

June, 2021

Preliminary Engineering Report

**Town of Richmond, Vermont
West Main Street Sewer Extension**

GME Project # 24-029.10



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PRELIMINARY ENGINEERING REPORT
TOWN OF RICHMOND, VERMONT
WEST MAIN STREET SEWER EXTENSION

June, 2021

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1.0 PROJECT PLANNING

1.1 Location

The Town of Richmond is located in eastern Chittenden County, Vermont and is bordered to the north by the Town of Jericho, to the east by Bolton, to the south by Hinesburg and Huntington and to the west by Williston. A Project Location Map is included as Figure 1, Appendix A.

The Town of Richmond currently provides municipal water and wastewater services to the village area of Richmond. The Town wishes to expand its municipal wastewater service area to include the West Main Street (Route 2) area from the village to the I-89 Exit 11 interchange as well as a small portion of Route 117 to the Riverview Commons Mobile Home Park. The total length of the proposed extension area is approximately 1.75 miles. The study area is defined on the Aerial Study Map, Figure 2, Appendix A as well as the Topographical Area Study Area Map, Figure 3, Appendix A.

The Town is proposing to construct the wastewater expansion project in three separate construction phases as follows:

Phase 1: Connection to existing sewer manhole located in front of #222 West Main Street and heading north westerly along West Main Street approximately 3,200 feet to the “Reap Development” property located at #840 West Main Street.

Phase 2: From #840 West Main Street north westerly along West Main Street approximately 3,000 feet to 1436 West Main Street.

Phase 3: From #1436 West Main Street northwesterly along West Main Street approximately 3,200 feet to the existing Riverview Commons Mobile Home Park entrance located at the intersection of Route 117 and Summers Street, Richmond.

1.2 Environmental Resources Present

GME conducted cursory review of existing environmental resources using the State of Vermont’s Natural Resource Atlas. Where specific environmental resources were identified within the project area, more indepth studies of those resources were performed as outlined in detail below.

1.2.1

Wetlands

Based on a review of the Natural Resource Atlans, a number of currently mapped wetland areas were identified. GME subsequently contracted with Gilman Briggs Environmental, of Barre Vermont who delineated the existing wetlands along the proposed route. separate areas containing wetlands were identified during this study. A Wetlands Map identifying these areas is included as Figure 4, Appendix A.

1.2.2 Flood Prone Areas

The Winooski River flows to the west of West Main Street as well as Route 117. There is an area of the project near the Exit 11, I-89 interchange that is within the 100-year flood plain. This area is shown on the Flood Prone Areas Map included as Figure 5, Appendix A.

1.2.3 Hydrology

There are no river crossings within the project limits. There are however six (6) ditches and intermittent drainage features within he project area. These features are highlighted on Figure 6, Appendix A.

1.2.4 Rare or Endangered Species

Based on information obtained from the Natural Resource Atlas, there were no “Rare or Endangered Species” or “significant natural communities” identified within the project area. There are two areas of significant natural community (one animal and one natural community) within the trailer park; but these areas are not within any areas of proposed construction disturbance.

1.2.5 Deer Wintering Areas

Based on information obtained from the Natural Resource Atlas, there were no deer wintering areas identified within the project area.

1.2.6 Prime Agricultural Soils

Based on information obtained from the Natural Resource Atlas, the majority of the study area along West Main Street and Route 117 is currently identified as Prime Agricultural soils. Figure 7, Appendix A identifies the Prime Agricultural Soils in the area.

1.2.7 Public Lands

There are no public parks or forests located within the project area.

1.2.8 Historic Preservation

The majority of the corridor runs parallel with the Winooski River further to the west. Areas along significant river channels are prime sites of archeological significance. GME contracted with Hartgen Archeological Associates Inc. (Hartgen) of Putney Vermont to conduct an Archeological Resource Assessment of the area. Areas with greater archeological potential were identified as part of this study as noted on Figure 9, Appendix A. A copy of Hargen's Archeological Resource Study is contained in Appendix B.

1.2.9 Soils

A Custom Soils Report from the USDA Web Soil Survey for the proposed service area extension is provided in Figure 10, Appendix A. The soils report evaluated the area soils for suitability and limitations with regard to Vermont soil-based residential on-site wastewater disposal. The ratings are represented by symbols for five interpretive groups and their subgroups. These groups and subgroups are described in the following paragraphs.

Group I Soils: are well suited to soil-based wastewater disposal systems. Good performance and low maintenance can be expected. The soils in this group are sandy and gravelly soils that have rapid permeability and well drained soils. These are suitable for conventional systems.

Group II soils: are moderately suited to soil-based wastewater disposal systems. This group includes soils with moderately slow to very slow permeability; complexes in which one or more of the soils have bedrock at a moderate depth (20 to 40 inches); soils that would qualify for inclusion in group I but have slopes of more than 20 percent; and soils that have a seasonal high-water table at a depth of 18 inches or more. On-site wastewater disposal systems in areas with these types of soils typically require a mound system.

Group III Soils: are marginally suited to soil-based wastewater disposal systems. Intensive onsite investigation may be needed to locate suitable areas, or special design, extra maintenance, or costly alteration may be needed to overcome the soil related limitations. In areas where the water table is at a shallow depth, seasonal onsite monitoring of the water table may be needed to determine whether the site is suitable. These areas typically require a mound system along with a pre-treatment system, a hydrogeological study, mounding analysis, enhanced prescriptive or performance-based system design. Some areas of any of the map units in group III may not be suitable for soil-based wastewater disposal systems.

Group IV Soils: map units are generally not suited to soil-based wastewater disposal systems because of such limitations as wetness, depth to bedrock, restricted permeability, and slope.

Group V Soils: are not rated for soil-based wastewater disposal systems. This group includes miscellaneous areas that have been filled, excavated, regraded, or otherwise disturbed by human activities; areas that are mapped above the series level; and areas of water. The miscellaneous areas and the areas mapped above the series level have a wide range of soil properties. Onsite investigation is needed to determine the suitability of these areas for soil-based wastewater disposal.

Table 1 provides a summary of the percentage of soils within the proposed wastewater expansion area by group.

Table 1
Soil Septic Suitability Rating

Group No.	Septic Suitability Rating	Percent of Area
I	Well Suited	<1%
II	Moderately Suited	16%
III	Marginally Suited	17%
IV	Not Suited	48%
V	Not Rated	18%

An analysis of the soils, as shown in Table 1, reveals in general soil conditions in the study area related to the effectiveness of on-site septic systems in the study area are primarily (48%) classified as not-suitable. Less than 1% of the soil area is classified as

well suited for on-site septic systems. Approximately 33% of the area is classified as moderately or marginally suited. The limitations of these soils generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

1.3 Population Trends

The population of the Town of Richmond is 4,081 (2010 Census) which includes both the village area served by municipal water and sewer and the rest of the Town. The population has been relatively constant over the last fifteen years. There were some significant increases in population from 1970 to 2000. US Census Data summarized since 1970 below:

1970: 2,249
1980: 3,159
1990: 3,729
2000: 4,090
2010: 4,081
2020: Not yet available

The population is fairly constant year-round. Richmond's population does not have significant seasonal influences. The Town of Richmond's population over the past 40-years has been steadily increasing. Although there was a leveling off between 2000 and 2010, much of that can likely be attributed to Richmond losing its largest employer in 1999. The last year that full census data was available was 2010. The average increase in population from 1970 until 2010 was slightly over 2% per year. Although Vermont's statewide population has in recent years stagnated, this has not been the case for towns such as Richmond that are considered "bedroom communities" for the larger Burlington metropolitan area. Richmond is well positioned for future population growth due to its location inside of Chittenden County, ample area for future growth and the expansion of broadband technology. GME anticipates that a similar population growth trend of approximately 2% annually will continue into the foreseeable future.

Employment in the Town used to be centered on the dairy industry with a cheese plant as the main employer. The cheese plant closed in 1999 and the Town would like to provide the ability for additional employment opportunities. These opportunities include extending municipal wastewater to zoned growth areas of the Town that need the services to grow due to limited on-site wastewater availability.

1.4 Community Engagement

The Town of Richmond has actively engaged the community and elected officials in the proposed West Main Street sewer expansion project. These engagement activities included:

- A survey questionnaire sent to all property owners within the proposed expanded service area in 2015 and 2021.
- Negotiations with the Riverview Commons Mobile Home Park in 2015 and once again in 2021.
- Completion of a Phase I Scoping Study of the proposed project.
- Two (2) public hearings on the results of the Scoping Study (11/17/14 and 12/1/14).
- Discussions of the project at regularly scheduled Water & Sewer Commission meetings in 2015, 2016, 2020 and 2021 which are open to the public.
- Rezoning of the Gateway zoning district and associated public meetings.
- Bond vote informational meeting on March 2, 2015
- Positive bond vote on March 4, 2015 in the amount of \$1,025,000.00.
- Income survey of the proposed expanded service area including the Route 2 area and residents within the Riverview Commons Mobile Home Park.

The Town of Richmond sent out a survey/questionnaire to all property owners within the study area in 2015 and 2021. Eight (8) surveys were returned in 2021. All eight surveys returned were in favor of the wastewater utility extension. The Town sent new survey's to all the property owners within the survey area again in 2021. _____ survey's were returned. _____ of these survey's indicated that they were in favor of the Wastewater Utility Extension. The Riverview Commons Mobile Home Park was one of the respondents who indicated that they were interested in the extension. In addition to the survey's the RCMHP is also interested and has been added to the study as Phase 3. See Appendix C for copies of the surveys.

2.0 EXISTING FACILITIES

2.1 Location Map

A current and proposed wastewater service area map is provided as Figures 2, Appendix A.

2.2 History

The municipal wastewater treatment facility is located on Esplanade Street in Richmond village. The wastewater collection system was last expanded in 1999 along Cochran road to cover the remainder of the homes in the service area. The wastewater plant was upgraded in 2005 as part of a \$3.9 million project to reduce phosphorous discharged to a maximum of 0.8 mg/l. The system lost its largest customer in 1999 with the closing of the Saputo Cheese Plant which was located on the corner of Bridge Street and Jolina Court. The plant closing created significant excess wastewater capacity within the existing plant. At that time, the Saputo plant provided 67% of the wastewater system revenue. No new large single customers have connected since that time to fill the void. A number of relatively small commercial and residential developments have moved into town, however the wastewater plant still has significant excess reserve capacity. In 2020, an average of approximately 68,883 gallons of wastewater was treated per day, equaling approximately 39% of the plant's capacity. Due to the large excess reserve capacity, wastewater operations now include aggressive septage receiving from septic tank pumping companies. Septage receiving does not preclude potential customers from buying additional uncommitted capacity, but it does generate much needed revenue for wastewater operations.

2.3 Condition of Existing Facilities

Presently, wastewater generated within the west Main Street and Route 117 portions of the study area are treated in individual on-site septic systems. Due to lot sizes, individual water wells, poor soil conditions, and depth to groundwater, it can be difficult to provide sufficient wastewater treatment with on-site systems. The proper land area required for on-site disposal is simply not available for most homes or businesses within the study area. Portions of the study area have a naturally high ground water table, which is a limiting characteristic of the dominant soil type in the study area. In these areas, it would be necessary to construct mound type systems to comply with applicable health codes, which may not be a feasible option due to financial and lot limitations. Concerns for future development in this area where both septic systems and water wells are utilized on

each site are very high due to the potential for groundwater/drinking water contamination. On-site wastewater suitability is a major constraint to the development of this area as a growth center.

The Riverview Commons Mobile Home Park has a permitted Indirect Discharge wastewater treatment and disposal system. The system consists of gravity sewers, a large septic tank, dosing pump station and a large subsurface disposal system. The system is approximately 30 years old. Some of the leach fields have clogged and failed in the past, requiring the fields to be replaced.

2.4 Financial Status of Existing Facilities

2.4.1 Income

Table 2 provides a summary of the Town’s existing rate structure for wastewater.

Table 2
User Rate Structure (2020)

System	User Type	User Rate
Wastewater	Commercial	\$475.05/Unit \$16.17/1,000 gal.
	Residential	\$169.72/Unit \$18.87/1,000 gal.

Based on the existing service area user types and flow usage, in FY 2020 the Town received approximately \$349,924 annually in wastewater revenues per year for user fees. The Town also received approximately \$430,000 in wastewater (septage) receiving fees in FY 2020. The average annual wastewater fee for a typical single family residential home is \$565.73 annually. These user rates are relatively high compared to average municipal wastewater rates in the State. If the Town were to be able to increase their user base, these rates could be reduced.

2.4.2 Debt Repayments

Table 3 provides a summary of the existing debt repayments for the sewer system as provide by the Town of Richmond.

Table 3
Existing Wastewater System Debt Repayments

Debt	Annual Payment	Year Due
RFL-101 Planning Loan Payment	\$12,081	2027
Project 7a – Sanitary Loan Payment	\$14,093	2032
Phosphorous SRF Loan Payment	\$22,220	2026
Jericho Road (principal & Interest)	\$29,621	2032
Total	\$78,015	

2.4.3 Existing O&M Costs

Table 4 provides a summary of the existing sewer system O&M costs as provided by the Town of Richmond.

Table 4
Existing Wastewater System O&M Costs

Debt	Existing O&M Cost
Administration	\$41,137
Engineering	\$500
Biosolids Disposal	\$120,000
Insurance	\$15,868
Repairs/Maintenance	\$35,000
Salaries/Benefits	\$197,217
Supplies	\$87,300
Utilities	\$84,500
Total	\$581,522

2.5 Water/Energy/Waste Audits

Water, energy and waste audits are not applicable to this project.

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3.0 NEED FOR PROJECT

3.1 Health, Sanitation, and Security

The proposed wastewater expansion area will benefit from the addition of municipal wastewater. Riverview Commons Mobile Home Park currently has one large leach field that provides wastewater service for 146 of the 148 residential mobile homes in the park. This system has had maintenance issues over the years and required replacement of a number of failed leach field trenches.

Further, private wells currently supply all of the residents' potable water in the proposed expansion area. This could lead to endangerment of the resident's water supply due to faulty or malfunctioning septic systems. **DOCUMENTATION???**

3.2 Aging Infrastructure

Many of the on-site septic systems within the expansion area, have generally matured to the point that replacement on-site treatment will either become very costly or not possible to meet the current rules. However, with the provision of public sewers, user fees cover the cost of operation for the public portion of the system. This assures the system is always in good working condition

3.3 Reasonable Growth

The Town's zoning regulations are established to preserve the look and feel of the Richmond area while accommodating reasonable development and growth in designated areas. As shown on Figure 11, Appendix A, the study area is located within four (4) zoning districts including:

- a. Gateway Commercial District (G)
- b. Commercial (C)
- c. Mobile Home Park (MHP)
- d. Special Flood Hazard Area

The Gateway Commercial District is a designated growth center which is designated to allow for commercial uses in an area that has importance as a scenic entrance to the Town of Richmond. There are various allowed and conditional uses as specified in the zoning regulations. Currently water supply and wastewater disposal in the area are both served by

on-site individual systems. The Gateway Commercial District allows for 1 acre lots served by municipal sewer. *Verify this statement with the Town Planner*

For the Mobile Home Park District, a lot which is not a mobile home park (MHP) shall not be less than 1 acre. A lot which is used for a MHP shall contain not less than 10 acres and individual lots within the park shall not be less than ¼ acre.

The Agricultural/Residential District allows for 1 acre lots.

A variety of uses are allowed in each district and reference is hereby made to the Richmond Zoning Regulations as well as the Subdivision regulations for a complete list of allowed and conditional uses.

3.4 WWTF Uncommitted Reserve Capacity

The uncommitted reserve capacity of the Wastewater Treatment Facility (WWTF) is calculated by adding the measured annual average daily flow to the committed unconnected allocations (new projects) and then subtracting the total from 80% of the total plant design capacity. The measured average daily flow for calendar year 2020 is 68,883 gallons as summarized in Table 5. The committed allocations are 2,360 gallons per day as outlined in Table 6. The permitted design capacity of the wastewater treatment plant is 222,000 gallons per day. Based on the following information as provided by the Town of Richmond, the plant's uncommitted reserve capacity is 106,407 gpd as shown in Table 7.

Table 5
WWTF 12-Month Average Daily Flow
Calendar Year 2020

Month	Average Daily Flow (gpd)
January	58,000
February	51,000
March	62,000
April	76,000
May	67,000
June	75,000
July	74,000
August	72,000
September	71,000
October	79,000
November	76,000
December	65,000
12 Month Average =	68,883

*Table 5 summarizes the 12-month Average Daily Flow information for calendar year 2020. This information was provided by the Town of Richmond.

Table 6
Estimated Unconnected Committed
Sewer Allocated Flows

Applicant	Unconnected Committed Sewer Allocated Flows (gpd)
Peaceable Kingdom (Residential)	1680
Whistle Stop Lane (Residential)	680
Total Unconnected Committed Sewer Allocations	2,360

*Table 6 summarizes the WWTF uncommitted sewer capacity allocation. This information was provided by the Town of Richmond.

Table 7
Estimated Sewer Uncommitted Reserve Capacity

Description	Flow (gpd)
WWTF Permitted Design Capacity	222,000
80% of WWTF Permitted Capacity	177,600
- 12-Month Annual Average Daily Flow	68,833
- Unconnected Committed Sewer Allocated Flows	2,360
= WWTF Uncommitted Reserve Capacity (gpd)	106,407

3.5 Existing and Future Wastewater Flows

3.5.1 Current Wastewater Flows

A wastewater flow estimate for each existing residential home and commercial business within the proposed wastewater expansion area was included within this survey. Estimated wastewater flows for commercial uses within the proposed expansion area were calculated using the “Flow Basis” estimates included in Subchapter 8, Table 8-3 of the Wastewater System and potable Water Supply Rules, Effective April 12, 2019. The “Quantity” information used in the commercial estimates was supplied by the Town of Richmond.

Residential wastewater flows were based on current data provided by the Town of Richmond as well as statewide wastewater flow averages. Average annual residential flows as reported by the Town of Richmond are 32,000 gallons per year (88 gpd) per living unit. This is lower than the statewide average of 36,000 gpd (99 gpd) per living unit as reported _____. Accordingly, GME conservatively used 100 gpd per living unit for the residential estimates. Infiltration is not envisioned in the low pressure force main piping. Average daily flows for the Riverview Mobile Home Park were obtained from the maintenance staff for calendar year 2020.

3.5.2 Future Wastewater Flows

As outlined in Table 8, the total future estimated wastewater flow demand for the study area for all three phases is 26,391 gpd.

Table 8**Estimated Study Area Wastewater Flow Demand**

Phase/ Address	Use Description	User Type	Quantity	Flow Basis	Ave. Daily Flow (gpd)
Phase 1					
840 W Main	Commercial	Reap Office Building/ Employees	42	15 gpd/employee	630
Subtotal Phase 1					630
Phase 2					
878 W Main	Residential	Single Family Home	1	100 gpd/Unit	100
920 W Main	Res./Commercial	Single Family Home/Tow Business	1	100 gpd/Unit	100
932 W Main	Residential	Single Family Home/Home Business	1	100 gpd/Unit	100
978 W Main	Residential	Single Family Home	1	100 gpd/Unit	100
1010-1014 W Main	Residential	Duplex	2	100 gpd/Unit	200
1008-1012 W Main	Residential	Duplex	2	210 gpd/Unit	200
1070 W Main	Commercial	Office Bldg./Employees	20	15 gpd/Employee	300
1108 W Main	Commercial	Dog Day Care Employees	8	15 gpd/staff	120
		Kennels	40	25 gpd/kennel	1,000
		Grooming Station	1	400 gpd/station	400
1151 W Main	Res./Commercial	Residence	1	100 gpd/Unit	100
		Chiropractor Office	3	35 gpd/Employee	105
			16	10 gpd/patient	160
-	Vacant	Hay barn	-	-	-
-	Vacant	Field South Side	-	-	-
-	Vacant	Empty Lot	-	-	-
Subtotal Phase 2					2,985
Subtotal Phase 1 and 2					3,615
Phase 3					
1436 W Main	Commercial Gas Station	1 st Pump Set	1	500 gpd/Pump	500
		Additional Pump Sets	3	300 gpd/Pump	900
		Employees	6	15 gpd/staff	90
9 Gov. Peck	Commercial- Fuel	Employees	8	15 gpd/Employee	120
116 River Rd	Commercial Fuel	Employees	10	15 gpd/Employee	150
Rte. 117	Mobile Home Park	Mobile Homes	148	142 gpd/MH	21,468
Subtotal Phase 3					23,228

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**Total Phase 1, 2 and 3
26,843**

Table 9 outlines the available wastewater treatment capacity in the existing WWTF.

**Table 9
Richmond WWTF
Estimated Wastewater Capacity Analysis**

Description	Existing	Estimated Full Build-Out
Available Capacity	106,407	106,407
Phase 1 Flows	630	2,645
Remaining Capacity	105,777	95,628
% Remaining of Available Capacity	99%	97%
Phase 2 Flows	2,985	13,875
Remaining Capacity (Phases 1 & 2)	102,792	81,753
% Remaining of Available Capacity	95%	83%
Phase 3 Flows	23,228	41,760
Remaining Capacity	80,016	39,933
% Remaining of Available Capacity	75%	41%

update

*↑
update*

4.0 ALTERNATIVES CONSIDERED

The Town of Richmond has significant excess wastewater capacity at its municipal wastewater treatment facility. At the same time there is a need for wastewater capacity in the West Main Street corridor and parts of the Route 117 corridor west of the village.

4.1 Force Main Route Alternatives

4.1.1 Force Main Route Alternatives – Phase 1

Two separate alternatives were evaluated for Phase 1 of the project. The first alternative (Alternate A) would consist of installing a new low pressure forcemain approximately 3,100-feet from the existing manhole near the elementary school entrance on Jericho Road, cross country to the “Reap Property” located at #840 West Main Street.

The second Alternative (Alternate B) would begin at an existing manhole in the Route 2 right of way located in front of #222 West Main Street as shown in Figure 14, Appendix A. A new low-pressure force main would extend from the manhole approximately 3,200-feet northward along the Route 2 right of way to the “Reap Property” located at #840 West Main Street. Both Phase 1 route alternatives considered are shown in Figure 10, Appendix A.

4.1.2 Force Main Route Alternatives - Phase 2 and Phase 3

The objective of the project is to incorporate the existing properties along the Route 2 and Route 117 corridors as part of the expanded wastewater collection system. Both roadways are State Highways that have substantial right of way widths. The majority of houses and businesses that could potentially benefit from this project are located on the east side of the roadway. Assuming that each individual property would have its own storage tank and grinder pump that feeds the forcemain, having the forcemain on the east side of the highway would be the most cost-effective choice for the adjacent property owners. Pipe stubs which cross Route 2 at specific locations would be necessary to service the few residential buildings located on the west side of Route 2.

4.2 Potential Environmental Impacts

As outlined in Section 1.2, potential environmental impacts from this project include wetlands, floodplains, hydrology, prime agricultural soils as well as archeology.

4.2.1 Wetlands

Both Class II and Class III wetlands were identified within the project area as shown on Figure 5, Appendix A. GME proposes to mitigate the impacts to wetlands by utilizing directional boring technology to wetland impacts while installing the low pressure forcemain. Using this technology should minimize if not eliminate any wetland impacts. In several areas the project will be within 50' of mapped wetlands. As such, State of Vermont wetlands permit(s) will be required as part of the design and permitting process.

4.2.2 Flood Prone Areas

There are areas of the proposed corridor that are within the 100-year flood plain as shown on Figure 6, Appendix A. GME proposes to mitigate any concerns related to working within the floodplain by ensuring that no additional fill is added and no existing changes to existing grades are made within these areas as part of the project. Additionally, the majority of the project will be performed by directional drilling which has almost no impact on surface conditions. GME anticipates that coordination with the State of Vermont Watershed Management Division, Rivers Program will be required as part of the design and permitting process.

4.2.3 Hydrology

As shown on the Hydrology Map, Figure 7, Appendix A, there are six (6) ditches and other unnamed drainage structures that cross the proposed route. To the extent possible these crossings would likely be done by directional drilling to minimize any impacts. Additional field reconnaissance will be required to determine the appropriate installation and mitigation measures for each crossing. Stream Alteration Permits will likely be required for these crossings as part of the design and permitting process.

4.2.4 Prime Agricultural Soils

Prime Agricultural Soils within the proposed corridor are shown on Figure 8, Appendix A. The majority of the proposed corridor is within areas defined as "prime agricultural soils". However, the entire corridor as proposed is within the

Route 2 and Route 117 right of ways. Use of the ROW is dedicated to transportation and utility rights of way in perpetuity. The land adjacent to both highways in this corridor is made up of relatively small residential and commercial lots no longer suitable for agriculture. As such, the land within the right of way where the low pressure forcemain would be located no longer contains areas of “agricultural importance” as defined and generally recognized by the State of Vermont.

4.2.5 Archeology

As outlined in Section 1.2.8, Hartgen Archeological Associates was contracted to conduct an archaeological resource assessment within the project corridor. The Hartgen study noted much larger archaeological potential in areas where prior disturbance from filling, roadway and utility construction had not been performed. The conclusion and recommendations from this study were as follows “*It is recommended that project disturbance stay as close to the edge of the roadways as possible to minimize affecting areas of archaeological potential*”. This is the primary reasons the Town choose the Route 2 and Route 117 right of ways as the preferred route for the low pressure forcemain. The State Division of Historic Preservation will still need to review the information as part of the design and permitting process and make a final determination as to whether or not additional archaeological work will be required as part of the project. **Add updated archaeological report when available.....**

4.2.6 Other Considerations

GME anticipates that Act 250 permitting will be required as part of the permitting phase for this project. Based on experience, Act 250 will likely want to review this as one complete project rather than three separate phases. Depending upon the depth of review as well as questions and concerns from the public, Act 250 may require a complete engineering design as well as permitting for all three phases of the project prior to approval. This would require a shift in potentially significant portions of engineering money from Phases 2 and 3 to Phase 1.

4.3 Land Requirements

The entire project as proposed is within the Vermont Agency of Transportation (VTrans) right of way. A Vtrans permit will be required for work within the right of way areas. The Federal Highway Administration (FHWA) may also need to be involved in areas around the I-89 Exit 11 interchange. Specific details as to which agency has right of way

authority over these areas will be addressed as part of final design. In determining an Opinion of Probable Cost, GME has assumed that permitting through FHWA will be required.

4.4 Sustainability Considerations

Water and energy efficiencies are not applicable. In addition, there are no sustainability or green infrastructure considerations in this project.

4.5 Opinion of Probable Cost

Prior to development of the Opinion of Probable Cost information, quantity take-offs were completed to establish unit quantities for projected project unit price bid items. Material and labor costs have undergone significant price changes over the past 12 months. Historical construction costs which would normally be utilized to generate future cost estimates are in most cases not accurate at this juncture. Estimated future construction costs were therefor generated based on direct conversations with local contractors. It should be noted that Opinion of Probable Cost numbers utilized herein are based on current 2021 The construction costs. Significant inflationary numbers, material shortages or other unknowns could significantly impact these estimates in the future. The construction costs also include a 20% contingency. At the planning level, a 20% contingency is reasonable and customary as any number of things could be encountered during the permitting or design stage that could materially impact these estimates.

An opinion of probable construction costs were developed for each phase of construction as provided in Table 10.

Table 10
Opinion of Probable Construction Cost

Phase/Alternate	*Estimate
Phase 1 – Alternate A (School Overland to Reap Property (#840 West Main) Note: This Alternate was not selected for use	
**Phase 1 – Alternate B (#222 West Main to Reap Property #840 West Main)	
Phase 2 - Reap Property to Mobile Station (#1436 West Main)	
Phase 3 – Mobile Station to Riverview Commons Mobile Home Park	

Total

*Detailed Opinions of Probable Cost Estimates are located in Appendix D.

** Phase 1 Alternate B was the Town's preferred alternative

5.0 SELECTION OF AN ALTERNATIVE

Two separate routes (Alternate A and Alternate B) were considered for Phase 1 as previously discussed. Opinions of Probable Construction Costs for Alternative A and Alternative B were noted to be of similar magnitude. However, the archaeological report indicated that areas along the proposed Alternate A route (cross country route from the school) was noted to have a higher archaeological potential and would require further study to utilize. Hartgen's recommendation related to archeology was to avoid Alternative A (cross country route) as this alternative if possible. Alternate A would have required negotiating and obtaining a number of easements from the school as well as private property owners along the route. These two issues bring a larger number of potential future unknowns. Alternate B on the other hand showed limited archaeological potential due to past disturbance from grading/filling, road construction and utility construction along West Main Street (Route 2) and Route 117. For these reasons, the Town ultimately selected Alternate B (West Main Street) as the preferred route for Phase 1. Due to the proximity of the future users of the system and ease of using the State right of way as opposed to having multiple easements on private property, Phase 2 and Phase 3 considered only using the West Main Street and Route 117 right of way.

5.1 Life Cycle Cost Analysis

A life cycle cost analysis is not applicable to this type of project. The piping material will be HDPE which for all practical purposes has an unlimited life expectancy.

5.2 Non-Monetary Considerations

GME envisions that pipe stubs for future connections will be left at each adjacent property. Although outside the scope of the PER, future final design considerations will be to include stubs for each building along the route, ensure that each hookup meets the criteria outlined in Chapter 1 of the Wastewater and Potable Water Supply Rules including backflow prevention, storage, and adequately sized pumps to ensure that minimum scouring velocities are achieved in the pipe.

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6.0 PROPOSED PROJECT

6.1 Preliminary Project Design

The selected project entails extending the existing the current wastewater service area from the current manhole located in front of house #222 West Main Street to the Riverview Mobile Home Park as shown on Figure's 12, 13 and 14. The project will include three separate phases of work which total approximately 1.75 miles.

6.2 Project Schedule

Project funding will be the key driver with regard to the project construction schedule. It is the Town's goal to secure funding for Phase 1 in calendar year 2022 with construction to follow in 2023. The schedule of Phases 2 and 3 will be subject to funding.

6.3 Sustainability Considerations

6.3.1 Water and Energy Efficiencies

The use of HDPE pipe helps promote water efficiency as fusion welding creates one solid pipe with no opportunity for joint leakage.

6.3.2 Green Infrastructure

There are no green infrastructure initiatives as part of this project.

6.4 Project Costs

GME's opinion of project costs were previously summarized in Table 10, Appendix D. All costs are in 2021 dollars. Except where noted, costs for final design and construction engineering service are based on current State of Vermont, Facility Engineering Division, Engineering Services Curve formulas. These curves are subject to change in the future.

6.5 Annual Operating Budget

6.5.1 Income

Table 11 provides a summary of the Town's existing rate structure for water and sewer.

Table 11
Existing User Rate Structure (2021)

System	User Type	User Rate
Wastewater	Commercial	\$475.05/Unit \$16.17/1,000 gal.
	Residential	\$169.72/Unit \$18,87/1,000 gal.

Based on the existing service area user types and flow usage, the Town currently receives approximately \$349,924 in wastewater revenues per year for user fees. The Town also receives approximately \$430,000 annually in septage receiving fees as summarized in Table 12.

Table 12
Current Richmond Wastewater Revenue (2020)

Income Type	Existing Wastewater System
User Fees	\$349,924
Septage Fees	430,000
Total	\$779,924

The Town's current rate for hookup fees is \$4.41/gal/day plus \$150 for an inspection fee for each property. Table 13 provides a summary of anticipated hook-on fees based on currently established rates. Wastewater generation quantities for the purposes of establishing hook-on fees are typically done using permitted design quantities or the

standard design flow rates from Chapter 1 of the Environmental Protection Rules.
Current hook-on fees are \$4.41/gal/day plus \$150 inspection fee.

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Table 13
Estimated Study Area Wastewater Hook-On Fees

Phase/ Address	Use Description	User Type	Quantity	Flow For Fee Basis*	Average Daily Flow (gpd)	Hook-On Fee*
Phase 1						
840 W Main	Commercial	Reap Office Building/ Employees	42	15 gpd/staff	630	\$2,928
Subtotal Phase 1					630	\$2,928
Phase 2						
878 W Main	Residential	Single Family Home	1	210 gpd/Unit	210	\$1,076
920 W Main	Res./Commercial	Single Family Home/Town/Business	1	210 gpd/Unit	210	\$1,076
932 W Main	Residential	Single Family Home/Home Business	1	210 gpd/Unit	210	\$1,076
978 W Main	Residential	Single Family Home	1	210 gpd/Unit	210	\$1,076
1010-1014 W Main	Residential	Duplex	2	210 gpd/Unit	420	\$2,002
1008-1012 W Main	Residential	Duplex	2	210 gpd/Unit	420	\$2,002
1070 W Main	Commercial	Office Bldg/Employees	20	15 gpd/staff	300	\$1,473
1108 W Main	Commercial	Dog Day Care Employees Kennels Grooming Station	8 40 1	15 gpd/staff 25 gpd/kennel 400gpd/station	120 1,000 400	\$6,853
1151 W Main	Res./Commercial	Residence Chiropractor Office	1 3 16	210 gpd/Unit 35 gpd/staff 10 gpd/patient	210 105 160	\$2,245
-	Vacant	Hay barn	-	-	-	-
-	Vacant	Field South Side	-	-	-	-
-	Vacant	Empty Lot	-	-	-	-
Subtotal Phase 2					3,975	\$18,879
Subtotal Phase 1 and 2					4,605	\$21,807
Phase 3						
1436 W Main	Commercial Gas Station	1 st Pump Set Add'l Pump Sets Employees	1 3 6	500 gpd/Pump 300 gpd/Pump 15 gpd/staff	500 900 90	\$6,721
9 Gov. Peck	Commercial-Fuel	Employees	8	15 gpd/staff	120	\$679
116River Rd	Commercial -Fuel	Employees	10	15 gpd/staff	150	\$812
Rte. 117	Mobile Home Park	Mobile Homes	146	210 gpd/MH	30,660	\$135,360
Subtotal Phase 3					32,420	\$143,572
Subtotal Phase 1, 2 and 3					37,025	\$165,379

*Based on estimates, State "book flows" or existing State Permits **gpd x 4.41/Gal/Day + \$150 Inspection Fee

Table 14 provides a summary of the Town’s existing and proposed wastewater income based on the existing and proposed user base, the above rate structure as well as septage fees.

Table 14
Estimated Future Wastewater Revenue

Income Type	Existing Wastewater System	Proposed Wastewater System
User Fees	\$349,924	
Septage Fees	\$430,000	
Total	\$779,924	

6.5.2 Annual O&M Costs

Table 15 provides a summary of the existing and proposed (with proposed project) O&M costs for the sewer system.

Table 15
Existing & Proposed Sewer System O&M Costs

Debt	Existing O&M Cost	Proposed O&M Cost
Administration	\$41,137	
Engineering	\$500	
Biosolids Disposal	\$120,000	
Insurance	\$15,868	
Repairs/Maintenance	\$35,000	
Salaries/Benefits	\$197,217	
Supplies	\$87,300	
Utilities	\$84,500	
Total	\$581,505	

6.5.3 Debt Repayments

The Town has set a policy for this project that the new users within the extension will pay for 100% of the debt service for the project.

The Town anticipates using CWSRF funds to finance this project. In 2015, the Town approved a bond vote for \$1,025,000 to expand the wastewater service area to West Main Street. As expected, estimated construction costs have increased since the original estimates were completed in 2015. As outlined in Table 10, the current Opinion of Probable Cost for all three phases of construction in 2021 dollars is \$1,236,253.52. The Town has a number of options that it will need to evaluate in terms of funding the project. The Town could opt to construct the first two phases with the currently approved bond money and make up the shortfall with user fees. The Town could also make up the difference with a targeted grants or seek eligibility for partial CWSRF loan forgiveness. The Town could also simply increase the hookup fees. This seems particularly true with the mobile home park. Finally, the Town could simply decide to have a new bond vote and authorize the entire \$1,236,252.00 needed to construct the project.

If the Town decides to borrow the full capital cost of all three phases of construction (\$1,236,252) and the capital costs for these loans are ultimately consolidated into a single 30-year loan for simplicity, using an assumed interest rate of 1.5%, the annual payment for the loan would be \$51,476.53. Because the Town's policy is to have the new users within the project area pay for the capital construction costs, a logical approach would be to pro-rate and spread the capital cost across the new user base using a percentage of anticipated use. Using that approach, Table 16 provides an estimate of anticipated annual debt service for each property.

Table 16
Future Estimated Annual Wastewater Debt Service Payments
(Loan Principal of \$1,236,253)

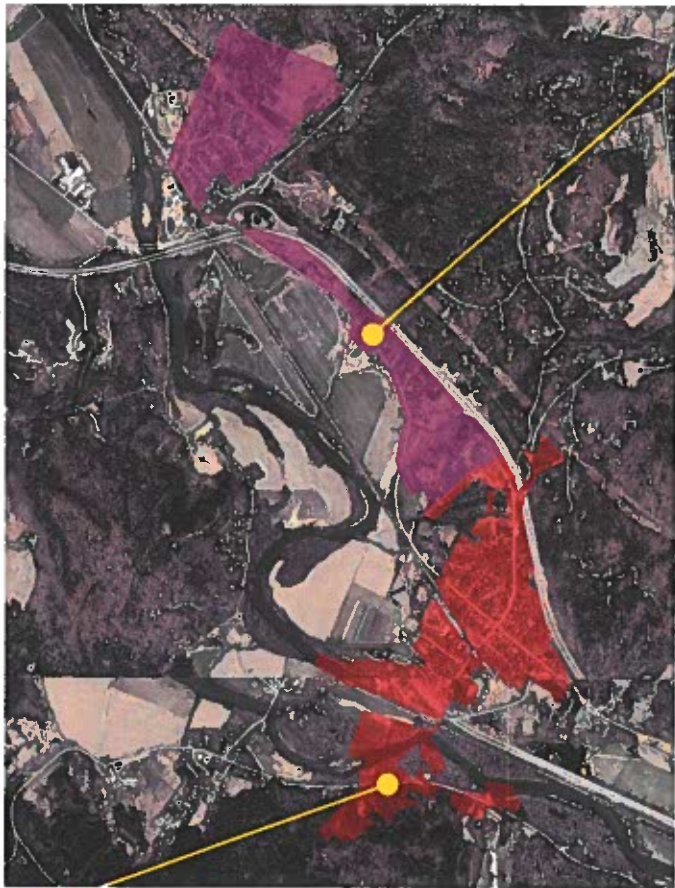
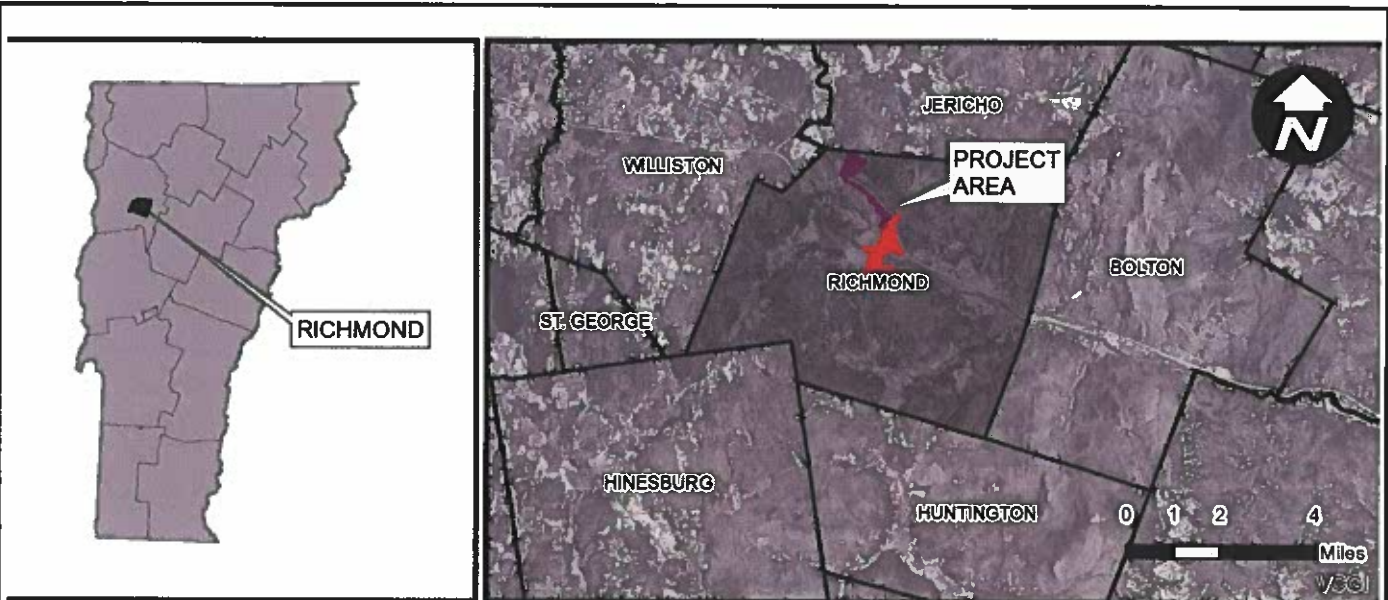
Phase/ Address	Use Description	User Type	% of Pro-rated Flow	Annual Sewer Debt Service (\$)
840 W Main	Commercial	Reap Office Building/ Employees	2	\$1,029
878 W Main	Residential	Single Family Home	1	\$515
920 W Main	Res./Commercial	Single Family Home/Tow Business	1	\$515
932 W Main	Res./Commercial	Single Family Home/ Home Business	1	\$515
978 W Main	Residential	Single Family Home	1	\$515
1010-1014 W Main	Residential	Duplex	1	\$515
1008-1012 W Main	Residential	Duplex	1	\$515
1070 W Main	Commercial	Office Building/Employees	1	\$515
1108 W Main	Commercial	Dog Day Care	4	\$2,058
1151 W Main	Res./Commercial	Residence Chiropractor Office	1	\$515
1436 W Main	Commercial - Gas Station	1 st Pump Set Additional Pump Sets Employees	4	\$2,058
9 Gov. Peck	Commercial - Fuel	Employees	1	\$515
116 River Rd	Commercial- Fuel	Employees	1	\$515
Rte. 117	Mobile Home Park	Mobile Homes	80	\$41,181
Totals			170	\$51,476

6.5.4 Anticipated User Rates

It is anticipated that the additional users will reduce the overall operating costs for the Town's municipal wastewater system.

As shown in Table 16, the annual debt service for a single-family home in the expansion area will be \$515. As stated in section 2.4.1, for average single-family home the average sewer user fee today is approximately \$565. It is anticipated that the overall annual operating cost of Richmond's wastewater treatment system will decrease on a per user basis with the addition of the wastewater from the expansion area. Conservatively however using today's rates, the average annual single family costs within the expansion area for a typical single-family home would be approximately \$1,080 per year for wastewater.

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EXISTING WASTEWATER SERVICE AREA

PROPOSED WASTEWATER EXPANSION AREA

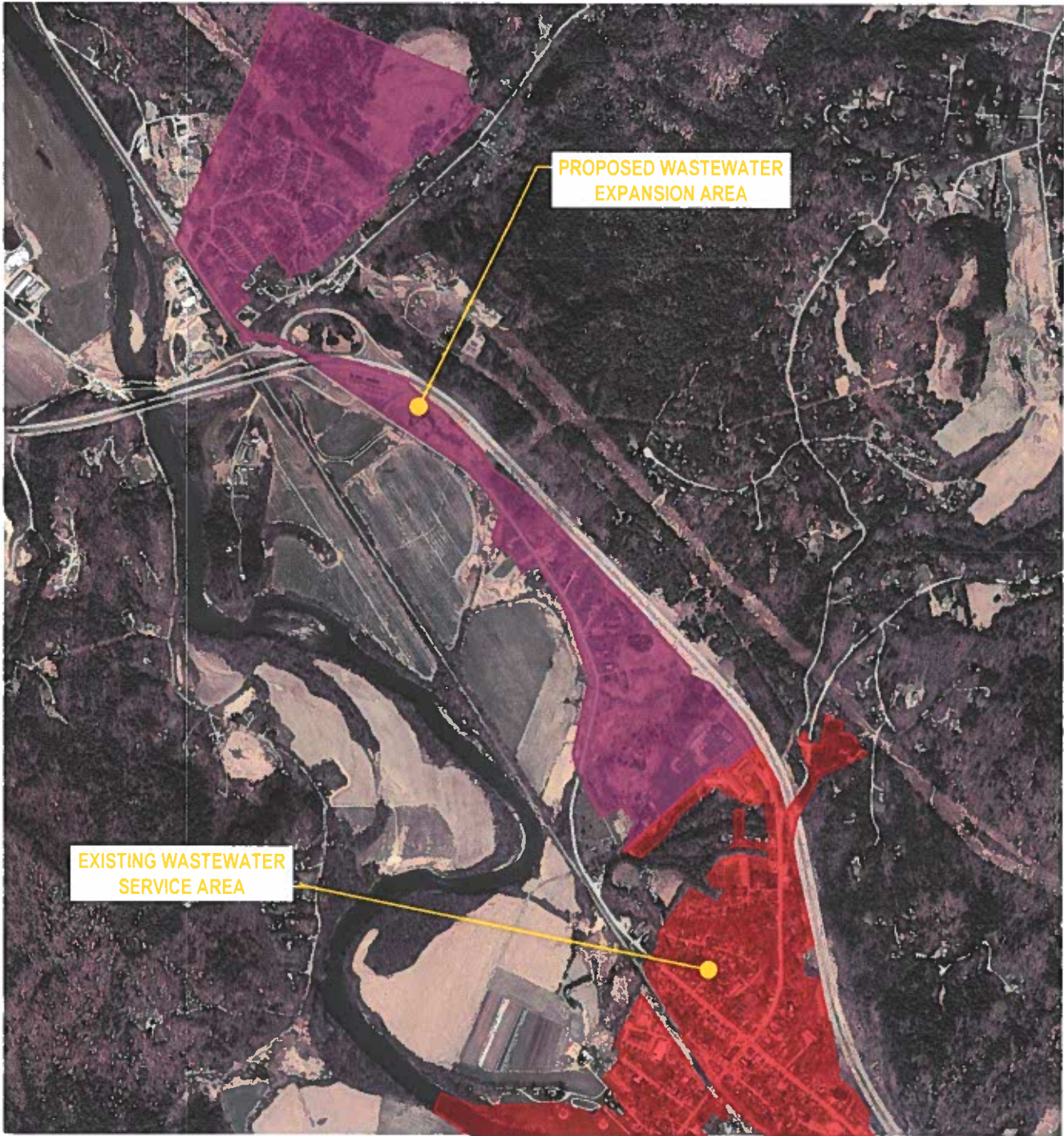
GREEN MOUNTAIN ENGINEERING

CIVIL WATER WASTEWATER

1438 SOUTH BROWNELL ROAD
WILLISTON, VERMONT 05495
PHONE (802)862-5590
FAX (802)862-7588

DRAFT

DRAWING TITLE		DESIGNED	PROJECT NO.
PROJECT LOCATION MAP		SP	24-029
PROJECT		DRAWN	
WEST MAIN STREET WASTEWATER EXTENSION		JJB	
CLIENT		CHECKED	DRAWING NO.
TOWN OF RICHMOND, VERMONT		AH	1
		PLOT DATE	
		6/9/21	
		SCALE	
		AS SHOWN	
		DATE	
		JUN. 2021	



EXISTING WASTEWATER SERVICE AREA

PROPOSED WASTEWATER EXPANSION AREA

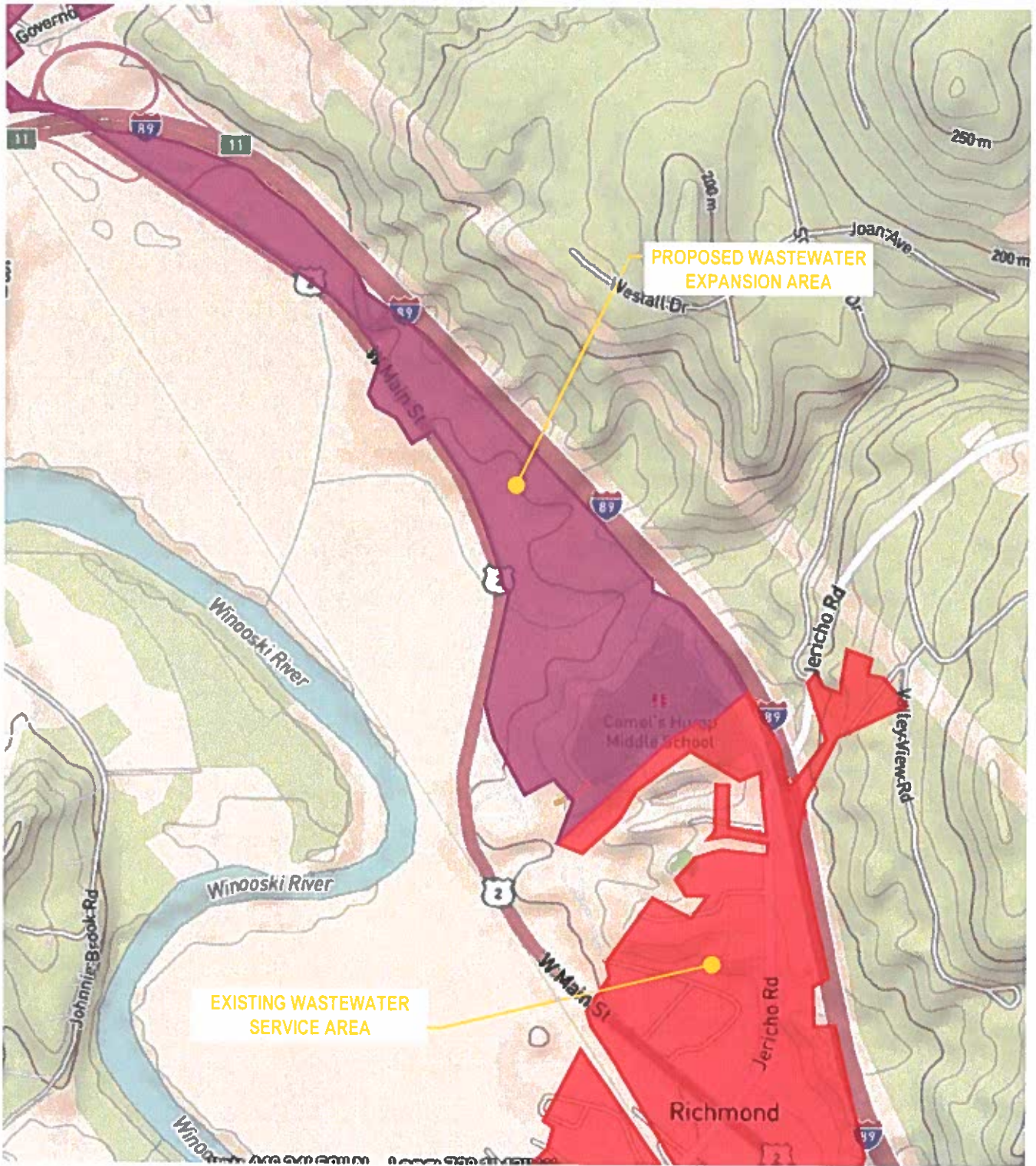
GREEN MOUNTAIN ENGINEERING

CIVIL WATER WASTEWATER

1438 SOUTH BROWNELL ROAD
WILLISTON, VERMONT 05495
PHONE (802)862-5590
FAX (802)862-7588

DRAFT

DRAWING TITLE	CURRENT & PROPOSED WASTEWATER SERVICE MAP (AERIAL VIEW)		DESIGNED	SP	PROJECT NO. 24-029
			DRAWN	JJB	
PROJECT	WEST MAIN STREET WASTEWATER EXTENSION		CHECKED	AH	DRAWING NO. 2
			PLOT DATE	6/9/21	
CLIENT	TOWN OF RICHMOND, VERMONT		SCALE	1" = 1500'	
			DATE	JUN. 2021	



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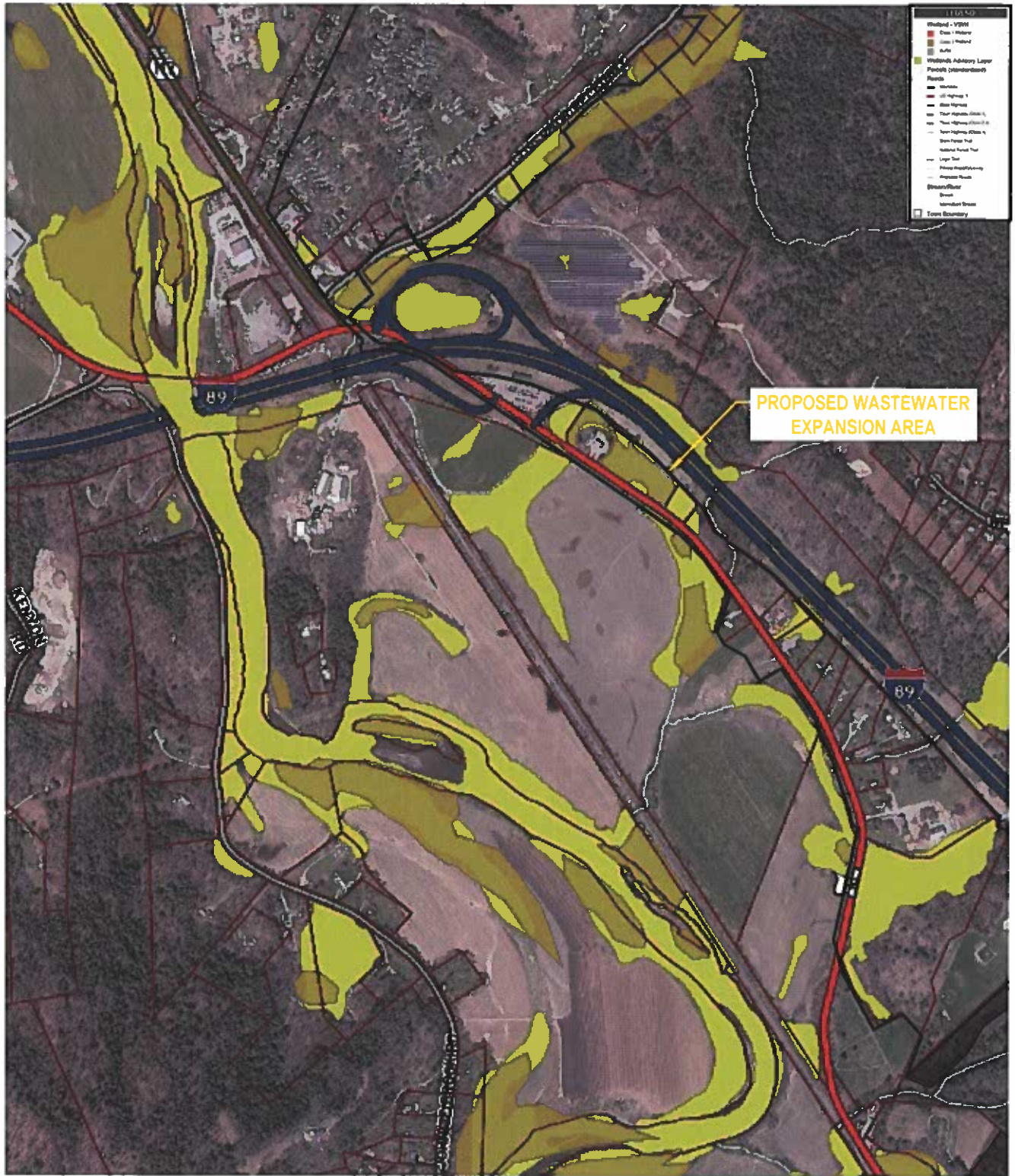
CIVIL
 WATER
 WASTEWATER

DRAFT

DRAWING TITLE	CURRENT & PROPOSED WASTEWATER SERVICE MAP (TOPO VIEW)
PROJECT	WEST MAIN STREET WASTEWATER EXTENSION
CITY	TOWN OF RICHMOND, VERMONT

DESIGNED	SP
DRAWN	JJB
CHECKED	AH
PLLOT DATE	6/9/21
SCALE	1" = 1000'
DATE	JUN. 2021

PROJECT NO.	24-029
DRAWING NO.	3



PROPOSED WASTEWATER EXPANSION AREA

1438 SOUTH BROWNELL ROAD
 WILLISTON, VERMONT 05495
 PHONE: (802)882-5590
 FAX: (802)882-7598

CIVIL WATER WASTEWATER

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DESIGNED	SP
DRAWN	JJB
CHECKED	AH
PROJECT	WEST MAIN STREET WASTEWATER EXTENSION
CLIENT	TOWN OF RICHMOND, VERMONT

PROJECT NO.	24-029
DRAWING NO.	4
DATE	JUN. 2021



LEGEND	
	Flooded Area
	Proposed Road
	Town Boundary
	Water
	Highway 1
	State Highway
	Water
	State Highway (Class 1)
	State Highway (Class 2)
	State Highway (Class 3)
	State Highway (Class 4)
	State Highway (Class 5)
	State Highway (Class 6)
	State Highway (Class 7)
	State Highway (Class 8)
	State Highway (Class 9)
	State Highway (Class 10)
	State Highway (Class 11)
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	State Highway (Class 13)
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	State Highway (Class 47)
	State Highway (Class 48)
	State Highway (Class 49)
	State Highway (Class 50)

1438 SOUTH BROWNELL ROAD
 WILLISTON, VERMONT 05495
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 FAX: (802)982-7590

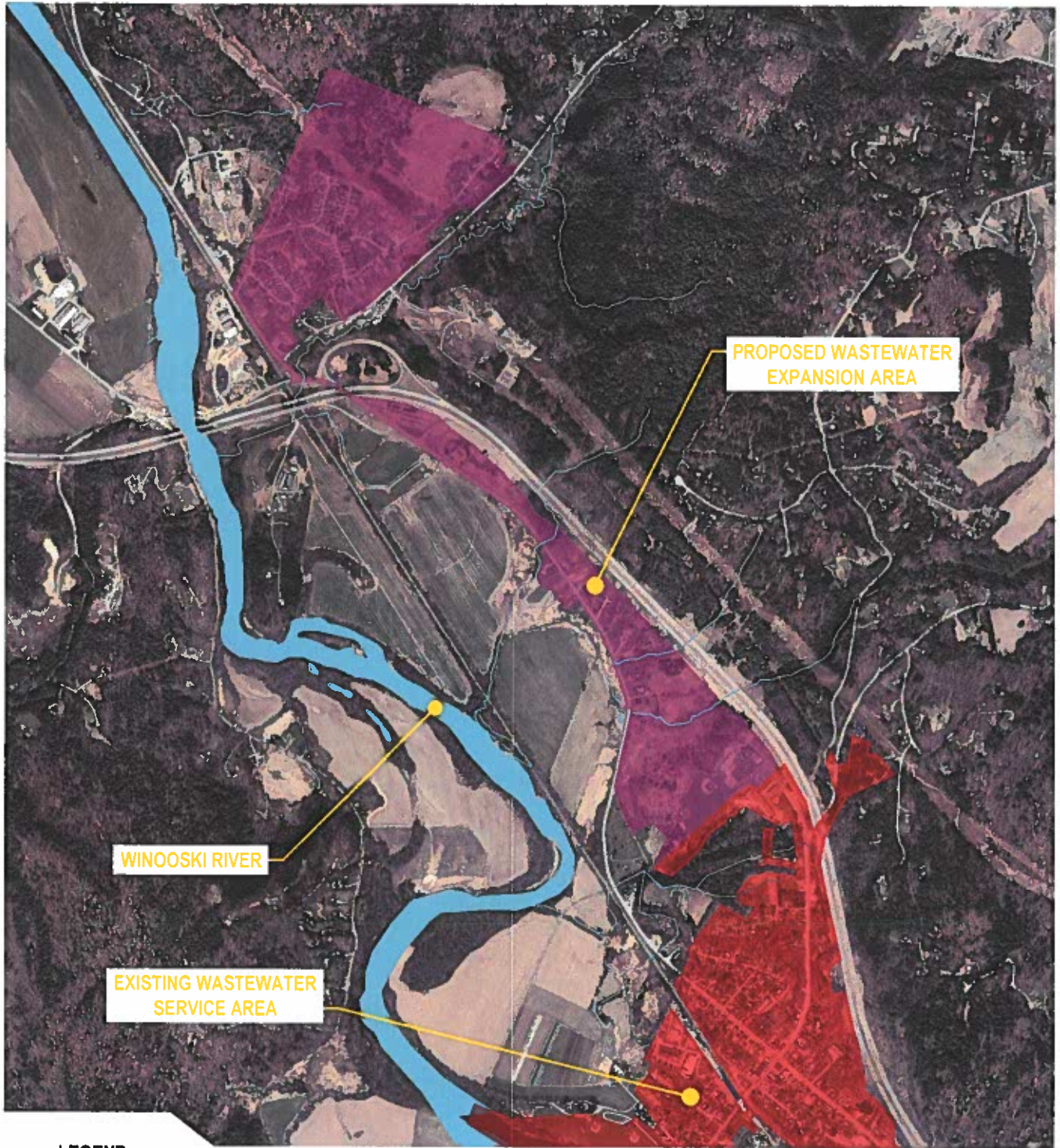
GREEN MOUNTAIN ENGINEERING

CIVIL WATER WASTEWATER

DRAFT

DESIGNED	SP
DRAWN	JJB
CHECKED	AH
PROJECT	WEST MAIN STREET WASTEWATER EXTENSION
CLIENT	TOWN OF RICHMOND, VERMONT
PROJECT TITLE	FLOOD PRONE AREAS MAP
PLANT DATE	6/9/21
SCALE	1" = 1000'
DATE	JUN. 2021

PROJECT NO.	24-029
DRAWING NO.	5



WINOOSKI RIVER

EXISTING WASTEWATER SERVICE AREA

PROPOSED WASTEWATER EXPANSION AREA

LEGEND

~ STREAM

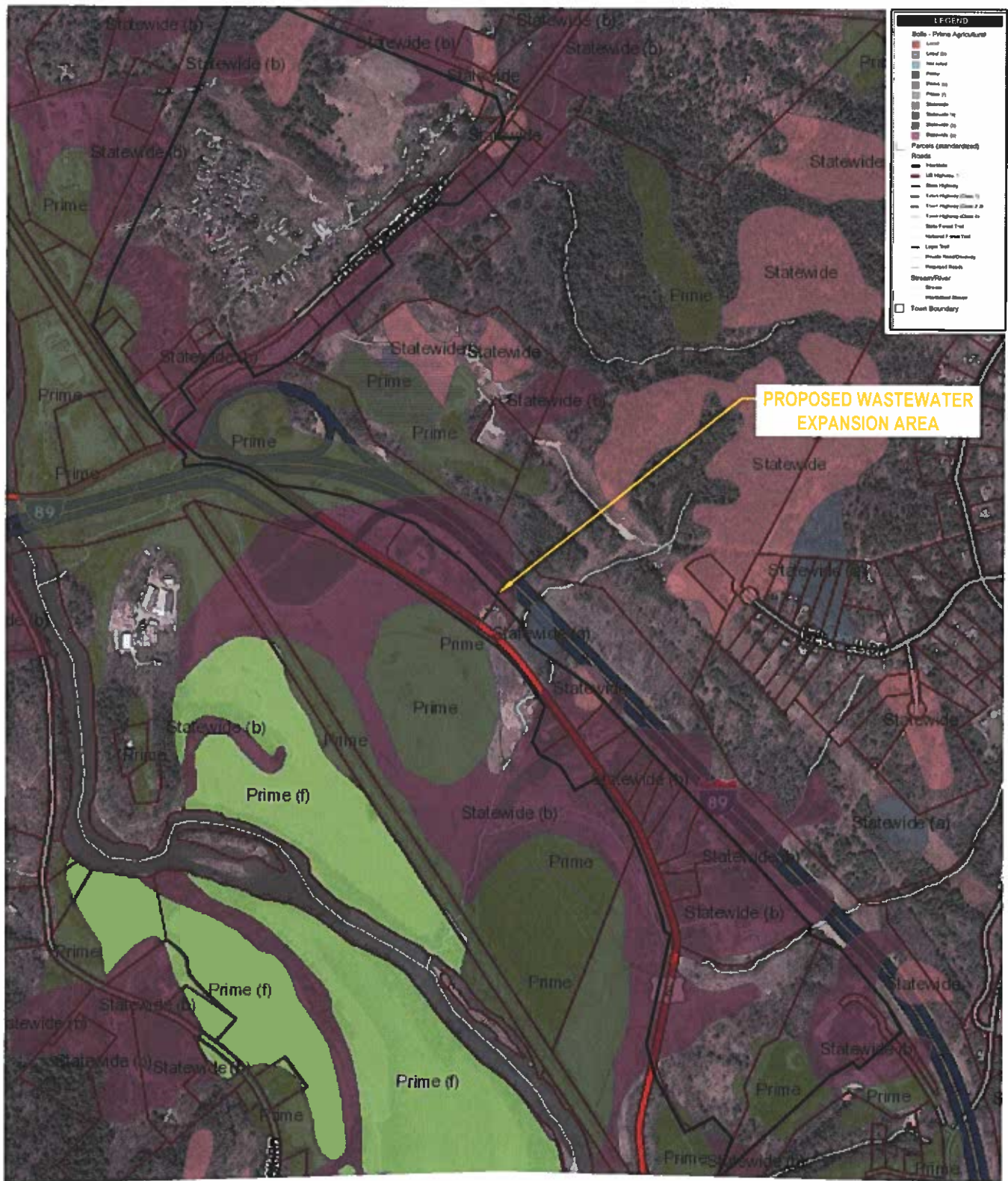
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CIVIL WATER WASTEWATER

1438 SOUTH BROWNELL ROAD
WILLISTON, VERMONT 05495
PHONE: (802)682-5590
FAX: (802)682-7598

DRAFT

DRAWING TITLE	HYDROLOGY MAP		DESIGNED	SP	PROJECT NO.
	PROJECT		DRAWN	JJB	
			WEST MAIN STREET WASTEWATER EXTENSION		CHECKED
CLIENT	TOWN OF RICHMOND, VERMONT		PLOT DATE	6/9/21	DRAWING NO.
			SCALE	1" = 1500'	6
			DATE	JUN. 2021	



LEGEND	
Soils - Prime Agriculture	
[Green]	Prime
[Light Green]	Prime (f)
[Dark Red]	Statewide (a)
[Medium Red]	Statewide (b)
[Dark Purple]	Statewide (c)
[Light Purple]	Statewide (d)
[Dark Blue]	Statewide (e)
[Light Blue]	Statewide (f)
[Red Outline]	Parcels (standardized)
Roads	
[Thick Black Line]	Main Road
[Thin Black Line]	Other Road
[Dashed Line]	Proposed Road
[Blue Line]	Stream/River
[Blue Line]	Water
[Red Outline]	Town Boundary

PROPOSED WASTEWATER EXPANSION AREA

1438 SOUTH BROWNELL ROAD
 WILLISTON, VERMONT 05495
 PHONE (802)862-5500
 FAX (802)862-7500

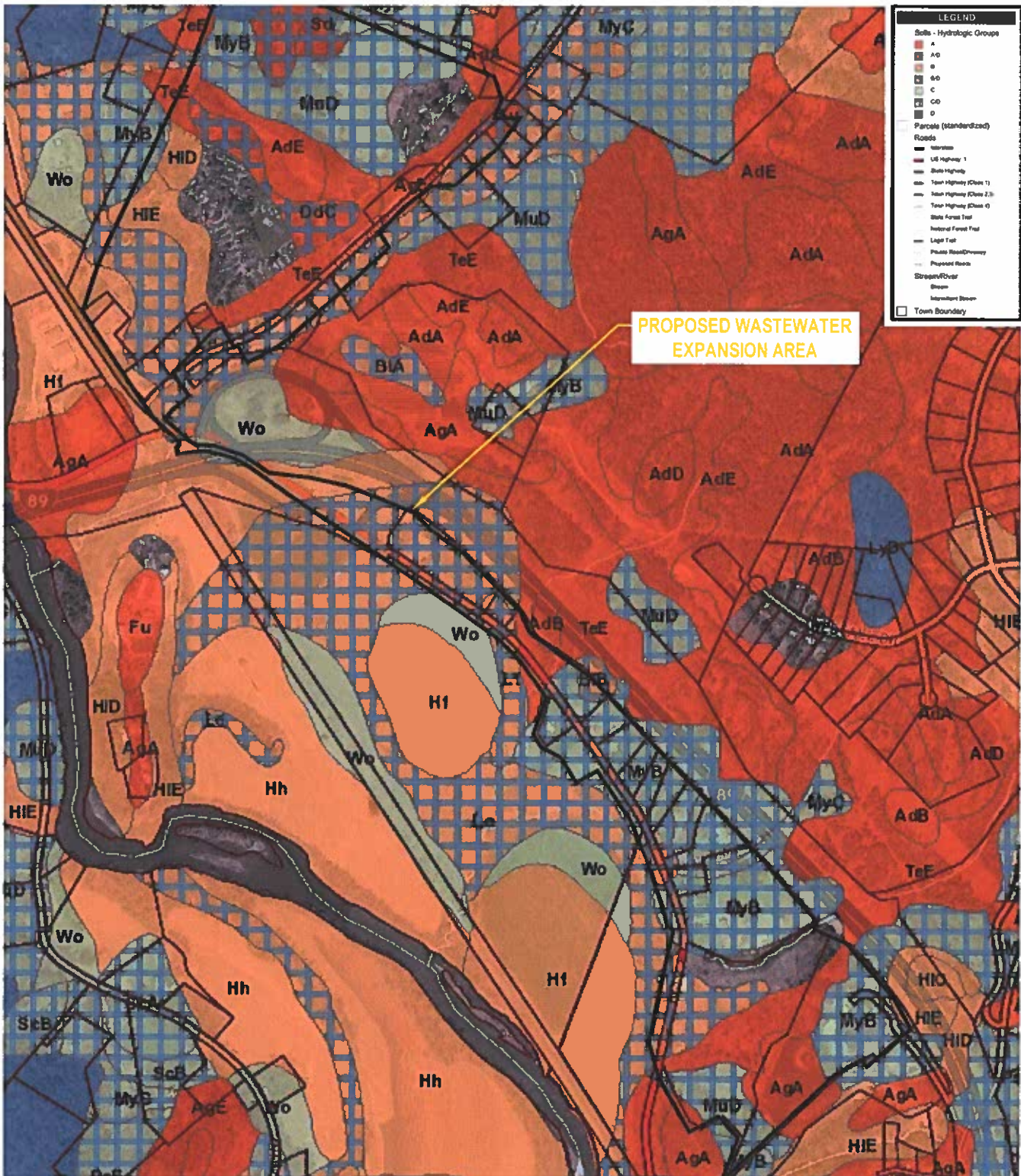
GREEN MOUNTAIN ENGINEERING

CIVIL WATER WASTEWATER

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DESIGNED	SP
DRAWN	JJB
CHECKED	AH
PROJECT	WEST MAIN STREET WASTEWATER EXTENSION
CITY/TOWN	TOWN OF RICHMOND, VERMONT

PROJECT NO.	24-029
DRAWING NO.	7
DATE	JUN. 2021



PROPOSED WASTEWATER EXPANSION AREA

1438 SOUTH BROWNELL ROAD
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PHONE (802)862-5590
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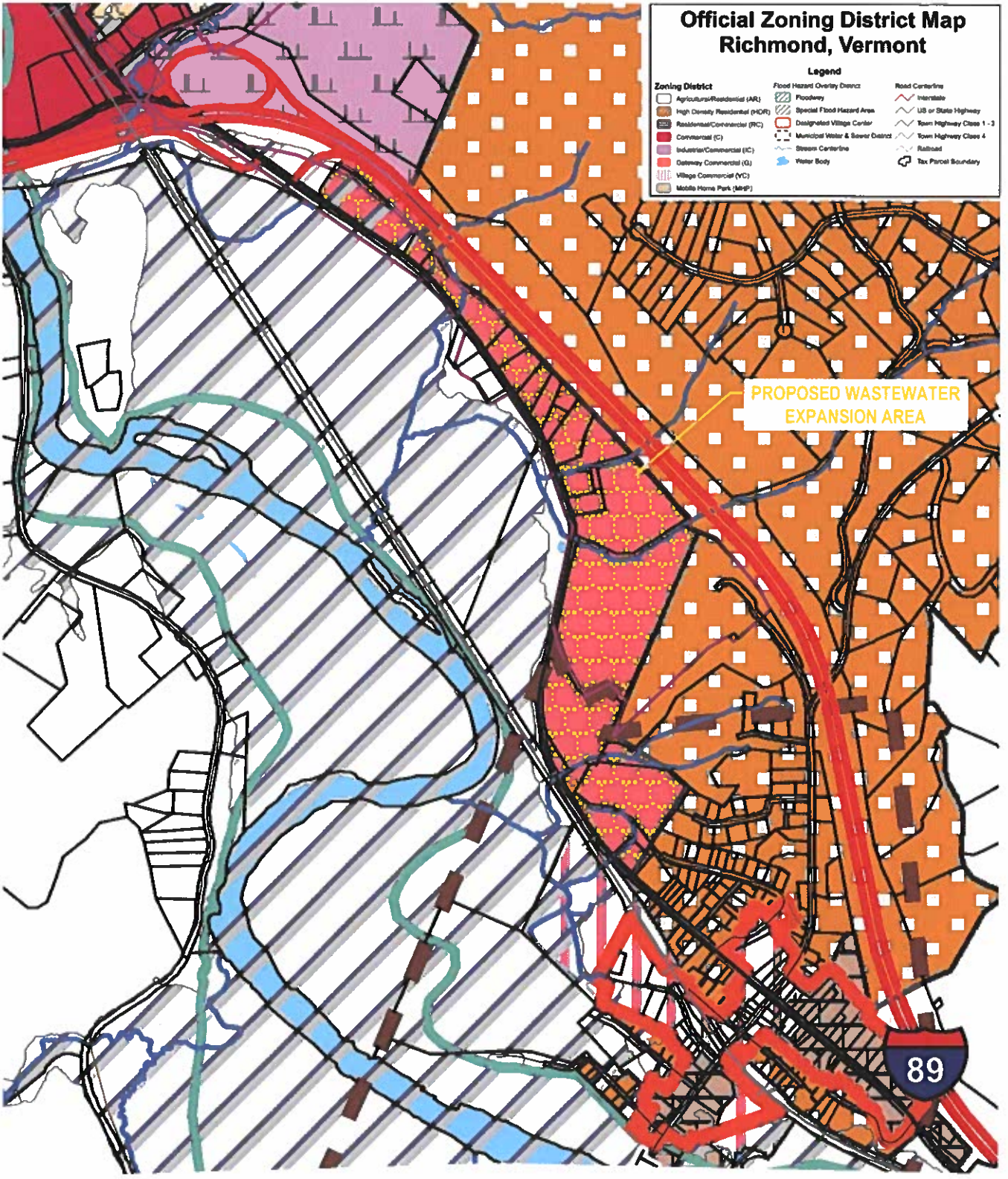
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DRAWING TITLE		DESIGNED	PROJECT NO.
USDA SOIL SURVEY MAP		SP	24-029
PROJECT		DRAWN	
WEST MAIN STREET WASTEWATER EXTENSION		JJB	
CLIENT		CHECKED	
TOWN OF RICHMOND, VERMONT		AH	
		PLOT DATE	DRAWING NO.
		6/9/21	8
		SCALE	
		1" = 1000'	
		DATE	
		JUN. 2021	

Official Zoning District Map Richmond, Vermont

- Zoning District**
- Agricultural/Residential (AR)
 - High Density Residential (HDR)
 - Residential/Commercial (RC)
 - Commercial (C)
 - Industrial/Commercial (IC)
 - Gateway Commercial (G)
 - Village Commercial (VC)
 - Mobile Home Park (MHP)
- Flood Hazard Overlay District**
- Floodway
 - Special Flood Hazard Area
 - Designated Village Center
 - Municipal Water & Sewer District
 - Stream Centerline
 - Water Body
- Road Centerline**
- Interstate
 - US or State Highway
 - Town Highway Class 1-3
 - Town Highway Class 4
 - Railroad
 - Tax Parcel Boundary

**PROPOSED WASTEWATER
EXPANSION AREA**



1434 SOUTH BROWNELL ROAD
WILLISTON, VERMONT 05495
PHONE (802)862-5590
FAX (802)862-7508

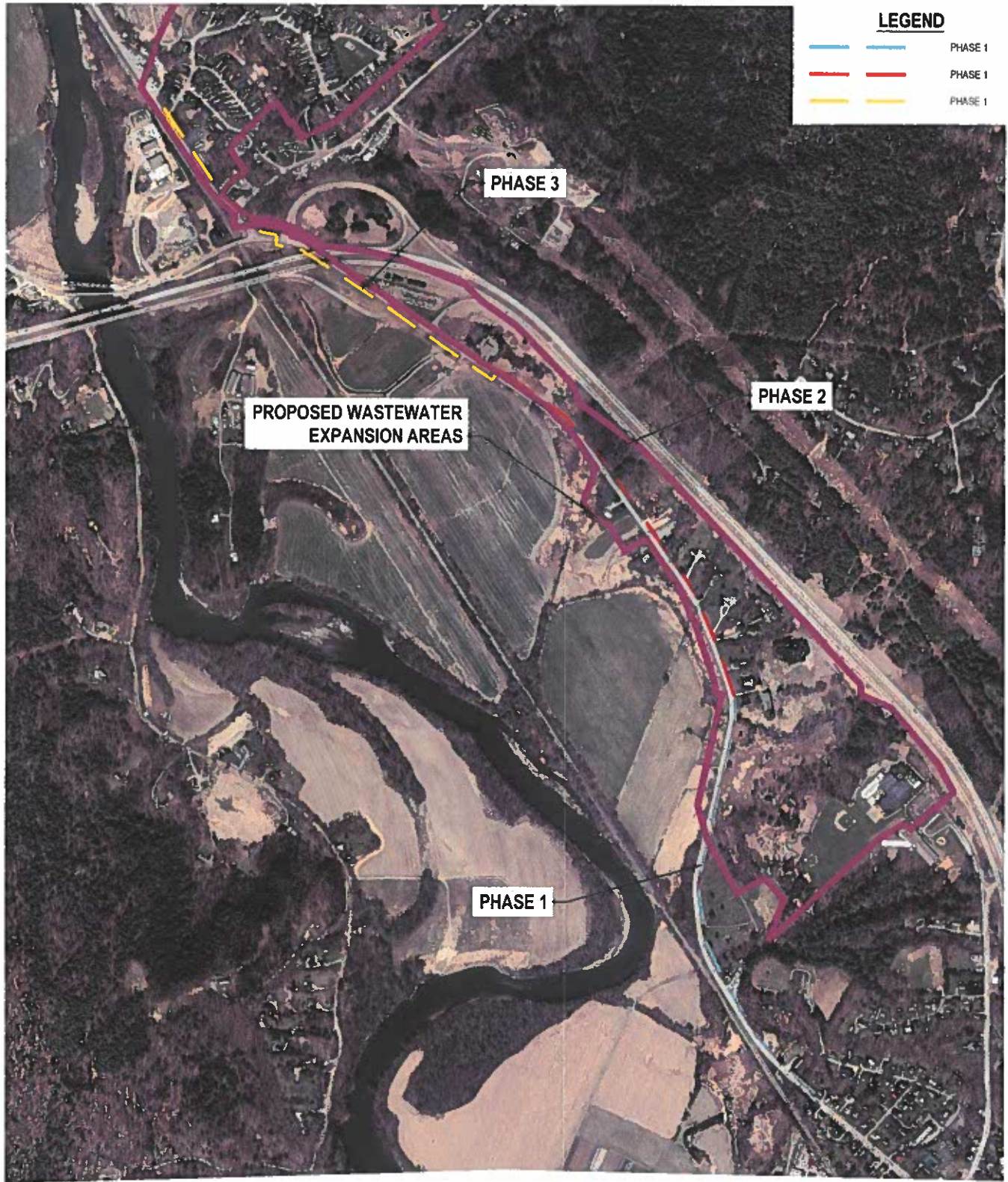
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CIVIL WATER WASTEWATER

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DRAWING TITLE		RICHMOND, VT ZONING MAP	
PROJECT		WEST MAIN STREET WASTEWATER EXTENSION	
CLIENT		TOWN OF RICHMOND, VERMONT	

DESIGNED	SP	PROJECT NO	24-029
DRAWN	JUB		
CHECKED	AH	DRAWING NO	11
PLLOT DATE	6/11/21		
SCALE	1" = 1000'		
DATE	MAY 2021		



LEGEND

- PHASE 1
- PHASE 1
- PHASE 1

PHASE 3

PHASE 2

PROPOSED WASTEWATER
EXPANSION AREAS

PHASE 1

1438 SOUTH BROWNELL ROAD
WILLISTON, VERMONT 05495
PHONE: (802)862-5590
FAX: (802)862-7598

GREEN MOUNTAIN ENGINEERING

CIVIL WATER WASTEWATER

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DRAWING TITLE		DESIGNED	PROJECT NO.
PROPOSED SEWER LINE EXTENSION OVERALL PHASING PLAN		SP	24-029
		DRAWN	
		JJB	
PROJECT		CHECKED	DRAWING NO.
WEST MAIN STREET WASTEWATER EXTENSION		AH	12
CLIENT		PLOT DATE	
TOWN OF RICHMOND, VERMONT		6/11/21	
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		DATE	
		JUN 2021	



PROPOSED WASTEWATER
EXPANSION AREAS

PHASE 1

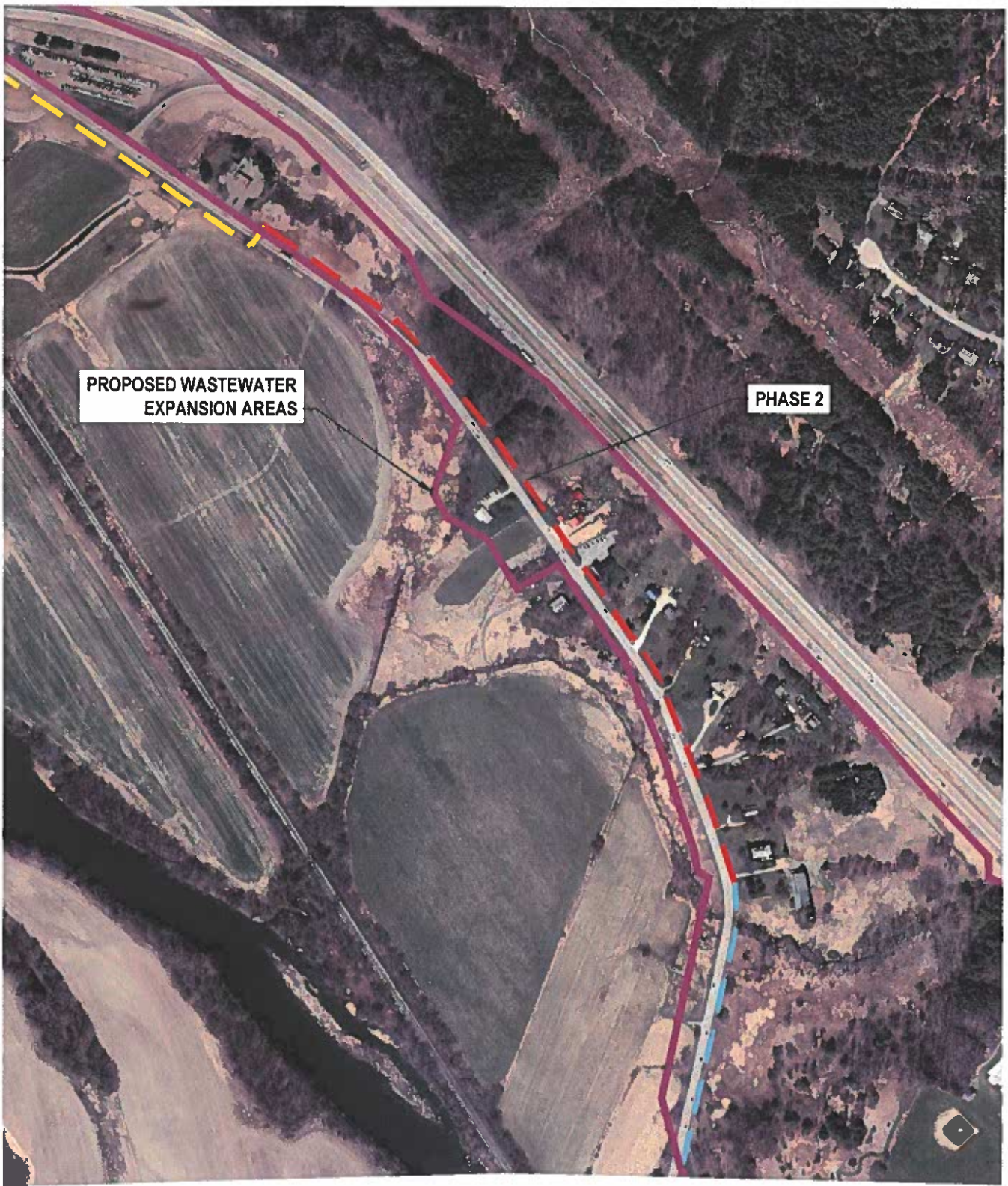
1438 SOUTH BROWNELL ROAD
WILLISTON, VERMONT 05495
PHONE (802)862-5590
FAX (802)862-7588

**GREEN
MOUNTAIN
ENGINEERING**

CIVIL
WATER
WASTEWATER


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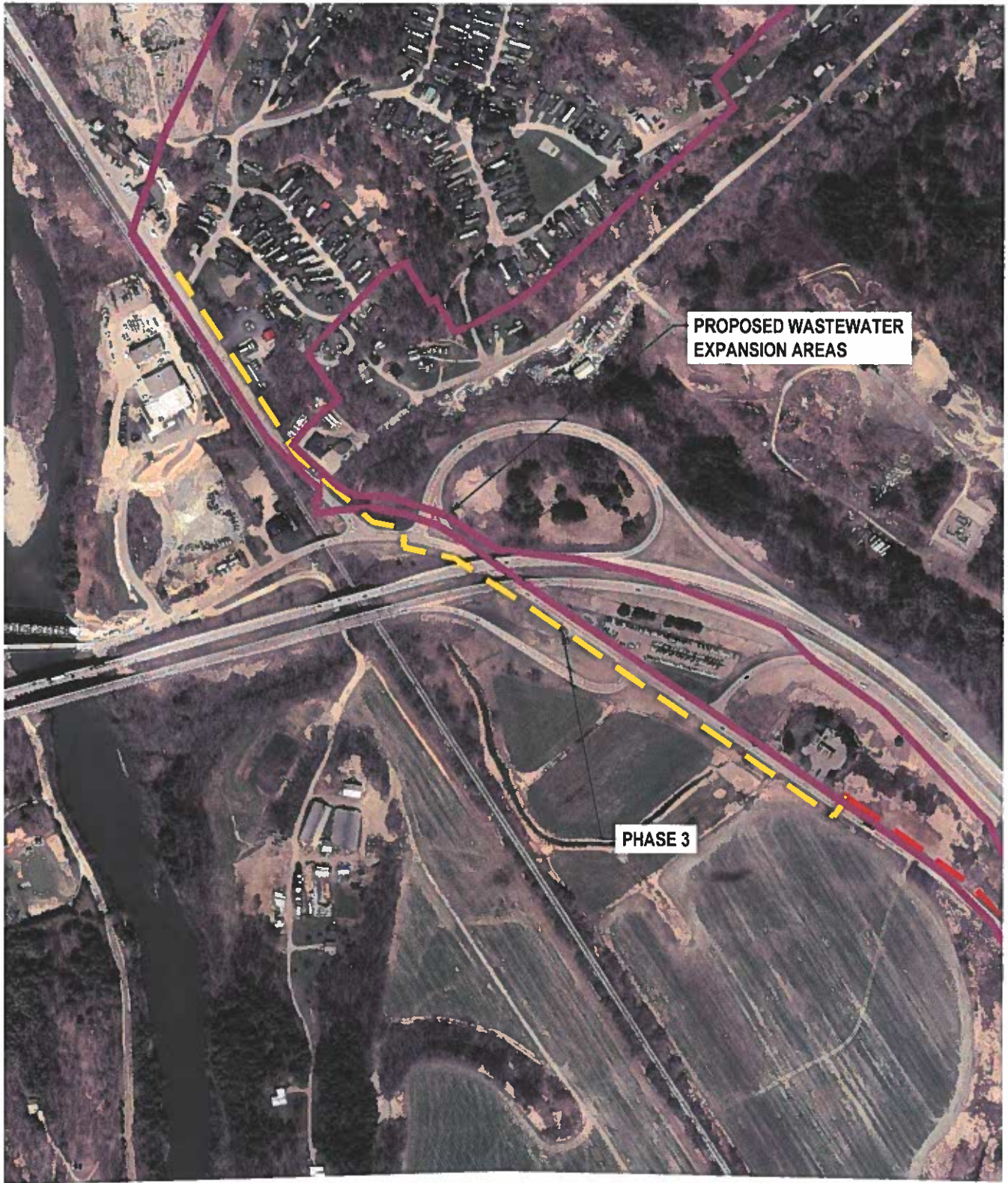
DRAWING TITLE	DESIGNED: SP	PROJECT NO.
PROPOSED SEWER LINE EXTENSION PHASE 1 PLAN	DRAWN: JJB	24-029
	CHECKED: AH	
PROJECT	PLOT DATE: 6/11/21	DRAWING NO.
WEST MAIN STREET WASTEWATER EXTENSION	SCALE: 1" = 500'	13
CLIENT	TOWN OF RICHMOND, VERMONT	
	DATE: JUN. 2021	



PROPOSED WASTEWATER
EXPANSION AREAS

PHASE 2

 CIVIL WATER WASTEWATER	1436 SOUTH BROWNELL ROAD WILLISTON, VERMONT 05495 PHONE (802)862-5590 FAX (802)862-7598	DRAFT	DRAWING TITLE PROPOSED SEWER LINE EXTENSION PHASE 2 PLAN	DESIGNED SP	PROJECT NO. 24-029	
			PROJECT WEST MAIN STREET WASTEWATER EXTENSION	DRAWN JJB		
			CLIENT TOWN OF RICHMOND, VERMONT	CHECKED AH	PLOT DATE 6/11/21	DRAWING NO. 14
				SCALE 1" = 500'	DATE MAY 2021	



PROPOSED WASTEWATER EXPANSION AREAS

PHASE 3

GREEN MOUNTAIN ENGINEERING
 CIVIL WATER WASTEWATER

1438 SOUTH BROWNELL ROAD
 WILLISTON, VERMONT 05495
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 FAX: (802)882-7598

DRAFT

DRAWING TITLE PROPOSED SEWERLINE EXTENSION PHASE 3 PLAN		DESIGNED: SP	PROJECT NO. 24-029
PROJECT WEST MAIN STREET WASTEWATER EXTENSION		DRAWN: JJB	DRAWING NO. 15
CLIENT TOWN OF RICHMOND, VERMONT		CHECKED: AH	
		PLOT DATE 6/11/21	
		SCALE 1" = 500'	
		DATE MAY, 2021	

Appendix D
Phase 1 Alternatives Analysis
Engineers Opinion of Probable Costs
Richmond West Main Street Wastewater Expansion Alternatives

Phase 1 - Option A

Description	School to Reap Property		Total Cost
	Unit Cost	Quantity	
ENGINEERING			
A. Preliminary Engineering (Step I)			
Archeology	\$9,900	1	\$9,900
Additional Environmental	\$1,900	1	\$1,900
	\$1,800	1	\$1,800
		Step I Subtotal =	\$13,600

Phase 1 - Option B

Description	Route 2 to Reap Property		Total Cost
	Unit Cost	Quantity	
ENGINEERING			
A. Preliminary Engineering (Step I)			
Archeology	\$9,900	1	\$9,900
Additional Environmental	\$1,900	1	\$1,900
	\$1,800	1	\$1,800
		Step I Subtotal =	\$13,600

6/7/202
Selected Alternative

B. Final Design/Permitting (Step II - State Fee Curve)			
Phase II Archeology	\$21,353	1	\$21,353
Act 250 Permitting	\$10,000	1	\$10,000
VT AOT Permitting	\$15,000	1	\$15,000
FHWA Permitting (as required)	\$0	1	\$0
	\$5,000	1	\$5,000
		Step II Subtotal =	\$51,353
Subtotal =			

B. Final Design/Permitting (Step II - State Fee Curve)			
Phase II Archeology	\$21,353	1	\$21,353
Act 250 Permitting	\$0	1	\$0
VT AOT Permitting	\$15,000	1	\$15,000
FHWA Permitting (as required)	\$5,000	1	\$5,000
	\$5,000	1	\$5,000
		Step II Subtotal =	\$46,353
Subtotal =			

C. Bidding/Construction Phase (Step III - State Fee Curve)			
Additional DBE Requirements	\$36,136	1	\$36,136
	\$2,000	1	\$2,000
		Step III Subtotal =	\$38,136
Subtotal =			
Total Phase I Engineering Cost = \$103,089			

C. Bidding/Construction Phase (Step III - State Fee Curve)			
Additional DBE Requirements	\$39,147	1	\$39,147
	\$2,000	1	\$2,000
		Step III Subtotal =	\$41,147
Subtotal =			
Total Phase I Engineering Cost = \$101,100			

ADMINISTRATION			
Permit Fees	\$5,000	1	\$5,000
Legal (Municipal Bond Issuance)	\$3,000	1	\$3,000
Legal (Right of Way Certification & Easements)	\$5,000	1	\$5,000
Misc.	\$5,000	1	\$5,000
		Phase 1 Total Administration Cost =	\$18,000

ADMINISTRATION			
Permit Fees	\$5,000	1	\$5,000
Legal (Municipal Bond Issuance)	\$3,000	1	\$3,000
Legal (Right of Way Certification & Easements)	\$5,000	1	\$5,000
Misc.	\$5,000	1	\$5,000
		Phase 1 Total Administration Cost =	\$18,000

CONSTRUCTION			
Site Preparation & Misc.	\$10,000	\$1	\$10,000
Archeological Monitoring (For Bore Pits)	\$5,000	1	\$5,000
3" Low Pressure Force Main (ft)	\$40	3,100	\$124,000
6" Sleeves	\$60	0	\$0
Blasting/Rock Removal (YD)	\$400	20	\$8,000
Surface Restoration/Landscaping (LS)	\$10,000	1	\$10,000
Erosion Control (LS)	\$10,000	1	\$10,000
Signage/Traffic Control (LS)	\$5,000	1	\$5,000
Surveying/Layout	\$5,000	1	\$5,000
Excavator for Bore Pits	\$5,000	1	\$5,000
Mobilization (LS)	\$30,000	1	\$30,000
Bonds (LS)	\$30,000	1	\$30,000
Contingency (20%)	\$5,000	1	\$5,000
		0.20	\$40,400
		Subtotal	\$257,400

CONSTRUCTION			
Site Preparation & Misc.	\$10,000	\$1	\$10,000
Archeological Monitoring (For Bore Pits)	\$0	1	\$0
3" Low Pressure Force Main (ft)	\$40	3,200	\$128,000
6" Sleeves	\$60	0	\$0
Blasting/Rock Removal (YD)	\$400	20	\$8,000
Surface Restoration/Landscaping (LS)	\$10,000	1	\$10,000
Erosion Control (LS)	\$10,000	1	\$10,000
Signage/Traffic Control (LS)	\$25,000	1	\$25,000
Surveying/Layout	\$5,000	1	\$5,000
Excavator for Bore Pits	\$5,000	1	\$5,000
Mobilization (LS)	\$30,000	1	\$30,000
Bonds (LS)	\$30,000	1	\$30,000
Contingency (20%)	\$5,000	1	\$5,000
		0.20	\$45,200
		Subtotal	\$281,200

Engineers Opinion of Total Phase 1 Costs = **\$378,489**

\$400,300

Notes

- Opinion of Probable Cost is based on preliminary phase estimates only. More detailed costs should be developed during Final Design based on actual design quantities.
- Assumes Right of Way/assessment purchase is not required.
- Staging pumps, alarms, controls and electrical by others.
- Step I Engineering based on draft agreement.
- Step II Engineering Estimates are based on the State fee curve plus additional non-customary engineering items where necessary.
- Assumes a minimal amount of ledge and large cobbles are encountered during directional drilling.
- "Site Preparation and Misc." includes miscellaneous equipment to be supplied, temporary offices, clean up and contractors contract administration.

Appendix E
Phase 1 Recommended Project
Engineers Opinion of Probable Cost
Proposed Richmond West Main Street Wastewater Expansion

Revised 6-7-21

Description	Unit Cost	Quantity	Total Cost
ENGINEERING (Phase 1)			
A. Preliminary Engineering (Step I)			
Archeology	\$9,900	1	\$9,900
Additional Environmental	\$1,900	1	\$1,900
	\$1,800	1	\$1,800
		Step I Subtotal =	\$13,600

B. Final Design/Permitting (Step II)			
VT Eng. Fee Curve		1	\$21,353
Act 250 Permitting (T&M) [#]	\$15,000	1	\$15,000
VT AOT Coordination/Permitting	\$5,000	1	\$5,000
FHWA Coordination/Permitting	\$5,000	1	\$5,000
		Step II Subtotal =	\$46,353

C. Bidding/Construction (Step III)			
VT Eng. Fee Curve		1	\$39,147
Additional DBE Requirements	\$2,000	1	\$2,000
		Step III Subtotal =	\$41,147
		Total Phase 1 Engineering Cost =	\$101,100

ADMINISTRATION (Phase 1)			
Permit Fees	\$5,000	1	\$5,000
Legal (Municipal Bond Issuance)	\$3,000	1	\$3,000
Legal (Right of Way Certification & Easements)	\$5,000	1	\$5,000
Misc.	\$5,000	1	\$5,000
		Total Phase 1 Total Administration Cost=	\$18,000

CONSTRUCTION (Phase 1)			
Site Preparation & Misc.	\$10,000	\$1	\$10,000
3" Low Pressure Force Main (ft)	\$40	3,200	\$128,000
6" Sleeves Directionally Drilled (Phase 3 only)	\$60	0	\$0
* Blasting/Rock Removal (YD)	\$400	20	\$8,000
Surface Restoration/Landscaping (LS)	\$10,000	1	\$10,000
Erosion Control (LS)	\$10,000	1	\$10,000
Signage/Traffic Control (LS)	\$25,000	1	\$25,000
Surveying/Layout	\$5,000	1	\$5,000
Excavator for bore pits (assume 1,000 foot runs)	\$5,000	1	\$5,000
Mobilization (LS)	\$30,000	1	\$30,000
Bonds (LS)	\$5,000	1	\$5,000
Contingency (20%)		0.20	\$45,200
		Total Phase 1 Construction Cost=	\$281,200
		Engineers Opinion of Total Phase 1 Costs =	\$400,300

NOTES

1. Opinion of Probable Cost is based on preliminary phase estimates only. More detailed costs should be developed during Final Design based on actual design quantities.
2. Assumes Right of Way/Easement purchase is not required.
3. Storming, pumps, alarms, controls and electrical by others.
4. Step I Engineering based on draft agreement.
5. Step II Engineering based on draft agreement.
6. Assumes a minimal amount of ledge and large cobbles are encountered during directional drilling.
7. "Site Preparation and Misc." includes miscellaneous equipment to be supplied, temporary offices, clean up and contractors contract administration.
8. Act 250 Permitting costs are highly variable and project dependant. Final costs are generally a reflection of the amount of local resistance there is to a project which is unpredictable until permits are applied for.

Appendix E
Phase 2 Recommended Project
Engineers Opinion of Probable Cost
Proposed Richmond West Main Street Wastewater Expansion

Revised 6 -7-21

Description	Unit Cost	Quantity	Total Cost
ENGINEERING (Phase 2)			
A. Preliminary Engineering (Step 1)			
Archeology		Completed in Phase 1	\$0
Additional Environmental		Completed in Phase 1	\$0
		Completed in Phase 1	\$0
		Step 1 Subtotal =	\$0

B. Final Design/Permitting (Step II)			
VT AOT Coordination/Permitting	VT Eng. Fee Curve	1	\$20,690
		1	<u>\$5,000</u>
		Step II Subtotal =	\$25,690

C. Bidding/Construction (Step III)			
Additional DBE Requirements	VT Eng. Fee Curve	1	\$37,932
		1	<u>\$2,000</u>
		Step III Subtotal =	\$39,932
		Total Phase 2 Engineering Cost =	\$65,623

ADMINISTRATION (Phase 2)			
Permit Fees	\$5,000	1	\$5,000
Legal (Municipal Bond Issuance)	\$3,000	1	\$3,000
Legal (Right of Way Certification & Easements)	\$5,000	1	\$5,000
Misc.	\$5,000	1	<u>\$5,000</u>
		Total Phase 2 Total Administration Cost=	\$18,000

CONSTRUCTION (Phase 2)			
Site Preparation & Misc.	\$10,000	\$1	\$10,000
3" Low Pressure Force Main (ft)	\$40	3,000	\$120,000
6" Sleeves Directionally Drilled (Phase 3 only)	\$60	0	\$0
*Blasting/Rock Removal (YD)	\$400	20	\$8,000
Surface Restoration/Landscaping (LS)	\$10,000	1	\$10,000
Erosion Control (LS)	\$10,000	1	\$10,000
Signage/Traffic Control (LS)	\$25,000	1	\$25,000
Surveying/Layout	\$5,000	1	\$5,000
Excavator for bore pits (assume 1,000 foot runs)	\$5,000	1	\$5,000
Mobilization (LS)	\$30,000	1	\$30,000
Bonds (LS)	\$5,000	1	\$5,000
Contingency (20%)	\$5,000	1	\$5,000
		0.20	<u>\$43,600</u>
		Total Phase 2 Construction Cost=	\$271,600

Engineers Opinion of Total Phase 2 Costs = \$355,223

Notes

1. Opinion of Probable Cost is based on preliminary phase estimates only. More detailed costs should be developed during Final Design based on actual design quantities.
2. Assumes Right of Way/Easement purchase is not required.
3. Storage, pumps, alarms, controls and electrical by others.
4. Step I Engineering based on draft agreement.
5. Step II & III Engineering Estimates are based on the State fee curve plus additional non-customary engineering items where necessary.
6. Assumes a minimal amount of ledge and large cobbles are encountered during directional drilling.
7. "Site Preparation and Misc." includes miscellaneous equipment to be supplied, temporary offices, clean up and contractor's contract administration.

Appendix E
Phase 3 Recommended Project
Engineers Opinion of Probable Cost
Proposed Richmond West Main Street Wastewater Expansion

Revised 6-7-21

Description	Unit Cost	Quantity	Total Cost
ENGINEERING (Phase 3)			
A. Preliminary Engineering (Step I)			
Archeology		Completed in Phase 1	\$0
Additional Environmental		Completed in Phase 1	\$0
		Completed in Phase 1	\$0
		0	\$0
		0	\$0
		Step I Subtotal =	\$0

B. Final Design/Permitting (Step II)			
VT AOT Coordination/Permitting	VT Eng. Fee Curve	1	\$27,646
FHWA Coordination/Permitting	VT AOT Coordination/Permitting	1	\$5,000
	FHWA Coordination/Permitting	1	\$5,000
		Step II Subtotal =	\$37,646

C. Bidding/Construction (Step III)			
Additional DBE Requirements	VT Eng. Fee Curve	1	\$50,684
		1	\$2,000
		Step III Subtotal =	\$52,684
		Total Phase 3 Engineering Cost =	\$90,329

ADMINISTRATION (Phase 3)			
Permit Fees	\$5,000	1	\$5,000
Legal (Municipal Bond Issuance)	\$3,000	1	\$3,000
Legal (Right of Way Certification & Easements)	\$5,000	1	\$5,000
Misc.	\$5,000	1	\$5,000
		Total Phase 3 Total Administration Cost=	\$18,000

CONSTRUCTION (Phase 3)			
Site Preparation & Misc.	\$10,000	\$1	\$10,000
3" Low Pressure Force Main (ft) ⁸	\$60	3,200	\$192,000
6" Sleeves Directionally Drilled (Phase 3 only)	\$60	200	\$12,000
*Blasting/Rock Removal (YD)	\$400	20	\$8,000
Surface Restoration/Landscaping (LS)	\$10,000	1	\$10,000
Erosion Control (LS)	\$10,000	1	\$10,000
Signage/Traffic Control (LS)	\$25,000	1	\$25,000
Surveying/Layout	\$5,000	1	\$5,000
Excavator for bore pits (assume 1,000 foot runs)	\$5,000	1	\$5,000
Mobilization (LS)	\$30,000	1	\$30,000
Bonds (LS)	\$5,000	1	\$5,000
Contingency (20%)	\$5,000	1	\$5,000
		0.20	\$60,400
		Total Phase 3 Construction Cost=	\$372,400

Engineers Opinion of Total Phase 3 Costs = \$480,729

Notes

1. Opinion of Probable Cost is based on preliminary phase estimates only. More detailed costs should be developed during Final Design based on actual design quantities.
2. Assumes Right of Way/Easement purchase is not required.
3. Storage, pumps, alarms, controls and electrical by others.
4. Step I Engineering based on draft agreement.
5. Step II Engineering Estimates are based on the State fee curve plus additional non-customary engineering items where necessary.
6. Assumes a minimal amount of ledge and large cobbles are encountered during directional drilling.
7. "Site Preparation and Misc." includes miscellaneous equipment to be supplied, temporary offices, clean up and contractor contract administration.
8. Anticipated 3" Low Pressure Force Main costs are increased due to the likelihood of technical challenges and slow pace of road and highway crossings.