpd and maximum day demand of 2,320,000 gpd. The capacity of these individual components will be referenced in the following sections.

9.2.1. Water Demand – Initial Years

The initial year water demands are summarized in Table 9.2. As it will take several years to construct the new water system infrastructure, the initial year is shown over multiple years

and is shown by fiscal year to align with the proposed water budget. Based on the proposed schedule detailed in Section 9.3, construction of the new supply, storage reservoir and transmission is not expected to be completed and functional until fall of 2024. This work includes Contracts No. 1, 2, 3A and 3B.

For FY 25, construction is planned to start on the south portion of the distribution piping in 2024 under Contract No. 4. This pipeline segment will allow connection of the existing public water systems with water quality concerns, Phase I of the SP Land development, and existing developed properties along Killington Road. For estimating the water demands, the following assumptions were made for the new connections:

- All of the existing public water systems with water quality concerns up to Ravine Road connect.
- 50% of the SP Land Phase I development connects.
- 50% of the existing developed properties along this section of Killington Road connect.

The average day demand (ADD) is projected at 142,466 gpd and maximum day demand (MDD) up to 284,932 gpd for FY 25. Using the historical flow data from the Killington wastewater treatment facilities, the actual average day demand is about 25% of the maximum day, so this proration was used to estimate the actual average day demand. As shown in Table 9.2, the actual average day demand (ADD) is estimated at 35,600 gpd or 13.0 MG per year.

For FY 26, construction is planned to continue with the middle portion of the distribution piping in 2025 under Contract No. 5. This pipeline segment will allow connection of the existing public water systems with water quality concerns, existing Killington Ski Area properties, existing developed properties along Killington Road and the Elementary School. For estimating the water demands, the following assumptions were made for the new connections:

- All of the existing public water systems with water quality concerns up to Killington Center Drive connect.
- 100% of the SP Land Phase I development connects.
- Killington Ski Area properties connect which include the Grand Hotel.
- 50% of the existing developed properties along Killington Road connect.
- The Elementary School connects.

The average day demand (ADD) is projected at 311,833 gpd for FY 26. As shown in Table 9.2, the actual average day demand (ADD) is estimated at 80,000 gpd or 29.2 MG per year.

For FY 27, construction is planned to continue with the north portion of the distribution piping under Contract No. 6A. The pipe under Contract No. 6B will have been constructed previously with the roadway reconstruction. This pipeline segment will allow connection of the existing developed properties along Killington Road. For estimating the water demands, the following assumptions were made for the new connections:

- 50% of the SP Land Phase II development connects.

- 50% of the existing developed properties along Killington Road connect.

The average day demand (ADD) is projected at 353,181 gpd for FY 27. As shown in Table 9.2, the actual average day demand (ADD) is estimated at 88,300 gpd or 32.2 MG per year.

Table 9.2
Projected Water Demands – Initial Years

Users	FY 25		FY 26		FY 27	
	ADD (gpd)	Actual ADD[1] (gpd)	ADD (gpd)	Actual ADD[1] (gpd)	ADD (gpd)	Actual ADD[1] (gpd)
Existing Public Water Systems with Water Quality Concerns	84,594	----	121,924	----	121,924	----
SP Land Phase I and II	37,432	----	74,864	----	74,864	----
Killington Ski Area	0	----	52,995	----	52,995	----
Killington Road Developed Properties	20,440	----	58,425	----	61,580	----
Elementary School	0	----	3,625	----	3,625	----
Total	142,466	35,600	311,833	80,000	353,181	88,300

Notes:
1. The actual average day demand (ADD) is estimated based on a % of the maximum day demand (MDD) that follows the existing Killington wastewater flows.

The design capacity of the Valley wells is shown in Table 9.3 for a combined yield of 714,240 gpd at the maximum day demand. At a projected ADD of 353,181 gpd, about 100% of the approved capacity is expected to be committed in FY 27. With the wells running up to 12 hours to meet the average day demands, a capacity up to 357,125 gpd is available.

9.2.2. Supply - Valley Wells

The preliminary design criteria for the Valley Wells and High Service pump station is summarized in Tables 9.3 and 9.4, respectively. The approved yield of the Valley wells is adequate in the initial years, but additional water source capacity will be required to meet the design year projections.

Testing of these wells for PFAS was performed at the request of the State and the results are provided in Appendix E. The results were non detect for PFAS so no treatment system is proposed.

The Town initiated the process to search for additional source capacity with Hoffer Consulting Inc. (HCI). A source capacity evaluation was issued in June 2022 and concluded that the Area A in the vicinity of the Valley Wells can support a withdrawal of over 2,000 gpm with two new larger diameter production wells and existing well PW-1D. Areas B and C were investigated

but determined to have little potential for high yielding production wells. These results are summarized in the HCI Memo dated July 19, 2022.

Table 9.3
Valley Wells
Preliminary Design Criteria

Item Description	Design Condition
Well PW-1D (WL001)	
Approved Yield @ Maximum Day Demand	391 gpm/ 563,040 gpd
Well Type	Gravel Well
Depth	96’ with 15’ screen
Diameter	6”
Total Available Head	65.7’
Type of Pump	Submersible
Design Capacity	391 gpm @ 45’
Motor	7.5 hp
Well PW-2S (WL002)	
Approved Yield @ Maximum Day Demand	105 gpm/ 151,200 gpd
Type	Gravel Well
Depth	43’ with 15’ screen
Diameter	6”
Total Available Head	17.3’
Type of Pump	Submersble
Design Capacity	105 gpm @ 40’
Motor	1.5 hp
Combined Yield	496 gpm/ 714,240 gpd

Notes:
1. Per the Source Permit.
2. Per the DG Contract 2011-1 technical specifications.

The capacity of the High Service pump station is shown in Table 9.4. Two (2) pumps are included in the proposed project, but up to four pumps can be installed to meet future demands with one pump as standby. The document included in Appendix R indicates a maximum pumping capacity of 3.0 mgd with 3 of 4 pumps operating.

Table 9.4
High Service Pump Station
Preliminary Design Criteria

Item Description	Design Condition
Pumps	
Number	2 (1 standby)
Type	Vertical Turbines
Design Capacity	700 gpm
Total Head	1,600’
Motor hp	400 hp

Notes:
1. Per the DG Contract No. 1 technical specifications.

9.2.3. Shagback Mountain Storage Tank

The preliminary design criteria for the new 750,000 gallon Shagback Mountain water storage tank constructed under this proposed project is summarized in Table 9.5. The storage tank provides for both average day demands and fire flow. Projected initial years demand of 353,181 gpd leaves about 396,819 gallons for fire flow demands. This provides more than adequate volume at about 2,500 gpm for 2.0 hours and exceeds the minimum required of 500 gpm for 2.0 hours. As the demands increase, the available fire flow will need to be monitored to ensure the minimum requirements are met. Additional space is provided on-site for construction of a second and/or third tank to meet the future domestic and fire flow demands.

Table 9.5
Shagback Mountain Water Storage Tank
Preliminary Design Criteria

Item Description	Design Condition
Number	1
Type	Prestressed Concrete
Storage Volume	750,000 gallons
Available Fire Flow	1500 gpm for 4 hours
Diameter	78’-0”
Depth	21’
Maximum Water Level	2654.00’

9.2.4. Transmission

The preliminary design criteria for the transmission mains is summarized in Table 9.6. The 16” transmission main from the High Service pump station to the storage tank has a capacity up to

4.5 mgd as shown in the Basis of Design summary by DG. Pressures at the end of the transmission main are higher than recommended, so addition of a pressure reducing valve at this location is recommended and the location will need to be evaluated by the design engineer for the Village development.

Table 9.6
Transmission Mains
Preliminary Design Criteria

Item Description	Design Condition
From Valley Well House to High Service Pump Station	
Size	20”
Material	HDPE
Type	DR-11 (160 psi)
From High Service Pump Station to Storage Reservoir	
Size	16”
Material	Ductile iron
Type	K-11 (900 psi) and Class 52
From Storage Reservoir to Distribution System	
Size	16”
Material	Ductile iron
Type	Class 52

Notes:
1. Per the Marsh Engineering drawings.

9.2.5. Distribution

The preliminary design criteria for the distribution system is summarized in Table 9.7, and pipe sizes were determined based on the hydraulic model results at the design year conditions to supply adequate domestic demands and fire flows. For the areas where fire flow will be supplied, a minimum 8” diameter pipeline is proposed.

Pressure reducing valves are located at four locations to reduce the static pressure as the distribution system extends north to Route 4 and maintains a suitable operating pressure between 40 and 120 psi. One of the pressure reducing valves should be shifted to the south near the end of the transmission main depending on what pressures are needed for the Village development.

Table 9.7
Distribution Mains
Preliminary Design Criteria

Item Description	Design Condition
Killington Road South	
Size	10”/ 12”
Material	PVC
Type	C900
PRV (1)	2
Killington Road Middle	
Size	10”
Material	PVC
Type	C900
PRV (1)	1
Killington Road North	
Size	8”
Material	PVC
Type	C900
PRV(1)	1
Route 4	
Size	4”/8”
Material	PVC
Type	C900

Notes:

1. PRV’s are included in both the Killington Road south and middle segments to maintain suitable operating pressures in the distribution system.

9.3. Project Schedule

9.3.1. Construction Schedules

A tentative construction schedule is shown in Table 9.8, and is broken down into multiple phases by assigned construction contract. The date is shown for the start of construction for each construction contract. This schedule has construction starting in 2023 and completed in 2026. A project schedule showing the construction schedules in a Gantt chart format is provided in Appendix M.

The Town wants to coordinate a segment of new waterline with the Killington Road reconstruction, so Contract No. 6B consists of installing the new pipeline in 2023 but not placing it into service until the connection is made under Contract No. 6A in 2025.

Table 9.8
Construction Schedule

Contract No.	Contract Name	Year			
		2023	2024	2025	2026
2011-1	Well Metering House and High Service Pump Station	✓			
2011-2	Shagback Mountain Water Storage	✓			
3A	Valley Wells Transmission Main	✓			
3B	Water Storage Transmission Main		✓		
4	Killington Road South Distribution Main		✓		
5	Killington Road Middle Distribution Main			✓	
6A	Killington Road North Distribution Main			✓	
6B[(1)]	Killington Road Rt 4 to Anthony Way Distribution Main	✓			
7	Route 4 Distribution Main				✓

Notes:
1. The Contract No. 6B waterline is being installed in conjunction with the roadway reconstruction project.

9.3.2. Overall Schedule

The overall project schedule is outlined in Table 9.9, and is based on the Town conducting a bond vote in December 2022. Completion of the water supply, storage and transmission is projected for September 2024 and would allow connection and providing service to water customers.

As the project continues to develop, there are many other tasks that will need to be included in the overall project schedule, such as, coordinating the design and permitting to keep the project on schedule.

Contract No. 6B is anticipated to be under construction in 2023 with the Killington roadway reconstruction but is not shown on this schedule as the design will likely be incorporated into the Killington Road reconstruction project.

Table 9.9
Overall Project Schedule

Date		Task
2022	February	Submit DWSRF priority list application *(completed)*
	June	Begin update of contract documents and permits for Contracts No. 1, 2, 3A, and 3B *(In progress)*
	September	Begin preparation for bond vote
	December	Conduct bond vote.
2023	February	Advertise for bids - Contracts No. 1, 2, and 3A
		Begin design and permitting for Contract No. 4
	May	Start construction – Contracts No. 1, 2, and 3A
2024	February	Advertise for bids – Contracts No. 3B and 4
		Begin design and permitting for Contracts No. 5 and 6A
	April	Start construction – Contracts No. 3B and 4
	September	Complete construction – Contracts No. 1, 2 and 3A
		Water supply, storage and transmission are placed into operation
	December	Complete construction – Contracts No. 3B and 4
2025	February	Advertise for bids – Contracts No. 5 and 6A
		Begin design and permitting for Contract No. 7
	April	Start construction – Contracts No. 5 and 6A
	December	Complete construction – Contracts No. 5 and 6A
2026	February	Advertise for bids – Contract No. 7
	April	Start construction – Contract No. 7
	December	Complete construction – Contract No. 7

9.4. Cost Estimates

9.4.1. Estimated Construction Costs

The breakdown of the current (July 2022) estimated construction cost of $28,031,000 is summarized below in Table 9.10 for each construction contract and a summary spreadsheet is provided in Appendix L. Following the construction schedule in Table 9.8, the ENR construction cost index was then used to extend the construction costs out to the anticipated start date. The total estimated construction cost is $31,785,250.

Updates of the construction costs were provided by Dufresne Group for the contracts that are being updated. This information was used for update of the construction costs, but was adjusted while still reflecting the recent increases in costs.

The projected construction cost estimates were used in the total project cost summary.

Table 9.10
Estimated Construction Costs

Contract No.	Contract Name	Estimated Construction Cost				
		2021(1)	**2023**(2)	**2024**(3)	**2025**(4)	**2026**(5)
1	Well Metering House and High Service Pump Station	$6,135,000	$6,600,000			
2	Shagback Mountain Water Storage	$3,250,000	$3,500,000			
3A	Valley Wells Transmission Main	$7,000,000	$7,500,000			
3B	Water Storage Transmission Main	$2,500,000		$2,900,000		
4	Killington Road South Distribution Main	$2,516,000		$2,892,000		
5	Killington Road Middle Distribution Main	$3,860,000			$4,785,000	
6A	Killington Road North Distribution Main	$1,305,000				$1,735,000
6B	Killington Road Rt 4 to Anthony Way Distribution	$310,000	$333,250			
7	Route 4 Distribution Main	$1,155,000				$1,540,000
	Total	$28,031,000	$31,785,250			

Notes:
1. ENR 13000 = July 2022
2. ENR 13975 = July 2023
3. ENR 15025 = July 2024
4. ENR 16150 = July 2025
5. ENR 17365 = July 2026

9.4.2. Total Project Cost Summary

The total project cost of $31,300,000 for the Phase 1 proposed project is summarized in Table 9.11, and a detailed spreadsheet is provided in Appendix L. This total project cost summary includes Contracts No, 1, 2, 3A, 3B, 4 and 6B, and will likely be the project scope for the initial bond vote. The total project cost includes: construction, construction contingency, engineering, administration, permit fees, land acquisition, legal, short term interest, etc.

Some of the assumptions in these total project costs are:

- The construction costs are based on the ENR cost index for the projected construction date.
- A 15% construction contingency is assumed.
- Engineering allowances are based upon State of Vermont Water Investment Division engineering fee curves.
- An allowance of $250,000 is included under Step II for well development.

Also provided in Appendix L is a total project cost summary for the entire project at $42,000,000.

The total project cost by construction contracts is summarized in Table 9.12 for the purposes of State Drinking Water funding eligibility. Initial input indicates that most of project is eligible as it is for a new public water system and will address existing water quality issues. Some of the distribution pipelines at the north end of Killington Road and Route 4 may not be eligible as this work is beyond the limits of the water systems which have water quality issues, so this determination will need to be confirmed for funding.

Table 9.11
Total Project Cost Summary – Phase 1

Item Description		Total Estimated Cost
Construction		
1[(1)]	Well, Metering House and High Service PS	$6,850,000
2	Shagback Mountain Water Storge	$3,500,000
3A	Valley Wells Transmission Main	$7,500,000
3B	Water Storage Transmission Main	$2,900,000
4	Killington Rd South Distribution	$2,892,000
6B	Killington Rd South Distribution	$333,250
	Construction Subtotal	$23,975,250
Construction Contingency		
	Construction Contingency (15%)	$3,596,288
	Construction Contingency Subtotal	$3,596,288
Step I – Preliminary Engineering		
	Study	$
	Well Development	$250,000
	Special Services	$
	Step I Subtotal	$362,971
Step II - Final Design and Permitting		
	Final Design Basic Services	$0
	Special Services	$0
	Step II Subtotal	$602,500
Step III - Construction Phase Services [(3)]		
	Construction Services	$0
	Special Services	$0
	Step III Subtotal	$2,162,500
Other Costs		
	Administrative/Bond Vote Assistance	$0
	Project Coordinator	
	Permit Fees	$0
	Easements/Land Acquisition	$0
	Legal	$0
	Short Term Interest	$0
	Other Subtotal	$603,195
	Total Project Cost	$31,302,703
	Use	**$31,300,000**

Notes:
1. An allowance of $250,000 for small purchases is shown under Contract No. 1.

Table 9.12
Drinking Water Funding Eligibility Determination

Contract No.	Contract Name	DWSRF Eligible Cost	DWSRF Non Eligible Cost
1	Well Metering House and High Service Pump Station	$9,180,214	$0
2	Shagback Mountain Water Storage	$4,511,128	$0
3A	Valley Wells Transmission Main	$9,532,559	$0
3B	Water Storage Transmission Main	$3,750,963	$0
4	Killington Road South Distribution Main	$3,850,400	$0
5	Killington Road Middle Distribution Main	$6,287,170	$0
6A	Killington Road North Distribution Main	$2,387,435	$0
6B	Killington Road Rt 4 to Anthony Way Distribution Main	$477,440	$0
7	Route 4 Distribution Main	$2,067,658	$0
	Total	$42,000,000 100%	$0 0%

9.5. Permit Requirements

The following approvals and permits are potentially required for this Town of Killington public water system project:

Water Investment Division (WID) Environmental Review – Since State of Vermont Drinking Water Funding will be used, an Environmental Report has been prepared for the Town of Killington and submitted for approval to the Vermont Water Investment Division staff. To comply with the National Environmental Policy Act (NEPA), this document will need to be approved during final design (Step II). Due to the size of this project, a public hearing will be required to solicit comments on the environment review, a 30 day public comment period noticed, and a Finding of No Significant Impact (FONSI) issued.

Division of Historic Preservation Archeological Assessment – In conjunction with the environmental review, contact has been made with WID staff to initiate an Archeological and Historic Properties Review for this project at the beginning of final design (Step II). This review will be focused on areas that have not been previously disturbed, and may require alternative construction methods to limit the project's impacts to historical resources.

Archeological and Historic Property Review was completed for the Valley Wells project as a condition of the Act 250 Land Use Permit, so this existing information should be useful in meeting this requirement but will require updates where changes to the design in the Valley

Wells project are made. These existing documents on the archeological investigation have been shared with the WID staff.

State of Vermont DWGPD Source Permit – An amended Public Community Water System Source Permit #S-2389-09.5 for Wells PW-1D and PW-2S was issued to SP Land Company on October 8, 2021. This Source Water Permit is valid for through May 15, 2023, but if the source is not connected to the public water system by this date, amendment of this permit will be required to extend the expiration date.

This Source Permit will need to be amended once the agreement is finalized with SP Land, and the permit is transferred to the Town.

State of Vermont DWGPD Permit to Construct – A Public Water System Construction Permit #C-2809-12.3 was issued to SP Land Company on September 9, 2020, and states the construction of the project must be completed by September 30, 2022. This Construction Permit includes the new water infrastructure for: the Valley Wells (Wells PW-1D and PW-2S), 3,800 of 20" HDPE transmission main, 3,400' of 16" high pressure ductile iron transmission main, 12,900' of 16" ductile iron transmission main, a high-pressure pump station, and 500,000 gallon storage tank. The following changes to this permit will be required once the updated final design documents are prepared:

- Amendment of this permit will be required to change the permittee to the Town of Killington, extend the project completion date, and change the tank size to 750,000 gallons.
- Either amendment of this permit or submittal of new permit applications will be required for the new distribution mains on Killington Road, and Route 4.

State of Vermont Act 250 Land Use Permit – An Act 250 Permit was issued to SP Land Company under Case No. 1R0980 for the Village Master Plan and authorizes construction of Phase I to include Two Potable Water Projects; Snowdon Well Field Project (SW Project) and the Valley Well Field Project (VW Project). The latest issuance is an Administrative Amendment dated January 23, 2017. Condition #5 lists other Agency of Natural Resource Permits which are incorporated by reference. Under Condition #32, all site work and construction shall be completed by October 7, 2023. Construction of the new water infrastructure under this Permit will need to be coordinated between SP Land Company and the Town of Killington. A request for extension was submitted on December 2, 2021, so the "Application Complete" letter is pending.

Amendment(s) of this Permit will be required to include the new distribution piping along Killington Road and Route 4.

State of Vermont Construction Stormwater Permit – For each of the waterline construction contracts, coverage for the construction activity will be required under Vermont Construction General Permit 3-9020. Depending on the extent of the project(s), it could be covered as a low risk or moderate construction activity and is required to follow the requirements in the

Vermont Standards and Specifications for Erosion Prevention and Sediment Control. Submittal of the permit applications is done one the final design documents are prepared.

State of Vermont Agency of Transportation Permit – A Section 1111 State Highway Access and Work Permit was obtained for the new transmission main along Route 4 from the wells to the high pressure pump station. On November 18, 2019, the date was extended to December 1, 2024.

For the new water distribution piping to be installed in the State right-of-way along Route 4, a Section 1111 State Highway Access and Work Permit will be required. Submittal of the letter of intent is required once the final design documents are prepared.

9.6. Land Requirements

Transfer of property ownership or permanent easements for the Valley Wells, High Service pump station, and Shagback storage reservoir will need to be completed prior to construction between SP Land and the Town. As part of the agreement, it will be important to ensure that sufficient land area is available at the Valley Wells for the 200’ well isolation zones and future expansion of the supply, and at the Shaback reservoir site for the addition of another reservoir(s). Each of these components are located on a separate parcel, so subdivision of each parcel will be required.

Permanent and temporary easements will need to be acquired from SP Land for the route of the transmission main from the Valley Wells to the High Service pump station, from the High Service pump station to the Shagback Storage Reservoir, and from the Shagback Storage Reservoir to the Village development.

For the distribution piping, most of the work is planned within the Town right-of-way along Killington Road. Permanent and temporary easements will be required for the pipeline through the Killington Ski Resort and the cross-country portion from East Mountain Road north along Old Mill Road to Killington Road under Contract No. 4.

Under Contract No. 5, the new watermain to the school will follow Hemlock Ridge Road but temporary and permanent easements will be required from the condo association and Elementary School.

The section of new pipeline along both sides of Route 4 under Contract No. 7 will be located with the Vtrans right-of-way and covered under the Section 1111 State Highway Access and Work Permit.

9.7. Funding

9.7.1. State of Vermont

Drinking Water SRF

The State of Vermont administers the Drinking Water State Revolving Fund (DWSRF) loan program for this type of project, and loans with an administrative interest rate of 0 to 3% and a term of 20 to 40 years, depending on the expected useful life of the proposed project. A priority list application for this project was submitted in February 2022 for this project. DWSRF also offers loan subsidies:

- Disadvantaged system subsidy (DisSub) of up to 50% of total project costs. This is available to systems that meet certain economic requirements and is applied as necessary to limit water rates to no more than 1% of the service area's median household income, not to exceed 50% of project costs. Depending on the projected water rates, the Town of Killington could qualify for a disadvantaged system subsidy.

ANR ARPA Village Water and Wastewater

Per the Legislature and Governor, the Agency of Natural Resources is committing significant American Rescue Plan Act (ARPA) funding to several areas of need. Between July 2021 and June 2022, the State plans to distribute ARPA funds to support water and wastewater infrastructure programs. One of these categories is for Village Drinking Water & Wastewater of which this project qualifies for, and a Drinking Water priority list application was submitted in November 2021. So far, $2,300,000 of ARPA funds were committed to this project for SFY 22 and the grant agreement is being prepared.

In the amended FFY2021 Clean Water Intended Use Plan, an additional $21.2 M in ARPA funds was forecasted for this project for SFY 23 to 25. This project was shown as the highest ranking project in this category. When the draft FFY2022 Clean Water Intended Use Plan was issued in July 2022, these funds were not shown for this project so comments were submitted prior to the September 6, 2022 deadline.

Infrastructure Investment Jobs Bill

This Infrastructure Bill (IIJB) was passed late last year and will contribute significant funding for water and wastewater infrastructure to the existing State Drinking Water and Clean Water programs over the next five years. Details are being are being incorporated into the Intended Use Plans. Initial input is that an average of 49% subsidy will be issued with this new money and could be greater depending on how the subsidy is allocated to specific projects.

Some of this new funding in the form of subsidy is being allocated for Emerging Contaminants which this project qualifies for.

9.7.2. USDA/Rural Development (RD)

The USDA/RD program includes both grants and loans, depending on the project and the community's ability to pay. Currently, the Town of Killington's Median Household Income (MHI) does not make the Town eligible for a grant up to 45% but a loan package could be offered at a market-based interest rate which varies, but is typically between 1% and 2%. Historically, a typical grant is issued in the range from 25 to 40% for eligible communities.

Funding offers from this program are not made until after a municipality has a positive bond vote for the project. Additionally, systems must use meter-based billing to make use of USDA/RD funding programs, though meter installation costs can also be funded through the USDA/RD program.

9.7.3. ARPA

ARPA funds are distributed directly to the community in 2021 and 2022 as State and Local Fiscal Recovery funds. These funds are eligible to be used for water and wastewater projects at the discretion of the community, and need to be committed by December 31, 2024, and spent by December 31, 2026.

9.7.4. Vermont Bond Bank (VBB)

The Vermont Bond Bank (VBB); formerly the Vermont Municipal Bond Bank) provides financing for infrastructure projects at a market-based interest rate and a variety of loan terms, though it does not provide subsidies or grants. While VBB financing could be used for the proposed water system improvements, it may not offer any advantage over DWSRF funding unless some portions of the project are not eligible for other State and Federal funding sources.

9.7.5. Funding Summary

The funding package will consist of a variety of sources as shown in Table 9.13. This project is on the State funding list in the Intended Use Plans, and the funding committed to date for SFY 22 and SFY 23 is summarized in Table 9.13 at $10,000,000. For SFY 23, an emerging contaminants grant and drinking water SRF loan are shown. It is anticipated that this project will continue to see a similar emerging contaminants grant each year and significantly more ANR ARPA funds through the Village Drinking Water & Wastewater and/or Drinking Water SRF revolving loan funds.

Other funding sources continue to be explored with key partners, such as, USDA, Northern Borders Regional Commission and the Agency of Community and Economic Development.

The Town has established a Tax Increment Finance (TIF) District which is a funding mechanism to help pay for the debt retirement to construct the new water supply, pumping,

transmission, and storage infrastructure. Preferably more of the loan funds are committed to this new water infrastructure so the Town can utilize these the TIF to pay down the debt retirement which will reduce the cost to the water customers.

Table 9.13
Funding Commitments
As of 9/26/2022

Funding Source	SFY 22	SFY 23	Funding Total
ANR ARPA Funds – Village Drinking Water & Wastewater	$2,300,000	$0	$2,300,000
State Drinking Water Program			
Revolving Loan (1)	$0	$4,020,192	$4,020,192
Emerging Contaminants Subsidy	$0	$3,679,807.98	$3,679,807.98
USDA/Rural Development			
Grant	$0	$0	$0
Loan	$0	$0	$0
ARPA	$0	$0	$0
Vermont Bond Bank (2)	$0	$0	$0
Total	$2,300,000	$7,699,999.98	$10,000,000

Notes:
1. The DW SRF Loan is assumed to be a 30 year term at an interest rate at 3.0%.

Separately, the total project cost summary and construction schedule were used to determine the amounts of funding required for each state fiscal year through SFY 25. More detail on this breakdown is provided in Appendix L, but is summarized below in Table 9.14. Funding is adequate through SFY 23, but once construction starts in 2023, additional funding of about $20,000,000 will be required for SFY 24.

Table 9.14
Projected Funding Needs Through SFY 25

	SFY 22	SFY 23	SFY 24	SFY 25
Funding Needed by Year	$295,000	$5,100,000	$20,000,000	$7,500,000
Funding Needed - Cumulative	$295,000	$5,395,000	$25,395,000	$32,895,000
Funding Commitment	$2,300,000	$10,000,000	----	----

9.8. Annual Operating Budget - Expenses

9.8.1. O&M Costs

A water budget was prepared for the initial years of operation, starting in FY 25, and is summarized in Table 9.15. Existing water budgets from similar Vermont municipal water systems were used to develop a template for the Town. It is assumed that operation of the water system will begin in FY 25, or about October, 2024, as customers are connected. This water department will be created within the Town as an enterprise fund with separate sources of income.

For the initial years, it is assumed that contract operations will be used versus the Town hiring certified water operators as Town employees to provide operation and maintenance of the system. Budget items are shown for overtime, employee benefits, worker's compensation insurance, and unemployment insurance but the Town will not likely incur these expenses until they decide to use Town employees for the operations.

For FY 25, the annual expenses are estimated at $158,500 and will increase to about $242,000 in FY 27. Within the O&M budget, there are fixed and variable costs. Typically, 60 to 80% of the overall expenses are fixed and do not change based on the volume of water produced. These fixed costs include: salaries and benefits, administration, contracted services, testing, permit fees, insurance, etc. Variable expenses will decrease or increase based on the volume of water produced, and these expenses include: chemicals, utilities, etc.

It will be important to start putting some funds in the line item for capital reserve as the expenses and income begin to stabilize with the water rates.

9.8.2. Debt Repayment

This budget currently only shows the expenses, excluding the debt retirement. Due to the size of this project, there will likely be multiple construction loans. Based on the current construction schedule, the first loan payment will likely be due about December 2025, one year from the date of substantial completion. Beginning in the FY 26 budget, debt retirement will need to be shown as an expense. Until the funding sources are determined, an annual loan payment can not be projected.

Table 9.15
Projected Water Budget
FY 25 – FY 27

Expenses		**FY 25 Budget**	**FY 26 Budget**	**FY 27 Budget**
Salary and Benefits [1]				
	Department Salary	$5,000	$10,000	$12,500
	Admin Salary	$5,000	$7,500	$10,000
	Overtime	$0	$0	$0
	Benefits	$0	$0	$0
	Uniforms	$0	$0	$0
	Vehicle Expense	$7,500	$10,000	$12,500
	Training and Conferences	$500	$1,500	$2,000
	Total Salary and Benefits	$18,000	$29,000	$37,000
Operations				
	Contracted Services [2]	$75,000	$75,000	$100,000
	Testing	$4,000	$5,000	$6,000
	Equipment Maintenance	$10,000	$10,000	$10,000
	Distribution Line Maintenance	$2,500	$5,000	$7,500
	Chemicals	$5,000	$10,000	$12,500
	Materials	$2,500	$2,500	$2,500
	Utilities [3]	$27,500	$45,000	$50,000
	Office Expenses	$500	$500	$500
	Plant Equipment	$1,000	$1,000	$1,000
	Total Operations	$128,000	$154,000	$190,000
General				
	Permit Fee	$2,500	$2,500	$2,500
	Audit Fee	$2,000	$2,000	$2,000
	Legal Services	$500	$2,000	$3,000
	Consulting Engineers	$0	$0	$0
	Worker's Compensation Insurance	$0	$0	$0
	Unemployment Insurance	$0	$0	$0
	Building Insurance	$7,500	$7,500	$7,500
	Capital Reserve	$0	$0	$0
	Total General	$12,500	$14,000	$15,000
	Total Expenses	$158,500	$197,000	$242,000

Notes:
1. It is assumed in the initial years that operations is provided by contract services so no expenses for overtime and benefits are shown.
2. Contracted services include the operation of the system at an average of 16 hrs per week to start.
3. Utilities include heat, electric and telphone. Electric expenses are based on the projected ADD water demands.

9.9. Water Department Income

9.9.1. Water Rates

A majority of the income to cover the O&M expenses will need to be generated through the water rates. Information was provided on existing rate structures for the Town wastewater system on Route 4 and the Sherburne Fire District wastewater system. For most utility rate structures, the rate includes a fixed fee and usage fee but for this type of system it would not be recommended to implement this billing method. The new water system will primarily serve a seasonal resort area, so the water allocations and billing method needs to be based on the unitized design criteria in the Vermont Water Supply Rules and/or Environmental Protection Rules. The basis for this approach is that the average day water demands are relatively low on an average compared to a typical Vermont community. Typically, the maximum day demands govern regarding capacity and the periods of highest water usage will be during peak winter holiday periods. Creating a billing structure that includes a usage component makes it difficult to establish a rate that will be fair and equitable while maintaining stability as an income source. Water meters are included in the project cost, so after a few years of operation, this data could be used in the future for billing but is more valuable for documenting the difference between water produced and water sold, or comparing the usage to the design flows of a specific customer(s). It should also be noted that installation of water meters is not required unless the Town pursues USDA/ Rural Development funding.

Currently, the Town and Sherburne Fire District bill on an equivalent residential unit (ERU) basis. For consistency, it makes sense to follow this billing method. For the wastewater utility, the Town defines an ERU as 450 gpd. In the Vermont Water Supply Rules, a single family home has a design value of 150 gpd per bedroom. For this new water system, an ERU will be defined as a single family home with 3 bedrooms at 450 gpd as follows:

- Residential:
  - Each residential unit will be a minimum of 1.0 ERU's irregardless of number of bedrooms.
  - For a residential unit greater than 3 bedrooms, the ERU's will be calculated based on the design flow and allocation. For example, a 4 bedroom residential unit would be 600 gpd/450 gpd = 1.3 ERU's, rounded to the nearest tenth.
- Non Residential:
  - Each non residential property will be a minimum of 1.0 ERU's irregardless of use.
  - The ERU's will be calculated based on the design flows or allocation.

For the initial FY 25, the ERU's were estimated based on the connected customers identified in Section 9.2 for each category, and are summarized in Table 9.16. The ERU's for FY 25 are projected at 316. Based on the projected FY 25 operating budget of $158,500, the annual water charge per ERU will be $500 ($158,500/316).

Even though the operation expenses are anticipated to increase, as the number of connections increases, this rate will decrease accordingly.

This water rate should be billed quarterly or semi-annually, and does not include debt retirement or a contribution to a capital reserve fund. In the first year if fewer or more connect to the new water system, then the ERU's will need to be adjusted accordingly.

Section 9.16
FY 25 – Equivalent Residential Units

Connections	**Calculated ERU's**
Existing Public Water Systems with Water Quality Concerns (2)	188
SP Land Phase I (3)	83
Killington Ski Area	0
Existing Developed Properties Along Killington Road (4)	45
Elementary School	0
Total	316

Notes:
1. One ERU = 450 gpd.
2. 84,594 gpd/450 gpd = 188 ERU's
3. 37,432 gpd/450 gpd = 83 ERU's
4. 20,440 gpd/450 gpd = 45 ERU's

9.9.2. Allocation Fees

One major source of income for debt retirement for the new water system can be a charge for allocation fees. Since the funding sources and annual loan payment are not yet defined, it is difficult to project what an allocation fee should be, but a possible methodology for calculating the fee is discussed here. For some of these public infrastructure projects, the allocation fee is waived in the first year to encourage existing development to connect to the new infrastructure so this approach is something that the Town could consider.

A basis for calculating the allocation fee is to use the total project cost and approved capacity to define a value per ERU or per gallon of capacity. Variations of the total project cost can be used that only include the supply, storage, and transmission or the entire project. Depending on the amount of grant/subsidy received by the Town, alternate funding scenarios can be considered for calculating the allocation fees.

9.9.3. Tax Increment Financing

Another major source of income that the Town is planning on to reduce the debt retirement is Tax Increment Financing (TIF). The TIF district has been approved by the State, so the increase in Town property tax value from the new development can be used by the Town for infrastructure improvements. This income source can be applied to the annual loan payments on the eligible infrastructure for the new water system.

9.10. New Water System Capacity Requirements

A copy of the Proposed System Checklist for a new community water system is provided in Appendix O and is briefly discussed here. Megan Young is to DWGPD contact for the water system capacity. Some of the items required have already been addressed, such as, Source Permit and Construction Permits but these permit related items will need to be transferred to the Town as the design documents are updated.

9.10.1. Capacity Approval

The following must be completed for capacity approval:

- 5 year budget that includes all income and major expenses
- Verbal agreement with VT certified operator
- Submit Officials Contact form
- Capacity approval letter

The above items are typically required to be completed before the Source Permit is issued.

9.10.2. Operating Permit Criteria

A Permit to Operate will need to be issued and the following items will need to be completed prior to issuance of the Permit to Operate:

- Compliance with Appendix A source water and infrastructure requirements
- Operation and maintenance manual
- Retention of a VT certified water system operator
- As-built/record drawings
- Updated Officials Contact Form
- Long Range Plan
- Operating permit application
- Bacteriological sampling plan
- Lead and copper sampling plan
- Disinfection By-Product (if applicable) sampling plan

Development of a Long Range Plan will be required for the new Town public water system, and major elements required in this plan are:

- Existing ownership of the system
- Final ownership structure
- Cost of operation and maintenance of system
- Revenues for operation and maintenance
- Alternatives and plans for growth and modernization
- Water conservation planning

10. CONCLUSIONS AND RECOMMENDATIONS

10.1. Water Source Capacity Investigation

In Section 4.0, the projected water demands for the design year are summarized and indicate that a source capacity of 1,600 to 1,700 gpm could be required. The Town worked with Hoffer Consulting Inc. to evaluate alternatives for increase of the source capacity. This study included drilling test wells in the vicinity of the approved Valley Wells to determine the maximum yield potential and investigate other potential well sites in the vicinity on property owned by SP Land. The site of the Valley wells (Area A) has the greatest potential as a withdrawal of over 2,000 gpm can be supported with two new larger diameter production wells and existing well PW-1D. The results of this assessment are summarized in the Memo by Hoffer Consulting dated June 6, 2022.

10.2. Available Funding Sources

Initial input from the Drinking Water Division indicate that the total project cost of $42 M could be eligible for State funding. A Drinking Water priority list application was submitted in January 2022 for ranking of this project and the Intended Use Plan was issued in September 2022 for SFY 23 funding. No ANR ARPA funds from the Village Drinking Water and Wastewater were shown of SFY 23, so comments were submitted by September 6, 2022. Funding was shown for this project on the approved DW IUP for emerging contaminants subsidy and DW revolving loan.

10.3. Town and SP Land MOU

Prior to a bond vote, a Memorandum of Understanding will need to be developed between the Town and SP Land for the new water system to include, but not limited to:

- Transfer of design documents and permits to the Town
- Source capacity commitments
- Coordination of temporary and permanent easements for the transmission mains, and land acquisition for the Valley Wells, High Service Pump Station and Shagback Mountain storage sites

10.4. Environmental Report

An environmental report has been prepared for the proposed project to meet the Drinking Water program requirements and submitted in August 2022. This report is currently under review. Issue of the Finding of No Significant Impact will be required prior to the start of construction. Additional detail on this item is provided in Section 9.5.

10.5. Contract Document and Permit Updates

Final design drawings have been prepared and permits obtained by SP Land for the water system supply, storage and transmission components. The design drawings and related information will need to be transferred over to the Town by SP Land, then update of the design documents will be required to update the permits so that construction can be started in 2023. These documents are referenced throughout the report, and are being updated by the original design engineers, Dufresne Group and Marsh Engineering, so that these documents are ready for construction purposes using State Drinking Water Planning funds. Use of these funds will require use of the EJCDC engineering services agreement and review and approval of the scope of services by the Drinking Water staff.

Review comments were provided on this 90% PER by DWGPD staff on April 1, 2022, and are listed below for addressing as part of the design updates:

- For the Well House, include/identify provisions for monitoring and recording the daily blending ratio as the two Valley wells have a combined radium blending requirement.
- There are existing Killington Road public water systems that have a corrosion control concern, so include the addition of orthophosphate for corrosion control optimization. (DWGPD comment).
- The Division recommends new source water quality samples to include at least alkalinity, pH, hardness, and radionuclides.

Some of the tasks required for each contract are briefly described below:

Contract No. 1 Well Metering House and High Service Pumps

- Add the EJCDC State approved front end documents
- Update the technical specifications and equipment models
- Drawings
    - Update the new well construction to reflect any changes recommended by Hoffer Consulting
    - Include any subsurface and geotechnical data at the Well House and High Service Pump Station Building
    - Provide design and details for the retaining wall at the High Service Pump Station
    - Include structural and architectural design for the Well House
    - Coordinate the design for the new electric service for the Well House and High Service Pump Station
- Update the bid quantities and construction cost estimate
- Submit a Drinking Water and Groundwater Permit to Construct application naming the Town as the applicant.
- Update other permits as required.

Contract No. 2 Shagback Mountain Water Storage Tank

- Add the EJCDC State approved front end documents
- Update the technical specifications
- For the new site, perform the topographical survey and geotechnical investigation
- Drawings
    - Update the proposed site plan for the new tank site
    - Coordinate the new 750,000 gallon tank design with DN Tanks.
- Update the bid quantities and construction cost estimate
- Submit a Drinking Water and Groundwater Permit to Construct application naming the Town as the applicant and for the larger 750,000 gallon tank.
- Update other permits as required.

Transmission Mains

- Add the EJCDC State approved front end documents
- Update the technical specifications
- Coordinate the material specifications with any new Buy American requirements
- Drawings
    - Include any subsurface data for the transmission main
    - Split the design drawings into Contracts No. 3A and 3b.
    - Coordinate the change in alignment with the revised storage tank site.
- Update the bid quantities and construction cost estimate
- Submit a Drinking Water and Groundwater Permit to Construct application naming the Town as the applicant and incorporating the change in alignment.
- Update other permits as required.

10.6. Bond Vote

A bond vote is tentatively planned for March 2023 vs December 2022, so next steps for the new water system will need to include:

- Finalizing the Phase 1 project scope and bond vote amount
- Preparation of a bond vote schedule to include public hearings and other posting dates
- Coordination and preparation of the bond documents by bond counsel
- Develop public education/outreach materials
- Selectboard approval and signing of bond vote documents
- Conduct public hearing(s)