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November 2, 2018

Paul Fraser, Chair & Jamaica Selectboard
Town of Jamaica
PO Box 173
Jamaica, VT 05343

Re: Jamaica Potable Water Study Report
DG 4180006

Dear Jamaica Selectboard Members:

This letter report has been developed to summarize our preliminary for a potential public water system in Jamaica Village, including an evaluation of existing conditions, identification of deficiencies and recommendations for next phases. Our work included compiling data on existing wells and septic systems and evaluating existing conditions in comparison to the current rules for wastewater disposal and potable water supply; performing water quality testing across the study area; conducting a survey of property owners; estimating current and future water demand and evaluating demand in comparison to the estimated water supply capacity; and, identifying parcels for potential future development or increased use and commenting on potential issues related to commercial growth.

1. Study Area Characteristics

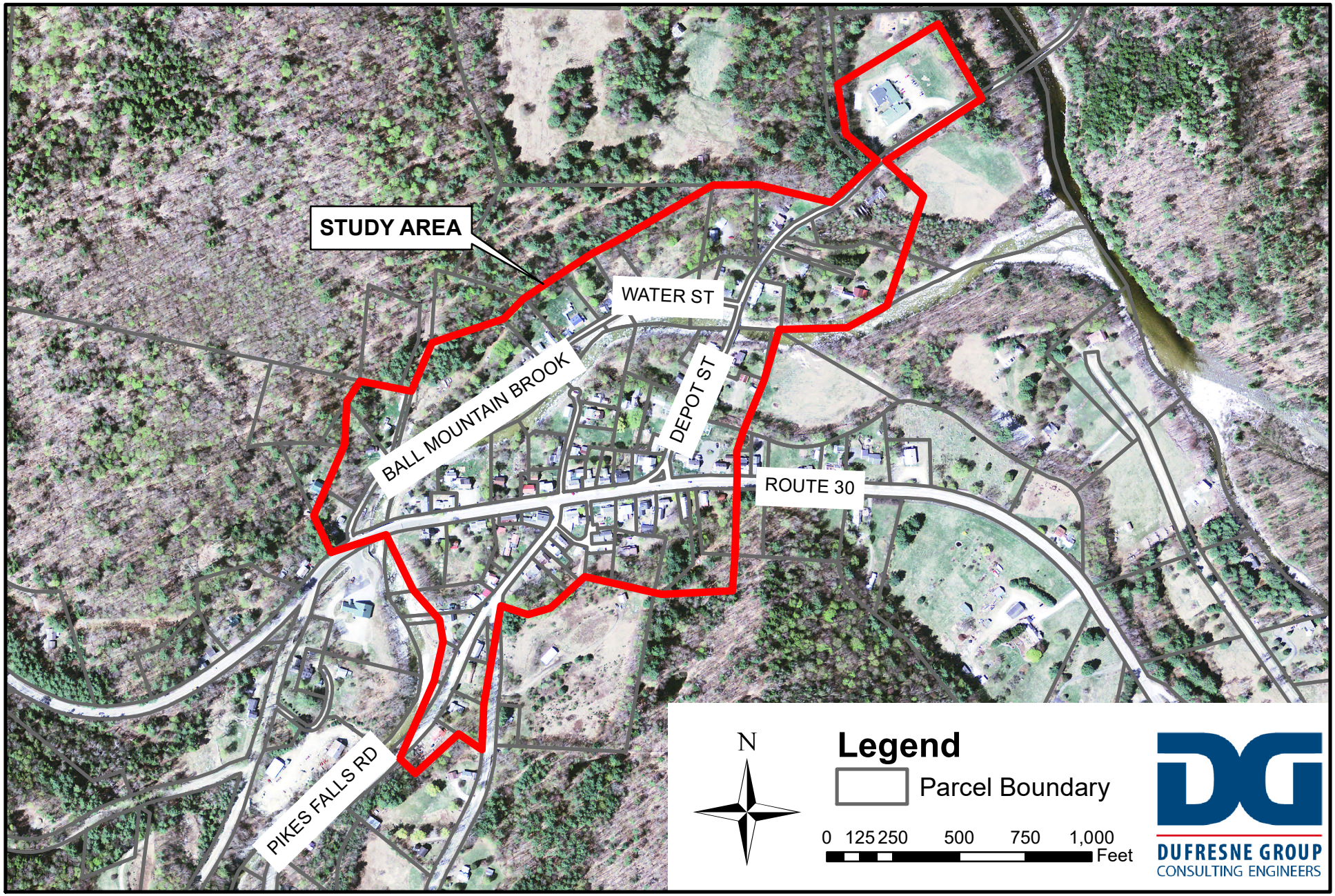
1.1. Study Area

The study area is shown in Figure 1.1 and includes the following areas:

- Route 30 from the bridge over the Ball Mountain Brook to the Three Mountain Inn
- Pikes Falls Road from Route 30 to 191 Pikes Falls Road
- Depot Street from Route 30 to the Jamaica Village School
- Water Street (all)
- Factory Street (all)

The study area was developed to focus on the most densely developed portion of Jamaica Village. The study area is solely for the purpose of defining the geographic limits of the evaluation and does not represent the extent of any potential future water or wastewater system.

FIGURE 1.1
STUDY AREA MAP



Information for this study was obtained through several sources, as follows:

- Property Owner Survey Responses
- Vermont Center for Geographic Information (VCGI)
- Vermont Drinking Water and Groundwater Protection Division (DWGWPD)
    - Drinking Water Watch Database
    - Public Water System Sample and Sampling Schedule Database
    - Well Completion Report Database
    - Wastewater Systems and Potable Water Supply Permit Database
- Jamaica Village Water Quality and Septic Study, prepared by Windham Regional Commission dated April 2000

The figures presented in this report may not show all wells and physical features as the data collected from the various sources listed above is not complete or may not be geographically accurate.

1.2. Study Area Survey

A paper survey was mailed to the owner of each developed parcel in the study area. The survey requested information on the existing parcel use, water supply, and wastewater disposal. A blank survey form is included in the Appendices.

The return response to the survey is shown in Table 1.1.

Table 1.1: Study Area Survey Return Response

	Number	**Percentage**
Surveys Mailed	63	N/A
Survey Responses	29	46%
Undeliverable	1	1.6%

The information provided by the survey respondents was used to develop the mapping included in this report, as well as identify potential water supply issues. The survey results are included in various sections of this report to support assumptions, conclusions and recommendations.

Additionally, an online survey was provided for residents outside of the study area. The questions were solely focused on gathering public opinion and did not include any questions relative to water supply or wastewater disposal. The online survey was publicized at Selectboard meetings and shared on the local community social media site. There were 49 participants in the online survey.

The data collected from both surveys is summarized and presented in various sections of this report and on the mapping.

1.3. Parcel Characteristics

The study area includes 63 developed parcels (containing habitable structures) and 4 undeveloped parcels. Of the developed parcels, it is estimated that 79% are currently characterized as residential use, 13% as commercial use and 8% as municipal or community use. For the purposes of this study, parcels that are currently vacant have been characterized based on their most recent use.

The average parcel size of existing developed parcels in the study area is 0.86 acres. Table 1.2 summarizes the sizes of developed parcels in the study area. The Jamaica Town Plan, dated November 13, 2017, states the following regarding land use development in the Village:

> *Average development density in Jamaica Village should not exceed one unit per acre, although it may not be possible to achieve this density in some areas of the Village because of the number of pre-existing small lots and the need to provide for safe isolation distances between leach fields and water supplies. Generally, villages are developed at a much higher density (one unit per 1/8 acre or 1/4 acre). However, due to the water and wastewater limitations previously mentioned, the ability to achieve this higher density is restricted.*

Table 1.2: Developed Parcel Size Summary

Size Category	Number of Parcels at or Below Size Category	% of All Parcels at or Below Size Category	% of Commercial Parcels at or Below Size Category
1 acre	55	87%	88%
½ acre	42	67%	75%
¼ acre	20	32%	63%
1/8 acre	14	22%	50%

The commercial parcel data is listed separately in Table 1.2 as many commercial uses will eventually require a public water supply, which has more stringent requirements than a private water supply. Therefore, parcel sizing becomes more critical for commercial properties in order to comply with isolation distance requirements.

1.4. Potable Water Supplies

Based on data available from the Vermont Center for Geographic Information (VCGI), the 2000 Wastewater Study and survey responses, there are an estimated 61 active potable wells in the study area. This includes 4 permitted (or previously permitted) public water supplies, which are summarized in Table 1.3.

Table 1.3: Public Water Supplies

WSID	Name	Current Type	Status
0931	Three Mountain Inn	NP	Inactive
1343	North Country General	TNC	Inactive
2221	Jamaica House	NP	Inactive
6070	Jamaica Village School	NTNC	Active

Notes:

1. WSID = Water System ID. This is a number assigned by the State to permitted public water supplies/systems.
2. NTNC = Non-Transient Non-Community Water Supply. This is a water supply regularly serving at least 25 of the same persons daily for more than six months per year (i.e. school, office building, etc.).
3. TNC = Transient Non-Community Water Supply. This is a water supply serving an average of at least 25 people per day for at least 60 days out of the year (i.e. restaurant, lodging, etc.).
4. NP = Non-Public Water Supply. This is a water supply serving the public, with a service population or duration less than a TNC.

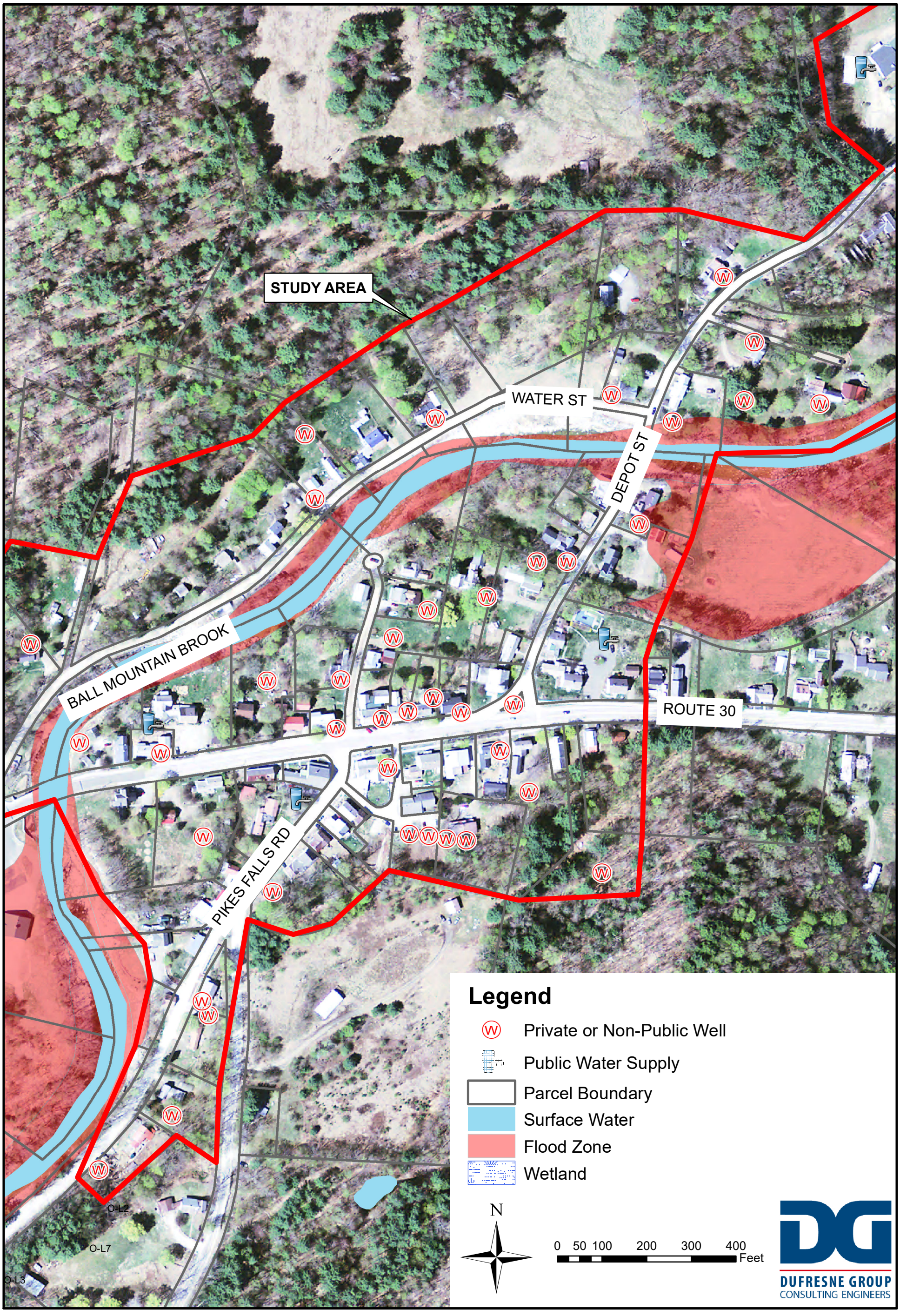
The public water supplies listed in Table 1.3 as inactive were previously permitted by the Vermont Drinking Water and Groundwater Protection Division (DWGWPD) as Transient Non-Community Water Supplies, meaning that they serve a transient or changing population, such as a restaurant or lodging. Two of these water supplies no longer serve a large enough population to require permitting through the DWGWPD, which changed the designation to a non-public water supply for both. The third is inactive as it is not currently being used, but it has not been changed to non-public by the DWGWPD. If the water supply returns to use, the DWGWPD will evaluate the population served to determine the proper designation.

There are other non-public water supplies in the study area that are not, nor have ever been, permitted by the DWGWPD. An example of this type of water supply is a well serving two single family homes. These types of water supplies are not specifically listed or identified in this study.

The only active public water supply in the study area as of the date of this study is the Jamaica Village School. As this supply is permitted as a Non-Transient Non-Community water supply, monthly and annual water quality testing of a variety of contaminants is required. A licensed water system operator is required to operate the system and perform all required testing and maintenance. Additionally, the DWGWPD performs a sanitary survey of the entire system (well, piping, treatment, storage, etc.) once every three years, which identifies any deficiencies in the system and sets a plan and schedule for resolving the deficiencies.

A map of the study area showing the approximate location of potable wells in relation to parcel boundaries, buildings, roads, driveways, surface water, wetlands and flood plains is provided as Figure 1.2. As shown, there are no mapped wetlands within the study area. There is a flood plain along Ball Mountain Brook. Public wells cannot be located within a flood plain and it is preferred that private wells be located outside of flood plains if possible.

FIGURE 1.2
POTABLE WELL SITE MAP



Note: This map does not show all wells in the study area as complete data was not available.

2. Regulatory Requirements

2.1. Vermont Wastewater and Potable Water Supply Rules

The Vermont Wastewater and Potable Water Supply Rules (WPWSR) is administered through the Drinking Water and Groundwater Protection Division (DWGWPD) Regional Offices and provides regulation, requirements and guidance for the design, construction, replacement, modification, operation and maintenance of potable water supplies and on-site wastewater disposal systems in order to protect human health and the environment. Any water supply that is not regulated under the Vermont Water Supply Rule is regulated under the WPWSR.

The WPWSR focuses mainly on regulation and design of on-site wastewater disposal systems. For potable water supplies, the WPWSR includes isolation distances and design flows for sizing pumps and water service piping.

Any new, replacement or modified potable water supply or wastewater disposal system requires a Wastewater and Potable Water Supply Permit through the Vermont Department of Environmental Conservation (DEC). This permitting process requires the applicant to complete a permit application and, depending on the extent of the proposed work, often requires plans prepared by an engineer.

2.1.1. Isolation Distances

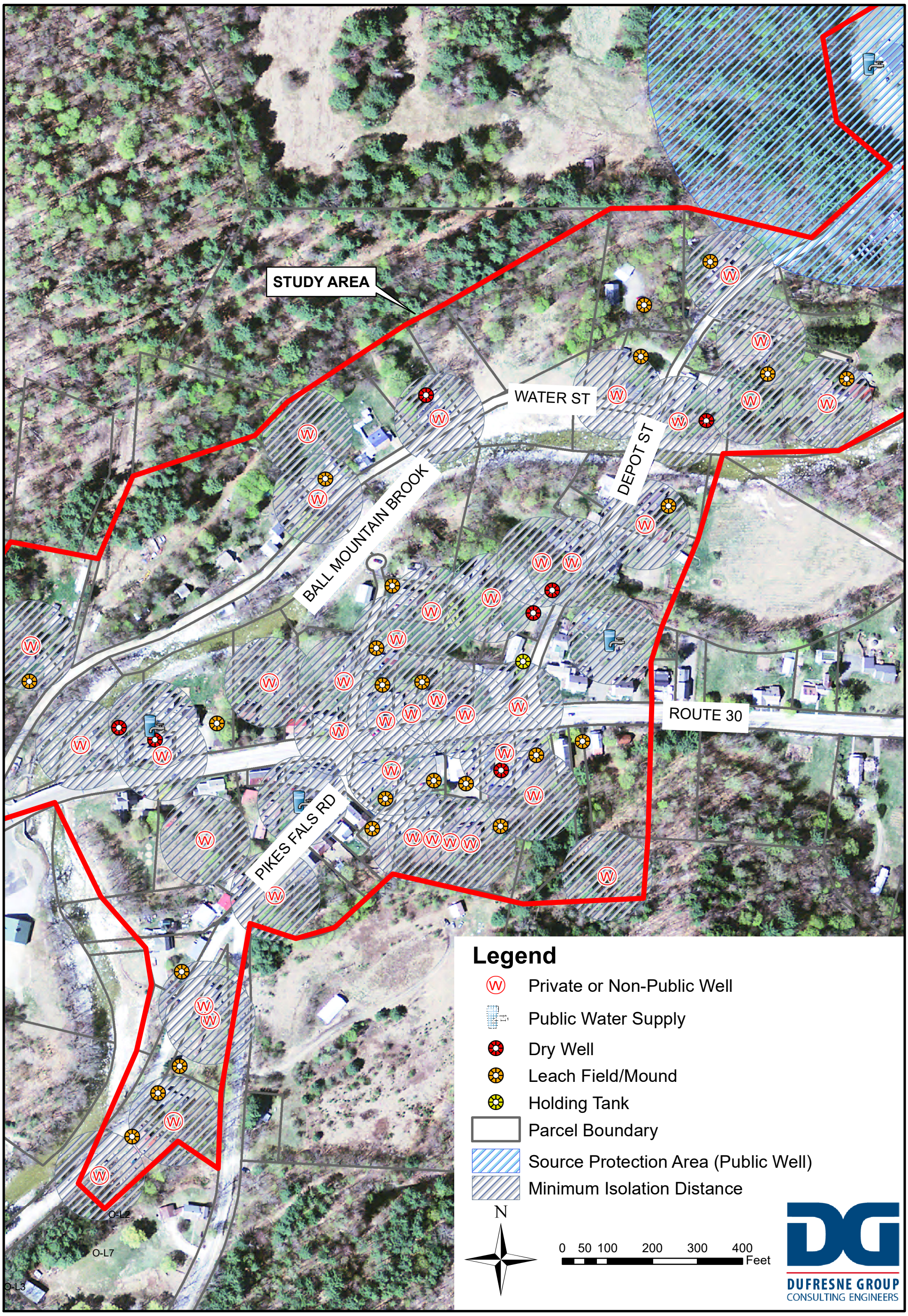
All private wells and water supply components require minimum isolation distances from wastewater system components as per the WPWSR. Table 2.1 summarizes the required isolation distances for private water supplies.

Table 2.1: WPWSR Minimum Isolation Distances for Private Water Supplies

Item	Horizontal Distance (feet)		
	Leachfield	**Septic Tank**	**Sewer Pipe**
Drilled Well	100-400+	50	50
Gravel Pack Well, Shallow Well or Spring	150-500	75	75
Water Main	50	50	10
Water Service	25	25	10
Water Storage Tank	50	50	50
Suction Water Pipe	100	50	50

Figure 2.1 shows potable wells, wastewater disposal systems and isolation areas around the potable wells using a typical minimum isolation distance of 100 feet (for private and non-public wells). This figure does not accurately represent the actual isolation distances of each well, which would be larger than the minimum shown on the map, and the well locations are approximate based on sketches and descriptions provided by property owners and other available data. Additionally, not all wastewater disposal systems are shown on the map due to lack of geographic information. Based on this figure, approximately 58% of the private and non-public wells appear to be

FIGURE 2.1
MINIMUM ISOLATION DISTANCES BETWEEN PRIVATE AND NON-PUBLIC WELLS AND WASTEWATER DISPOSAL SYSTEMS



Note: This map does not show all wells or septic systems in the study area as complete data was not available.

located too close to leach fields, which is likely a low estimate due to the lack of available information and the use of minimum isolation distances. In small, dense villages like Jamaica, it is not uncommon to find a large percentage of the existing potable water supplies located within 30 or 40 feet of a wastewater disposal system.

When there is a need to replace a potable water supply or a wastewater disposal system in these densely developed villages, it is often impossible to obtain the required isolation distances. When permitting these water and wastewater replacement components under the WPWSR, the DEC often approves variances for a “best fit” design that allows for continued use of a property while providing the highest level of protection for human health and the environment that can be achieved on a particular property.

2.2. Water Supply Rule

The Vermont Water Supply Rule (WSR) is administered through the Drinking Water and Groundwater Protection Division (DWGWPD) State office and applies to all water systems, including public, bottled, non-public and private. Only portions of the WRF apply to each type of water system. The primary purpose of the WSR is to regulate water systems to provide clean and safe drinking water. The WSR includes well construction standards, which apply to every constructed well in the State, regardless of type.

The WSR also serves as the tool used by the State to administer the Safe Drinking Water Act, which is a Federal regulation that applies to all public water systems in the country.

The WSR includes design demand flows for public water systems, which vary somewhat from the design demand flows listed in the WPWSR. A well serving a single-family home would be designed based on the WPWSR, while a well serving a public water system would be designed based on the WSR.

The WSR covers multiple permits for public and some non-public water systems, including source permits, construction permits and operating permits. As an owner of a single-family home, one would typically not need to permit their water supply under the WSR. They would however be required to comply with the requirements for well construction. Permitting under the WSR requires a permit application, a basis of design prepared by a licensed engineer, plans and specifications prepared by a licensed engineer and public comment periods.

2.2.1. Isolation Distances

All public and some non-public wells require isolation distances from various potential sources of contamination as per the WSR. Table 2.2 summarizes the required isolation distances for public (and some non-public) water supplies.

Table 2.2: Minimum Isolation Distances for Public Water Supplies

Potential Source of Contamination and Other Siting Limitations	**Separation Distance (feet)**
Roadway or Parking Lot	25
Driveway (<3 residences)	15
Sewage System Disposal Fields	100-400+
Subsurface Wastewater Piping/Tanks	50
Property Line	10
Herbicide Application on Utility ROW	100
Surface Water	10
Flood Ways	Outside of Flood Way
Buildings	10
Hazardous/Solid Waste Disposal Site	Varies

Unlike the WPWSR, the WSR does not allow any variances for isolation distances, therefore public and permitted non-public wells must comply with all isolation distances in order to be approved for use. This is problematic for economic development as commercial buildings may require a public water system under the WSR. The private and non-public water supplies shown in Figure 2.1 that appear to be within the minimum isolation distance from a leach field cannot be permitted under the current WSR as a public water supply. Therefore, they can never serve a building that requires a public water source, such as a sit-down food or drink establishment.

An example of this occurred in Jamaica Village in 2016 when a business owner in the study area attempted to obtain approval of an existing private well as a public water supply. However, since the existing private well was located only 40 feet from the existing leach field, the DWGWPD would not approve the use of the existing private well as a public water supply as 100 feet is the minimum required isolation distance. In 2017, the same business owner attempted to obtain approval to install a new well approximately 70 feet from the leach field as a public water supply. This was the maximum separation from the leach field that could be obtained within the property boundaries for this specific parcel. Again, the DWGWPD would not approve the proposed well as it did not comply with the required 100 feet isolation distance from a leach field. This business was not able to expand due to the lack of a public water supply.

It is important to note that State law does allow for a property to remain in active use, regardless of compliance with the current rules, for the use and scale that existed in 2007. For example, if a building contained a restaurant with 20 seats serving 2 meals per day in 2007, the restaurant can remain in operation with the same number of seats and meals per day even if the water system is not in full compliance with the current regulations. However, if the restaurant adds 5 seats or another meal per day, the water system would need to be brought into full compliance with the current regulations.

3. Water Quality Testing

3.1. Water Treatment

It appears people are becoming more conscience of their water quality. Water filters for residential use have become common in homes to provide water treatment. These can include whole-house water filters, faucet water filters, counter-top water filters, under-sink water filters, showerhead filters, and water filter pitchers. Most filters have a variety of cartridge options to filter out different contaminants, such as sediment, lead, manganese, and iron. Another common treatment component is a water softener, which is used to reduce water hardness. The property owner survey asked respondents if they used any water treatment and if so, what kind. The results of this question are summarized in Table 3.1.

Table 3.1: Survey Response: Water Treatment Methods

Type of Treatment	Number of Responses	Percentage of Responses
Filter (any type)	9	28%
Multiple Filters (any type)	4	13%
Ultraviolet Disinfection	1	3%
Softener	2	6%
Total Providing Treatment	16	50%
Do Not Provide Treatment	13	41%
Did Not Respond	3	9%

Note: Some respondents reported multiple types of treatment.

The property owner survey also asked respondents what type of water they drink in their buildings. The results of this question are summarized in Table 3.2.

Table 3.2: Survey Response: Types of Drinking Water Used

Type of Drinking Water Used	Number of Responses	Percentage of Responses
Tap Water	22	76%
Bottled Water	2	7%
Tap and Bottled Water	3	10%
No Response	2	7%

The high percentage of respondents using tap water indicates that the water users feel comfortable with the water quality at the tap in their buildings.

3.2. Water Quality Testing

A public water system is required by their operating permit to test for a variety of contaminants each year. However, property owners with private wells are not required to perform water quality testing. Most property owners do not perform regular water quality testing on their water supply. The potable water industry recommends

residential water quality testing on an annual basis to ensure water quality is suitable for human consumption. Water quality testing is a low-cost tool that can be used to check water quality, as well as identify what type of water treatment may be best suited for a particular water supply. A comprehensive water quality testing package typically costs less than $200.

The property owner survey asked respondents if they had ever tested their water and if so, what contaminants the testing included. 83% of respondents have tested their water at least once. The contaminants tested are summarized in Table 3.3.

Table 3.3: Survey Response: Water Quality Testing

Contaminant	Number of Respondents Performed Testing	Percentage of Respondents Performed Testing
E.Coli	8	28%
E. Coli and Lead	4	14%
Hardness Only	1	3%
Package Test	9	31%
No Testing Performed	4	14%
Did Not Respond	3	10%

Based on the information provided in the property owner surveys, there were several wells that tested positive for e.coli after Tropical Storm Irene in 2011 due to the flood waters overtopping well caps. In these cases, the wells were disinfected and subsequently tested negative for e.coli.

The only other typical contaminants reported in the survey were iron and manganese, which are naturally occurring in groundwater and are often found together. Manganese usually occurs in much lower concentrations than iron. The DWGWPD has set a Secondary Maximum Contaminant Level of 0.3 mg/L for iron and 0.05 mg/L for manganese for public water systems to manage the aesthetics of the drinking water. The Vermont Department of Health has set a Health Advisory level of 0.3 mg/L for manganese. Iron and manganese will cause staining in plumbing fixtures, such as sinks and tubs, and create a metallic taste. Iron and manganese are not considered to present a risk to human health at the SMCL.

3.3. Water Quality Test Results

As part of this study, some of the wells within the study area were tested for a variety of contaminants. Property owners were asked as part of the property owner survey if they would be willing to submit to a free water quality test. Most of the respondents indicated they would be willing to have their water tested. 11 of the respondents were chosen for the water quality testing based on a variety of factors including type of source and location in the study area. The testing locations are anonymous and therefore a map of the testing locations is not provided.

The testing was performed by the Vermont Department of Health as part of a statewide water quality study focusing on privately owned residential wells. The contaminants tested for and a brief description of the source of each potential contaminant are included in Table 3.4.

Table 3.4: Water Quality Tests Performed

Contaminant	Typical Source of Contaminant
Total Coliform	Bacteria in water that has been influenced by surface water; present in digestive tracts of animals and humans; provides a general indication of sanitary condition of water supply
E.Coli	Major species in the fecal coliform group; generally not found growing/reproducing in the environment; best indicator of fecal pollution and possible presence of pathogens
Arsenic	Erosion of natural deposits; runoff from orchards; runoff from glass and electronics production waste
Chloride	Erosion of natural deposits; runoff from roads; runoff from fertilizer use; leaching from landfills, septic tanks, sewage
Copper	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Fluoride	Erosion of natural deposits; discharge from fertilizer and aluminum factories
Iron	Erosion of natural deposits
Lead	Corrosion of household plumbing systems; erosion of natural deposits
Manganese	Erosion of natural deposits
Nitrate/Nitrite	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Sodium	Erosion of natural deposits; runoff from roads; water softeners; leaching from septic tanks, sewage
Hardness	Erosion of natural deposits of calcium and magnesium, runoff from soils
Gross Alpha	Erosion of natural deposits
Uranium	Erosion of natural deposits

The results of the water quality testing are summarized in Table 3.5 on the following page. Six of the eleven wells tested were flagged for recommended action. The owners of these wells were notified by the Department of Health and provided with the recommended actions. These actions included repairs, additional testing and/or water treatment.

There were contaminants detected in some of the test locations that might indicate leaching from septic systems. However, there are other potential causes for these contaminants, therefore the presence of the contaminant cannot be directly linked to potential septic system failure. There were four positive tests for total coliform, which is an indication of well contamination; however, there were no positive tests for e.coli contamination.

Table 3.5: Water Quality Testing Results

Location #	Total Coliform	E.Coli	Arsenic (mg/L)	Chloride (mg/L)	Copper (mg/L)	Fluoride (mg/L)	Iron (mg/L)	Lead (mg/L)	Manganese (mg/L)	Nitrate/Nitrite	Sodium (mg/L)	Hardness	Gross Alpha (pCi/L)	Uranium (ug/L)
MCL	*D*	*D*	*0.010*	*-*	*1.3*	*4.0*	*-*	*0.015*	*-*	*10 / 1*	*-*	*-*	*15*	*20*
SMCL	*-*	*-*	*-*	*250*	*1.0*	*2.0*	*0.3*	*-*	*0.05*	*-*	*250*	*-*	*-*	*-*
1	D	ND	<0.001	<5	0.11	<0.10	<0.10	<0.001	<0.005	<0.5	<5	45	<1.50	<0.001
2	D	ND	<0.001	7	0.05	0.12	<0.10	<0.001	<0.005	<0.5	7	60	3.15	<0.001
3	D	ND	<0.001	134	0.12	<0.10	<0.10	0.002	<0.005	3.9	75	90	5.57	<0.001
4	ND	ND	<0.001	19	<0.02	0.12	0.21	<0.001	<0.005	<0.5	58	<5	2.57	<0.001
5	ND	ND	<0.001	<5	0.02	<0.10	<0.10	<0.001	<0.005	<0.5	<5	63	<1.50	<0.001
6	ND	ND	<0.001	53	0.47	<0.10	<0.10	0.001	<0.005	<0.5	24	77	<1.50	<0.001
7	ND	ND	<0.001	<5	<0.02	<0.10	<0.10	<0.001	<0.005	<0.5	5	40	<1.50	<0.001
8	D	ND	<0.001	19	<0.02	0.13	0.45	<0.001	0.34	<0.5	10	103	2.46	<0.001
9	ND	ND	<0.001	<5	<0.02	<0.10	0.24	<0.001	0.021	<0.5	5	47	<1.50	<0.001
10	ND	ND	<0.001	<5	<0.02	0.12	0.38	<0.001	0.252	<0.5	<5	68	6.96	<0.001
11	ND	ND	<0.001	<5	0.05	<0.10	<0.10	<0.001	<0.005	<0.5	37	<5	<1.50	<0.001

Notes:

1. MCL = maximum contaminant level, SMCL = secondary maximum contaminant level
2. mg/L = milligrams per liter
3. pCi/L = picocurries per liter
4. D = detected, ND = not detected
5. Hardness - <5 mg/L to 75 mg/L = soft water
6. Values listed with a '<' sign represent results below the detectable limits of the test.
7. There is a Vermont Health Advisory level of 0.3 mg/L for manganese.
8. The yellow shading indicates results exceeding a SMCL.
9. The orange shading indicates results below an MCL but requiring attention.
10. The red shading indicates results above an MCL, SMCL or the Vermont Health Advisory limit.

4. Property Owner Maintenance Costs

All property owners with wells have annual maintenance costs related to water supply. When most property owners think of the cost of annual maintenance, they typically consider water treatment maintenance. Water treatment costs can vary depending on the type of treatment. Filters typically require cartridge replacements every few months to a year, depending on the daily volume of water used. Water softeners typically require monthly refills with salt, again depending on the daily usage. Another option for water treatment is ultraviolet light, which requires electricity and bulb replacement.

Usually, property owners do not consider the cost of electricity when thinking of their annual maintenance costs. Electricity is not usually a significant cost for residential well pumps. Even though it is often a low cost, it is still a maintenance cost that should be included in the annual cost of a private water supply.

In most cases, the annual maintenance cost is not realized by the property owner. The cost of a repair or replacement is typically significant and should be planned for. When calculating an annual maintenance cost, the annual cost of repair or replacement should be included. For example, if a well pump replacement is estimated to cost $2,000 and the useful life of a well pump is estimated at 10 years, the annual cost of replacement would be $200 per year (not including inflation).

The property owner survey asked how much property owners spend annually on maintenance for their water supply. Table 4.1 summarizes the responses:

Table 4.1: Survey Response: Annual Maintenance Costs

Annual Cost	Number of Responses	Percentage of Responses
$0-300	25	86%
$301-600	1	3%
$601-1000	1	3%
Did Not Answer	2	7%

In determining affordability for funding determinations, the Vermont Drinking Water State Revolving Fund uses 1% of median household income as the target annual user fee for a typical residential user on a public water system. Based on the median household income of $56,719 (from the American Community Survey) in Jamaica, this would equate to approximately $567 per year for potable water.

5. Estimated Water Usage and Available Capacity

5.1. Estimating Existing Water Usage

Since private wells do not typically have meters to record water usage, it is difficult to determine the actual water usage characteristics and trends in the study area. The water usage can be roughly estimated using the current use and size of the existing buildings. When new private water supplies are permitted, the WPWSR includes three

tables of design demands (theoretical water usage) for use in estimating the water usage for the new water supply. Similarly, when new connections are permitted for public water systems, the WSR includes a table of design demands for use in determining the demand allocation to the new connection.

In order to estimate existing water usage in the study area, the building use and size information from the property owner surveys was used, along with the design demand tables from the WPWSR and the WSR. For properties where a survey was not completed, the current use was assumed based on local knowledge and similarly sized properties. For vacant properties, the current use was based on the most recent use. For example, a single-family home with three bedrooms has a design demand of 420 gallons per day. It is likely that the users of a three-bedroom home actually use more or less than 420 gallons per day; however, this is the best information available at this time for estimating usage. Based on the reported and assumed existing uses and sizes of properties within the study area, the estimated existing average day water usage is estimated as follows:

- Residential Average Day Usage: 25,300 gallons per day
- Commercial Average Day Usage: 7,200 gallons per day
- Total Estimated Existing Average Day Usage: 32,500 gallons per day

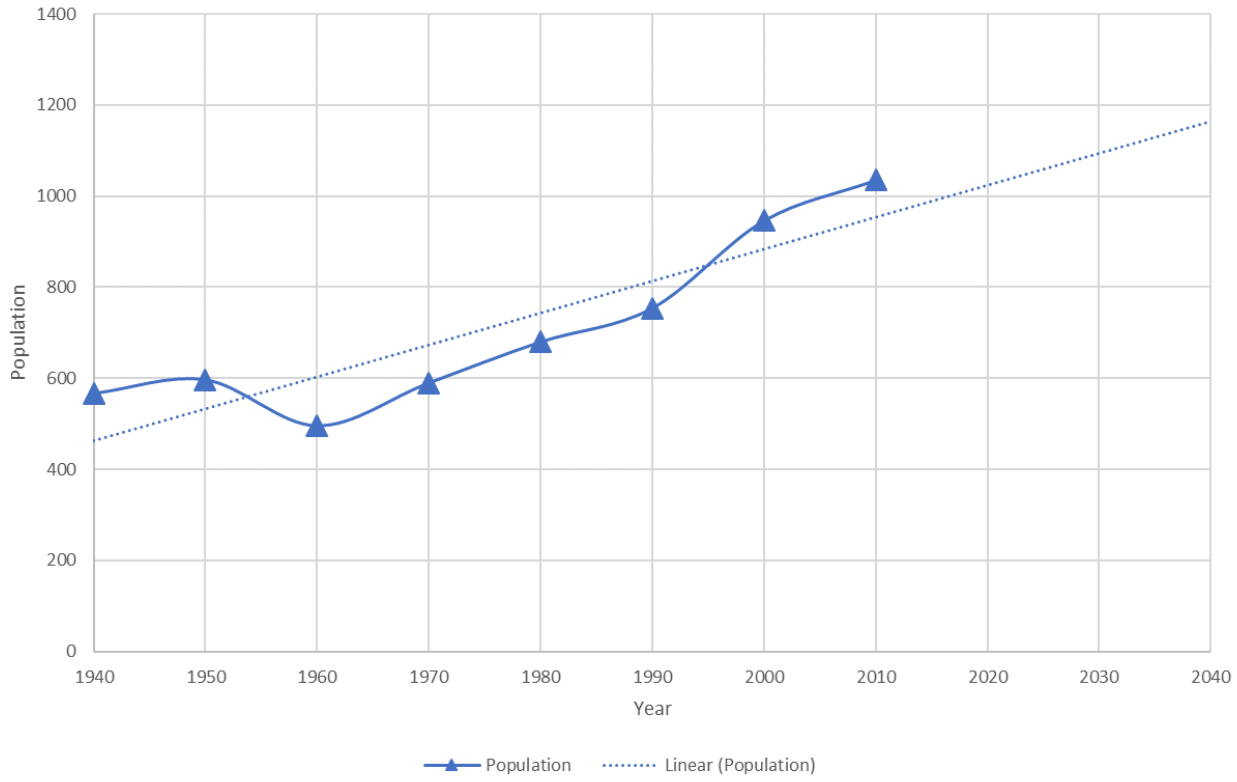
5.2. Projecting Future Water Usage

Projecting future demand depends on numerous factors including population growth, regional expansion and commercial trends. Typically, future water usage can be estimated using a linear projection of historical water demand combined with a projection based on population trends. In this case, there is no historical water demand data for a linear projection. For the purposes of this study, the estimated design demand will be projected using population trends to estimate future water usage.

Population projections are often used to estimate future water usage when historic water usage data is not available, or as a supplement to historic water usage data. Population projections relate to water demand based on the service area population as compared to the population data for the political entity. For the purposes of this study, the population trend for the study area will be equal to the trend for the entire Town of Jamaica.

The historic population data presented in the 2017 Jamaica Town Plan was utilized to create a population projection. The historic data and the 20-year linear projection are shown in Figure 5.1. The Town of Jamaica has experienced a generally increasing population trend since 1960. The linear projection of the population data from 1940 to 2010 results in an estimated population of 1,180 in 2040, which is a 14% increase from 2010, which equates to approximately 0.47% per year. Therefore, the projected increase from 2018 to 2040 is estimated at 10.3%.

Figure 5.1: Population Projection



If we assume the per capita water usage doesn't change, the future water use can be projected as a function of the serviced population. The population trend of a projected 10.3% increase from 2018 to 2040 can be applied to the estimated existing water usage to project future water usage. However, as there are several vacant commercial properties in the study area, the projected future water usage should be adjusted to account for use of the vacant buildings. Since there is no way to predict what the future uses of the commercial buildings will be, the future use of the vacant commercial buildings will be based on the previous use of the buildings.

The estimated projected average day water usage in 2040 is estimated as follows:

- Estimated Existing Average Day Water Usage in 2018: 32,500 gallons per day
- Residential and Commercial Development: +4,500 gallons per day
- Population Trend Increase of 10.3%: +4,000 gallons per day
- Estimated Projected Average Day Water Usage in 2040: 41,000 gallons per day

5.3. Estimated Well Capacity

In order to estimate well capacity in the study area, we reviewed the well completion reports and the Wastewater and Potable Water Supply permits in the State's databases. The estimated well yields (available capacity) were available for 18 wells in the study area. The well yields range from 1 gpm to 150 gpm, with an average of 19 gpm.

Based on the number of developed parcels in the study area and responses to property owner surveys, it is estimated that there are 69 wells in the study area. As the well yield data is only available for 26% of the wells in the study area, it is not possible to draw any meaningful conclusions regarding available capacity throughout the study area. A typical peak hour demand preliminary design estimate for a single-family home is 3-5 gpm; however, a fixture count of the building would likely be performed prior to constructing a well to obtain a more accurate design demand.

5.4. Summary of Current and Future Demand

Table 5.1 provides a summary of the existing and future water usage developed in this section.

Table 5.1: Summary of Current and Future Demand

Demand Condition	Existing Conditions	Future Projections
Estimated Average Daily Use	32,500 gpd	41,000 gpd
Estimated Maximum Daily Use	65,000 gpd	82,000 gpd
Estimated Peak Hour Use	225 gpm	285 gpm

Note:

1. The estimated maximum daily use is based on an average to maximum peaking factor of 2 as per the WSR.
2. The estimated peak hour use is based on an average day to peak hour peaking factor of 10, which is a typical peaking factor for water systems of this approximate size.

Since well yield data was not available for approximately 75% of the study area, it is not possible to compare future projects to the current available capacity at this time. If a public water system is pursued by the Town in the future, it is likely that a new source would be obtained versus the Town acquiring an existing well from a private property owner. Therefore, the capacity of the existing wells may not be critical information for the Town. If the Town needed to utilize an existing well for a potential public water system, the existing well yields would be further investigated at that time.

6. Impact on Economic Development and Property Values

6.1. Vacant Properties

There are several vacant properties within the study area. On Route 30, there are approximately 5 buildings previously in commercial use that are now vacant. There are several other properties in the study area that are for sale. As discussed previously, there are four vacant lots in the study area that could be developed at some point in the future.

6.2. Town Plan Goals and Policies

The Town Plan has several policies and priorities for action related to potable water supply and the vision for the Village of Jamaica. Some of the related policies and priorities for action are as follows:

- Land Use Policy #2: Further development within and adjacent to the Village districts must be carefully planned to minimize adverse impacts on the character of the Village, existing water supply and wastewater disposal and traffic within the villages.
- Land Use Priority for Action #5: Investigate acquisition of water rights in anticipation of possible development of a municipal water supply and/or wastewater disposal system.
- Economic Development Policy #2: Promote existing businesses and encourage new businesses to locate in the Town of Jamaica, including Jamaica Village and Rawsonville, following the guidance of the updated economic development survey.
- Economic Development Policy #3: Ensure adequate infrastructure (cellular, high-speed internet, road maintenance, fire/safety services, water supply and wastewater, and snow removal) to promote and support the increase of economic activities.
- Economic Development Policy #4: Develop a solution to Jamaica Village compliance with wastewater and potable water isolation standards that at a minimum will allow businesses forced to close to reopen and support Jamaica Village as a viable residential community and enable further economic growth within the Village.
- Water Supply & Wastewater Policy #2: Support collaborative potable water supply and wastewater planning efforts that build on the Jamaica Village Water Quality and Septic Study and investigate alternatives for water supply and/or wastewater treatment.
- Water Supply & Wastewater Policy #3: Encourage the use of technical assistance to help address the potable water supply and wastewater issues in Jamaica and to allow existing buildings to be used at full capacity.
- Water Supply & Wastewater Policy #4: Building on the existing Water Quality and Septic Study, require the development and review of options for municipal water and/or wastewater systems.
- Water Supply & Wastewater Priority for Action #1: Evaluate the feasibility of a water supply and distribution system and/or a wastewater collection and treatment system in Jamaica Village.
- Water Supply & Wastewater Priority for Action #3: Follow up on the Water Quality and Septic Study, including mapping potential water supply sources.

The Town Plan clearly supports the concept of a public water system to aid in the growth and development of Jamaica Village and to resolve existing isolation distance deficiencies.

The property owner survey and the online survey asked respondents the following question: *Do you think a Village water system is desirable?* The combined responses to this survey question are summarized in Table 6.1.

Table 6.1: Survey Response: Water System Opinion Question

Response	Number of Responses	Percentage of Responses
Yes	25	34%
No	22	30%
Not Sure	12	16%
Want to See Study	15	20%

The online survey also asked respondents the following question: *If a public water system was constructed, would you, as a non-user, be willing to pay an annual fee that would be used to help the system users pay for the construction?* The combined responses to this survey question are summarized in Table 6.2.

Table 6.2: Survey Response: Water System Fee Question

Response	Number of Responses	Percentage of Responses
Yes	6	12%
No	35	72%
Not Sure	8	16%

The Town Plan addresses this question in Town Services Policy #2, which states: *If the capacity of community facilities or services (e.g. sewer, water, fire, police protection, schools) cannot be expanded without incurring significant capital expenditures, then the expansion of such facilities or services shall be limited to that which the Town can finance or a fair share of the burden for required services or facilities shall be borne by the beneficiary of such services.*

Based on the survey results in Table 6.2, it appears that the Town residents that would not be directly served by a public water system would not support paying for the water system. The argument behind this is that these residents would still need to pay for maintenance and replacement of their own water supply. Typically, in Vermont, water systems are paid for by the users of the system. Users are the properties that are physically connected to the water system and receive water at their properties from the water system. The potential service area, customer base, cost and user fees have not been developed yet as there is additional information required before these questions can be answered. These questions are typically answered in a preliminary phase, once a conceptual design is developed and a source is identified.

6.3. Impact on Economic Development and Property Values

The property owner survey and the online survey asked respondents the following question: *Do you think a public water system will increase economic development in the Village?* The combined responses to this survey question are summarized in Table 6.2.

Table 6.2: Survey Response: Economic Development Opinion Question

Response	Number of Responses	Percentage of Responses
Yes	35	47%
No	25	34%
Not Sure	14	19%

As a local expert on community and economic development, Windham Regional Commission's Director, Chris Campany, has spoken many times throughout Windham County about the benefits of public water and/or wastewater. Mr. Campany provided the following comments on community and economic development in regard to public water in village centers:

> *Village businesses not only provide goods and services to residents and travelers. They are community gathering places. They are social and cultural anchors that contribute to the identity of a community. Reliance upon private wells and on-site wastewater systems can pose serious problems for retention of existing businesses, and certainly for business expansion or the opening of new businesses. It can also pose a challenge for the sale of these businesses and commercial buildings generally. The law allows the use that existed in approximately 2007 to remain active on the site. However, changes in use or use intensity may require an upgrade to water and wastewater systems that are simply not possible on what are typically small, heavily-constrained lots, or which are very expensive to design and maintain. This means that many or most businesses are ostensibly frozen in time – they cannot significantly deviate from the use that was in existence more than a decade ago. Anecdotally, this has meant businesses cannot grow or evolve, potential buyers may be dissuaded by the use constraints or fears of maintaining or replacing what are often older water or septic systems and replacing existing systems at a cost of tens of thousands of dollars may not be financially feasible. Water and wastewater constraints may not be the cause of a business closure or discontinuance, but it can be a significant contributing factor.*

Realtors have a good understanding of property values and what features may increase or decrease a property's value. We reached out to several local realtors to gather information and opinions on how a public water system may impact property values in a village center. The consensus was that a public water system would increase property value. A public water system eliminates the issue of contaminated water as public water systems are required to test various water quality parameters on a regular schedule and report the results to the State and users. It was noted that some mortgage companies will not approve a mortgage if the minimum isolation distances for a well and/or septic are not met, even if the well and septic are both in good working order and the well provides for good water quality. This is not an issue when dealing with a public water system as the minimum isolation distance between a septic system and a water main is much less than from a well. It was also noted that shared water and/or wastewater systems can be a negative to buyers as the shared systems often do

not have maintenance agreements, which can lead to financial and legal issues if repairs or replacement is needed.

7. Summary, Conclusions and Recommendations

The purpose of this study is to evaluate the existing water supply conditions in the Village, identify deficiencies and make recommendations for what the next steps may be. The primary question that triggered the Town to perform this study was:

Is there a need for a public water system in Jamaica Village?

Based on the data collected and evaluated for this study, the answer to this question is that if the Town wants to see economic development and growth in the Village, a potable water system is necessary. This leads to other questions that the Town (consisting of Town government and the public) needs to investigate further to identify a vision for the future of Jamaica Village. Some of these questions may be:

- Does the Town want economic development and growth in Jamaica Village?
- What type and how much of economic development and growth is desired?

It is clear from the survey responses that there are varying public opinions on the vision for growth in the Village. However, the Town Plan clearly supports economic and community development and growth in Jamaica Village, as well as the development of a public water system to aid in the growth. The need for a public water system will largely depend on what the Town's vision is for Jamaica Village in the next 5 years, 10 years and beyond. If economic development and growth is not desired or locally supported, it is likely a public water system would also not be supported.

It is recommended that the Selectboard and Planning Commission work with the public to identify the community's vision for the future of the Village. The Town Plan is a good place to start as it provides direction with several goals, policies and priorities for action to support the future of Jamaica.

Table 7.1 summarizes the results of the water study. There are some significant concerns for potable water over the next 20 years in the study area if the Town's goal is growth. Most of the deficiencies are related to economic and community growth, however, there are some water quality deficiencies that should be addressed immediately by the individual property owners. In these cases, the property owners were notified by the Department of Health and provided with recommendations on how to resolve the deficiency.

If growth is desired, a public water system would significantly support economic and community development and growth and resolve the deficiencies listed in Table 7.1. An additional key benefit of a public water system is that it would eliminate the private wells throughout the village, thereby making more space for replacement and decentralized wastewater disposal systems.

Table 7.1: Summary of Water Study

Category	Rating	Summary
Private Well Isolation Distance	Deficient	Refer to Figure 2.1. At least 60% of the private wells in the study area appear to be located too close to leach field or dry well.
Public Well Isolation Distance	Deficient	The only active public water supply currently is the Jamaica Village School, which is not deficient in isolation distance. However, the study is deficient in isolation distance for converting existing private wells into public water supplies.
Bacteria Contamination	Adequate	Total coliform was identified in 4 wells; however, there were no positive results for e.coli.
Chemical/Mineral Contamination	Deficient	There were a few wells with various contaminants over the SMCL/Health Advisory or approaching the MCL. Recommendations were provided to each of the affected property owners by the Department of Health for additional testing, repairs and/or treatment. In one case, ongoing treatment will be necessary to reduce manganese levels.
Current Maintenance Costs	Adequate	Most respondents reported spending less than $300 on maintenance for their water system. This likely does not account for the replacement cost of a well or pump; however, it is on the lower side of what the State considers as a reasonable cost for potable water.
Capacity of Existing Wells	Unknown	Since well yield data was only available for approximately 26% of the wells in the study area at this time, it is not possible to make a determination on whether the capacity of the wells is sufficient.
Ability to Support Economic Growth	Deficient	The dense development in the Village makes it impossible to obtain approval for a public water supply in most of the denser section of the study area. Many commercial uses will require a public water supply. Without the ability to obtain a public water supply, businesses will not move to Jamaica Village.
Ability to Support Existing Businesses	Deficient	The ability to support existing businesses is adequate as long as the existing business does not increase, add/modify use or undergo any other major modification. The State allows the use as of 2007 to continue without permitting; however, if that use changes type or size, permitting and full compliance with the rules is required. This can be a challenge for existing businesses when they cannot grow and expand to meet customer demand.

This study has concluded that if growth is desired in the village, a public water system is necessary to support the growth. Therefore, if there is local support for economic growth, it is recommended that the Town proceed with source exploration and a preliminary engineering report (PER) for a potable water system. In past public meetings and through the property owner and online surveys, there have been questions from the public on the service area, well location, fee structure and cost. Even with the completion of this study, these questions cannot be answered. The only way to answer these questions is to locate a potential source, perform preliminary testing to confirm viability of the potential source, and develop a PER to identify a potential service area, evaluate alternatives, develop a conceptual design, estimate costs, and develop a fee structure. Without the information provided through source exploration and a PER, it is not possible to make an informed decision on how to proceed with a public water system.

If the Town decides to proceed with further investigation into a public water system to support economic growth, it is recommended that the Town apply for a Planning Loan through the Drinking Water State Revolving Fund (DWSRF). This is a 0% interest loan that can be used for source exploration, PERs and final design. The loans do not require repayment until the project goes to construction. If the project does not proceed to construction, the loan repayment occurs over a five-year period. Planning loan applications are received by the DWSRF throughout the year and loans are awarded on a first-come, first-serve basis.

The following is a summary of the study recommendations and next steps:

1. The property owners that were notified of water quality deficiencies in their wells should address these deficiencies by completing the recommended actions provided by the Department of Health.
2. The Town should identify the level of local support for economic development in Jamaica Village. The Town Plan should be utilized in these discussions. To keep the momentum going, this should be completed by March 2019.
3. If economic development and growth is desired:
   a. A public water system should be further investigated by the Town by performing source exploration and developing a PER by the end of 2019. This will provide the information necessary to answer the public questions.
   b. The Town should apply for a DWSRF planning loan in March 2019.

If you have any questions, please do not hesitate to contact us.

Sincerely,
DUFRESNE GROUP

CHaskins

Christina M. Haskins, PE
Vice President