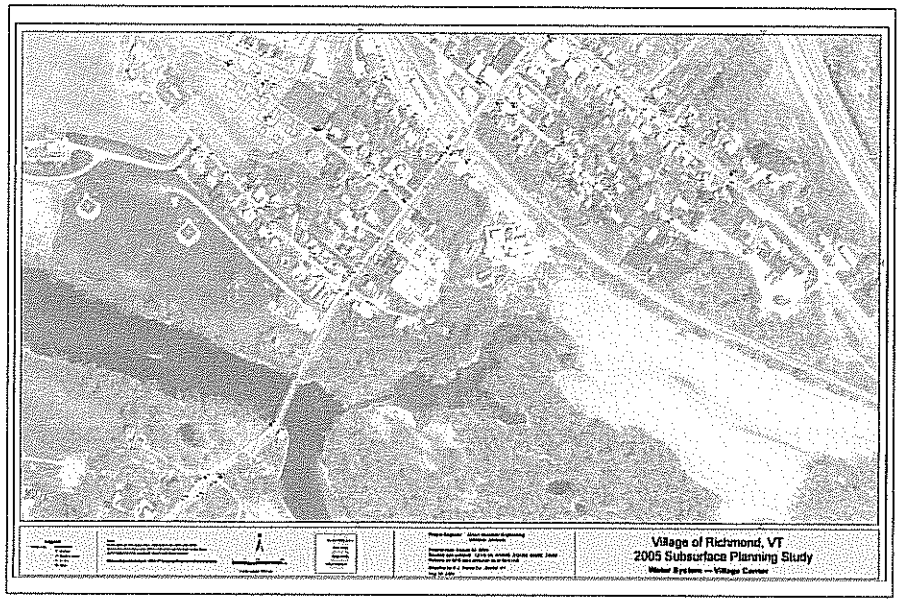
SUBSURFACE PLANNING STUDY

RICHMOND, VERMONT
AUGUST 2005
(MARCH 2006 UPDATE)



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Civil
Water
Waste Water
Storm Water

Richmond, Vermont
Subsurface Planning Study
August 2005 *(March 2006 Update)*

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SECTION I

PLANNING STUDY PROJECT SCOPE

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PLANNING STUDY PROJECT SCOPE

A. Purpose

The purpose of this Study is to compile all available data on the existing subsurface systems of wastewater collection, water distribution and stormwater collection, and augment this data with field investigations. The impetus for this work was the desire of the Town of Richmond to, prior to any more major street and road work, step back and be reasonably confident of the extent of repair or upgrade the underlying utilities would require. This Report is to be used as a planning tool for prioritizing both surface and subsurface infrastructure needs for the future. The compilation of GPS information and the resulting database is to be used to document future work and provide a basis for a permanent, accessible record. Maps are provided which show information compiled from the GPS work as well as other available record data gathered from the Town of Richmond, the Richmond Water Resources Department, and the Chittenden East School District.

B. Format of Report

The Report is broken into four major components that, in turn, are further broken down into sub-categories for presentation and analysis. The major components are the wastewater collection system, the water distribution system, the storm water system, and a street by street assessment. This report does not include discussion of surface restoration work, greenways, power and telephone burial, sidewalks or other aesthetic enhancements which way be prudent to undertake as an overall comprehensive upgrade of a street, road, or neighborhood.

C. Methods of Data Collection

Data used for this Report is from various sources. The main collection method for mapping purposes was the use of a Global Positioning System Receiver provided by R.J. Turner Company of Bristol and operated by GME personnel.

The result of this GPS field work with Robert Turner is presented in the appendices to this Report. Existing physical record data was gathered to locate items in the field which could then be entered into the GPS database.

Information on the condition of gravity sewers and manholes was gathered with the assistance of Vermont Underground Locators, Dick Mulvaney of South Burlington. Various segments of the system were inspected with a camera, much of which was recorded.

Information on the location of water lines which was not available from Record Drawings or the tie books was gathered, to the best of our ability, via the locating services of Vermont Underground Locators, and mapped.

Information on the location and condition of the storm drain system was gathered through field investigation and various record information found on Water & Sewer Record Drawings, and other sketches/maps supplied by the Highway Department and the Water Resources Department.

D. GPS Data Collection Overview

The project area encompasses the extent of the water, sewer and stormwater systems, predominantly within the Village boundary. It was the goal of the project to capture GPS data at the sub-meter level at the various system points (e.g., manholes, valves, etc.) and lines (water pipes, sewer lines, etc.), where these features were identifiable in the field. Since the line features are below ground, GPS field data collection for these features was limited to those sections where the locations were able to be identified by field personnel. GPS data were augmented by a review of public works records with lines added to the GIS database from these documents.

All GPS was collected using a Trimble® Pathfinder Pro XR GPS receiver. This receiver was operated under settings and in a manner to ensure most positions were in the 1-3 meter accuracy range. Collected data was post-processed using the VAOT base station.

Data was collected, and processing was done, using the most current software for both the GPS hardware and post-processing software. ArcGIS™ v. 9.1 was used to evaluate spatial data, digitize from field maps, and plot maps for review.

The field GPS receiver recorded observations with the following settings:

- Minimum of four satellites in "3-D" positioning mode,
- Minimum satellite elevation angle mask for the receiver at 15° above the horizon,
- PDOP will generally be set at 6 for sub-meter accuracies; however, a maximum PDOP value of 8 was allowed under difficult conditions. In general, horizontal precision ranged from .5 to 2 meters.

All GPS positions were corrected by standard differential GPS methods (pseudorange) using files from the VAOT base station. Standard correction procedures were used. All positions were plotted on maps showing the Vermont ortho photos and were checked for accuracy by personnel who also collected the field data.

Deliverables are GIS data in shape file or geodatabase format, projected to the Vermont State Plane coordinate system. All attributes shown in the output tables, found in the Appendices of this Report, are part of this spatial dataset.

E. Conclusions and Recommendations

Extensive research was conducted into the records of the Town Water Resources Department, Town Administrator's Office, Town Clerk's Office, and School Department.

Field work was conducted to locate all evident and semi-evident components of the water, sewer and storm drain systems. Many days of sewer line television camera inspection were completed. Based on this work, we provide the following general conclusions and recommendations which are explored later in the Report.

A detailed list of water system improvements and costs can be found in the Appendices of this Report and a Subsurface Condition Matrix can be found in Section V.

1. Conclusions - Sewer

   a. The 1972 sections of the sewage collection system are in good overall condition. The asbestos cement pipe looks to be sound and connections look to be in good condition.

   b. The manholes installed in 1972 are in overall good condition. An extensive inspection was completed in 1996 by Webster-Martin, Inc., and those records are available. Each manhole riser should be inspected and replaced with an HDPE (High Density Polyethylene) riser prior to any paving or road re-construction work.

   c. The drop manholes, in general, seem to be in poor condition due to settlement. These manholes can lead to major back-ups of the system.

   d. The pre-1972 clay sewers which are still in service pose the greatest challenge and are likely the cause of a great deal of infiltration into the system.

   e. Access to the old clay sewers is, in most cases, limited to one end. This limited access encumbers cleaning and inspection operations.

   f. The most vulnerable of the old clay lines is the main 12-inch line which runs through the business/downtown district. This section of sewer runs approximately 1,500 feet without a manhole and crosses a railroad track. Problems with this sewer could have an impact on businesses and both vehicular and rail traffic.

   g. There is a potential combined sewer in the Tilden Avenue area which should be investigated further and disconnected.

2. Recommendations – Sewer

   a. Continue the complete flushing of the system on a periodic basis (a minimum of once every six months) to remove built-up solids or grease, especially the runs from the schools and from the East Main Street area (Harrington's).

   b. Monitor the drop manholes closely and clean/flush as needed to prevent back-ups.

   c. Repair or replace drop manholes as major street renovations occur. Re-build outside drop, or replace with an inside-drop manhole.

   d. Add manholes to the old clay sewers for access and further inspection.

   e. Line the old clay sewers in place with a new liner that will cut down on infiltration and inflow and repair minor defects in the pipe.

   f. Repair known, acute problems with sewers as soon as possible, including the potential combined sewer in the Tilden Avenue area.

3. Conclusions – Water

   a. In general, the existing water lines seem to be performing well, with no major leaks or other flow or pressure problems reported related to potable water delivery.

   b. The low pH water that was transmitted from the well from 1968 until 1998, when a pH adjustment treatment system was installed, is a concern. Although the Church Street line inspected appeared to be in good condition, no inspections of the older cast iron lines were done.

   c. The lines on East Main Street are the oldest and need to be upgraded due to inadequate size for fire protection and inadequate potable service through a 2-inch diameter line on the south side of the road.

d. Brown's Court is fed by a 2-inch line which should be upgraded to provide fire protection.

4. Recommendations – Water

a. Perform a complete hydraulic analysis of the water system to ascertain existing levels of fire protection. Use this information in conjunction with the 2005 ISO Fire Flow Testing.

b. Perform a complete upgrade analysis based on (a.) above, with proposed new potable and fire protection lines and upgrades based on planning/zoning documents and other future development conditions.

c. Do "in-situ" inspections of older cast iron pipe which may continue in service. This involves excavation and removal of a piece of pipe for inspection.

d. Consider the recommendations within this Report in the plans for a "Main Street Enhancement" project for the East Main Street area similar to the West Main Street comprehensive project done in 2003.

e. Install interconnections with the 12-inch main on West Main Street by extending the 8-inch to existing connections on Millet and Baker Streets.

f. Perform upgrades outlined in the Appendix to this Report, based on hydraulic analysis work of (a.) and (b.) above.

g. Obtain record documents from recent development and store a copy with the Water Resources Department.

5. Conclusions – Stormwater

a. In general, the stormwater collection system seems to be performing well with only general maintenance issues for a majority of the system.

b. Corrosion of metal pipe in the system seems to be the most evident problem.

c. The large culvert from Tilden Avenue to the Goodwin-Baker Building is in poor condition.

d. The stormwater system on Jericho Road from Brown's Court to Route 2 is in disrepair. It is constructed of metal pipe and of 50+ years in age.

6. Recommendations – Stormwater

a. Perform a full hydraulic analysis of the stormwater system to ascertain ability to properly handle future flows.

b. Repair the metal culvert from Tilden Avenue to the Goodwin-Baker Building. Lining this culvert may be the least disruptive and least costly method, or combine this replacement with a water replacement project planned for the area.

c. Replace the Stormwater system on Jericho Road as part of a larger potential Water Main, Sewer Manhole and Street Upgrade.

d. Perform upgrades outlined in the Appendix of this Report.

SECTION II

WASTEWATER COLLECTION SYSTEM

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WASTEWATER COLLECTION SYSTEM

A. History / Layout

The Richmond Village area Wastewater Collection System is made up of numerous types and sizes of lines. The original system, which until 1972 ran directly to the Winooski River without treatment, was made up exclusively of vitrified clay pipe. In 1972, a sewer interceptor project was constructed which picked up many of the clay sewers and transported the sewage to a new wastewater treatment facility constructed concurrently. A 1973 "As Built" map of the 1972 sewer is provided in Appendix A of this Report. Pre-cast, concrete manholes were installed and the sewer was of asbestos cement construction. The term "interceptor sewer" implies that lines were laid to "intercept" existing sewers which were already in place. In Richmond, a number of the clay sewers were left in service and manholes were placed to intercept them. The streets where major clay sewers remain include Esplanade, Church, Railroad, Tilden, East Main Street, the lower section of Jericho Road, and approximately 1,500 feet of 12-inch diameter on Bridge Street from Route 2 to Volunteer's Green.

Since 1972, additional sewage flow has been added to the system with the construction of pump stations and pressure sewers at Richmond Terrace, Cochran Road and a duplex just west of the Village Area on Route 2, as well as pump stations serving the Elementary and Middle Schools. Development of condominiums to the north of East Main Street added flow to an existing vitrified clay line on the south side of the street. Lemroy Court was extended and Harringtons, a specialty meats producer, expanded, adding flow to the line which runs down Pleasant Street. Additional developments on Railroad and Church Streets have also added to the sewage flow through the main sewer leading to the treatment plant.

The only major drop in flow can be attributed to the closing of the cheese factory in the late 1990s. A treatment plant upgrade was completed late in 2004, which updated the overall process and has resulted in better sewage treatment.

B. Scope of Work Completed

Beginning in late September 2004 and spanning into late November, Green Mountain Engineering, along with Vermont Underground Locators, located and performed television inspections of ±70% of the sewer system. Observations were made to obtain general condition and to note any major deficiencies. Tapes were made of the inspections and have been transferred to DVD. A copy of each DVD is provided with the Final Report. In addition to the television inspections, additional information was gathered including Record Drawings from the 1972 interceptor project, various development plans and a copy of the manhole inspection report done in 1996-1997 by Webster-Martin, Inc. Manholes, pump stations and cleanouts were located and mapped on Ortho Photos using GPS equipment. The Ortho Photos are located in an Appendix to this Report.

C. Existing Conditions and Recommendations for Upgrade

The overall condition of the sewage collection system is consistent with the age of the system, and the flows. The asbestos cement sewerline is in good condition with the drop connections and the riser rings being the main problems with the manholes. The older clay sewers pose the greatest risk for back-up, failure, or inflow and infiltration (I/I). It is important to identify "critical sewers" which pose potential problems. The 12-inch diameter vitrified clay sewer which runs down Bridge Street from Route 2 to Volunteer's Green, a run of approximately 1,500 feet without a manhole, would be considered a critical sewer which, upon backup or failure, could have a great effect on business, transportation or public health. Most of the clay sewers were difficult or impossible to inspect due to available access from one end only.

Critical sewers are likely to meet one or more of the following conditions[1]:

- Old age (older than 50 years);
- Deeper than average;
- Large diameter;
- Brick or masonry construction;
- Unlined or un-reinforced concrete;
- Located under busy streets, in streets providing access to emergency service or in sensitive environmental locations (offshore, wetlands);
- Difficult access (such as in easements or under structures);
- At or near hydraulic capacity and in poor soil conditions or high groundwater;
- Difficult to bypass;
- Require frequent inspection or maintenance; and
- Excessive Inflow/Infiltration (I/I)

All of the clay sewers meet at least three (3) of the above criteria. Another aspect of the 1972 sewer installation was the abandonment of some clay sewers which led to the Winooski River. These sewers do not seem to have been filled and have caused sink holes in Volunteer's Green over the years. It may be advisable to find and fill these sewers to prevent injury to the public.

Recommendations:

1. Install manholes at intersections of old vitrified clay sewers and at ends of pre-1972 vitrified clay sewers.
2. Utilize the new manholes to clean, inspect and line the pre-1972 vitrified clay sewers. A sample sewer lining specification from NASSCO (National Association of Sewer Service Companies) is included as an Appendix to this Report.
3. Monitor the drop manholes closely and clean/flush as needed to prevent back-ups. Replace or repair the drop manholes as major street renovations occur.

1 Existing Sewer Evaluation and Rehabilitation, WEF Manual of Practice FD-6, ASCE Manuals and Reports on Engineering Practice No. 62, Second Edition, 1994

4. Repair manhole rims and risers which are in poor condition to cut down on I/I and to prevent debris from entering the sewer system and causing back-ups.
5. Continue to completely flush the system at least twice a year.

D. Funding Sources

Funding for municipally owned sewage system projects in Vermont is generally available from the Vermont Agency of Natural Resources, Department of Environmental Conservation (DEC), through the Clean Water State Revolving Fund (CWSRF) loan program. Additionally, funding is available through the U.S. Department of Agriculture, Rural Development Office in Montpelier.

1. CWSRF Funding

This project would be eligible for CWSRF funding. This will be discussed in more detail in the following paragraphs.

a). Funding Priority List

If a project is eligible for funding through the CWSRF loan program, the sewage system must apply for the annual CWSRF Project Priority List. Projects to correct the most serious risks to public health receive first consideration in awarding available funds. Completed applications for placement on the construction project priority list must be filed by April of each year to be eligible for the next October 1 to September 30 funding cycle. Projects are funded based on their priority points and their readiness to proceed. If a project is not ready to proceed, it will be bypassed on the current list, and must re-apply for the next year's priority list. Through this bypass procedure, additional projects that were not initially identified for funding and are ready to proceed may be funded.

b). Planning Assistance

This preliminary study has been partially funded through the Vermont DEC through the planning advance program. In general, additional planning may require the investment of engineering design and/ or other services before actual construction of any improvements. Planning loans are generally rolled into a construction loan and are typically available for preliminary engineering studies, surveys, and the development of final design plans.

c). CWSRF Funding for Construction

As previously stated, projects requesting construction funding must apply for the annual CWSRF project priority list. Construction funding is available for municipalities and for non-profit, privately-owned community systems. The loans are interest-free but are subject to a two percent (2%) administration fee. Loans are paid back in equal, yearly installments for up to twenty (20) years.

2. U.S. Department of Agriculture, Rural Development Office

Funding is also available for municipal projects through the United States Department of Agriculture Rural Development office (USDA RD) in Montpelier, VT. Loans can be provided as strictly loan, or grant/loan combinations.

To be eligible for a grant/loan through USDA RD, the project must be located in a community with a population less than 10,000. Additionally, to receive a grant, the median household income (MHI) of the service area must be less than a statewide MHI and the project must result in a user rate greater than a target rate set by USDA RD.

A municipality may use the current MHI for the Town or conduct an income survey of the user area to determine eligibility. The current lending rate from USDA RD for strictly loan projects is 4.5% for 30 years; however they should be contacted directly for current funding packages.

3. Vermont Municipal Bond Bank

   Municipal systems can go directly to the Vermont Municipal Bond Bank for funding. Current rates rate at the bond bank for a 30-year loan are 4.9%.

4. Assistance with funding for upgrades in the Tilden Avenue, Millet Street, and Goodwin-Baker Building area may be available from VT AOT due to the high volume of runoff from Interstate 89.

SECTION III

WATER DISTRIBUTION SYSTEM

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WATER DISTRIBUTION SYSTEM

A. History / Layout

The existing water system started as a private water company known as the Richmond Water Company. A 1931 map (see Appendix A) obtained from the Water Resources Department shows the original layout of the system with springs along the Jericho Road for sources, and a reservoir to the northeast of Town (which was abandoned to make way for I-89). An Inventory and Purchase Value was done in 1931 for what is assumed to be the purchase of the system by the Village of Richmond. 3-inch diameter and 2-inch diameter pipe carried the water to the reservoir with various distribution lines of 4-inch to 1-inch pipe distributing the water as far south as Esplanade.

At some point, prior to 1968, a new 50,000 gallon reservoir was constructed on the Jericho Road, located just north of what is now the entrance to the Southview Development. An 8-inch diameter cast iron water main was run to the center of Town (intersection of Main Street, Bridge Street, Jericho Road). A Record Drawing of the 8-inch was provided by the Water Resources Department, though no date was evident on the plan. The source of water feeding this system may have still been the springs shown on the 1931 plan. In 1955, a 4-inch asbestos cement line was added to Pleasant Street connecting to the 4-inch cast iron crossing, Lemroy Court and the railroad, feeding the former cheese factory building.

In 1968, a new well to the east of Bridge Street, south of the Winooski River Bridge, was installed, as well as a section of new 8-inch and a section of new 10-inch transmission main linking to the 8-inch cast iron on Jericho Road. A new 200,000 gallon welded steel tank was installed south of the 50,000 gallon reservoir on Jericho Road. Both reservoirs are in use today with cleaning and roof work done on the northern 50,000 gallon reservoir just a few years ago.

It is assumed that upon installation and utilization of the Bridge Street well, the springs were abandoned, though pipes and valves to the north of the reservoir still exist.

At some point a fire system was installed to protect the Village. The system utilized a pumping station on the north bank of the Winooski River (just to the west of the bridge) and fed the Village through a system of cast iron pipes. Portions of the fire system appear to have been abandoned upon installation of the new 200,000 gallon reservoir and the hydrants and fire branch lines were connected to the potable water system.

The 1968 source, transmission, and storage project did not add any lines to the side streets nor did it extend the system to the south past the well. Subsequent projects extended the water via 8-inch mains to Huntington Road, Cochran Road, Thompson Road, Baker Street and Tilden Avenue. Very few, if any, records exist of these extensions. A 12-inch PVC main was installed in 2003, connecting to an 8-inch cast iron main installed in 1970, to the west along Main Street. This 12-inch main was part of a West Main Street Enhancement Project which included additional utility, green belt, sidewalk and road work. Additional lines have also been added over the years to serve various developments.

B. Scope of Work Completed

Beginning in August 2004 and running to June 2005, Green Mountain Engineering gathered field data and Record Drawings to compile an inventory of existing underground water lines. Gate valves, curb stops and active lines were located by GPS equipment and record information, and mapped on Ortho Photos. The Ortho Photos are located in the appendix to this Report.

C. Existing Conditions and Recommendations for Upgrade

The overall condition of the water mains tends to vary greatly based on pipe material and age. There was a concern about the metal lines in service from 1972 until 1997. This concern was based on the addition of a system at the well to raise the pH of the well water.

Prior to treatment, the water was more corrosive than normal. Inspection of a line removed from Church Street in 2004 did not show any adverse condition.

Thirteen general areas of the distribution system exist and the conditions are as follows:

1. Jericho Road

   The installation date of the 8-inch cast iron on Jericho Road is unknown but it is most likely 50+ years of age. Depending on the corrosiveness of the water and its effect on 1950s cast iron versus 1970s cast iron found on Church Street, the condition may warrant replacement. As a pipe ages its relative ability to carry high velocities or volumes goes down due to corrosion or deposits.

2. West Main Street

   The West Main Street main is 12-inch PVC installed in 2003. It is assumed to be in the best condition of any line in Town. The 12-inch main is fed by an 8-inch cast iron main installed in 1970.

3. East Main Street

   The East Main Street 6-inch line pre-dates the 1968 water project and the installation of the 8-inch diameter cast iron to the 50,000 gallon reservoir. The age and reported condition of this pipe, as well as the fire hydrant on the north side of the road, indicates the need for replacement. A conglomeration of 1 ½-inch and 2-inch PVC pipes feed the south side and connect to a 4-inch diameter cast iron near Harrington's which was a former fire system line that also connects to the 6-inch cast iron across on the north, an 8-inch diameter asbestos cement fire sprinkler line to Harrington's, and the 4-inch line on Pleasant Street. A 1 ½-inch galvanized iron line running east from the hydrant to the Fire Department has been reported to fail upon use of the hydrant. An enhancement project similar to that on West Main Street is contemplated and should include water main upgrades.

4. Baker Street, Tilden Avenue and Millet Street

Tilden Avenue is served by an 8-inch cast iron water main (as per the sewer project Record Drawings) which was connected by the Village of Richmond to a 6-inch cast iron line from Jericho Road, subsequent to the installation of the 8-inch diameter cast iron.

It appears Baker Street is fed by an 8-inch cast iron water line from the 8-inch cast iron line on Tilden Avenue at the hydrant on the south end of Baker Street. The 8-inch cast iron turns to 4-inch asbestos cement and runs to, and west on, West Main Street to the last house on the north side of West Main Street. Millet Street is fed from the south by a 2-inch diameter PVC water line which was previously a fire line and by an 8-inch diameter PVC main installed in 1992 from Tilden Avenue to the Goodwin-Baker Building near the front entrance.

5. Bridge Street, north of Winooski River Bridge

Two (2) water lines feed Bridge Street. The 10-inch diameter/8-inch diameter asbestos cement main pipe which was installed as part of the 1968 water source, transmission and storage project, serves as the transmission main and should be in good shape due to age and pipe material. Asbestos cement pipe can be hard to work around but in general holds up well. There is a 4-inch asbestos cement line which runs from Pleasant Street south to the bridge, and has various services and branch connections which serve as the distribution main for Bridge Street and the side streets, though distribution lines and services have been connected directly to the transmission main over the years.

6. Depot Street

Depot Street is fed with approximately 80 feet of 8-inch cast iron water main. A 1-inch line runs behind the Masonic Block parallel to Bridge Street and feeds the entire block from the rear of the buildings. A 1-inch copper line feeds the remainder of the street, fed from the 8-inch cast iron.

7. Railroad Street

Railroad Street water is fed from the 10-inch asbestos cement transmission pipe on Bridge Street through an 8-inch PVC main that extends to the rescue building. Fire protection is provided through hydrants on the 8-inch PVC main.

8. Church Street

Church Street water is fed through an 8-inch PVC main installed as part of the Church Street Water & Road Upgrade of 2004. Water main was installed to feed the Church Street Development and provide fire protection.

9. Pleasant Street

Pleasant Street is fed with a 4-inch diameter asbestos cement main, installed in 1956, which runs from the 4-inch diameter cast iron on Lemroy Court to the 4-inch diameter asbestos cement line on Bridge Street.

10. Bridge Street, south of Winooski River Bridge

The lines south of the bridge are all 8-inch diameter and of asbestos cement, cast iron or PVC construction. These lines appear to be of adequate size to handle the potable flows in this area.

11. Cochran Road

Cochran Road water is fed through an 8-inch asbestos cement, 8-inch PVC and 2-inch PVC pipe. Fire protection extends to the hydrant through the 8-inch AC pipe. The pipe is of relatively new construction, 30 years of age or less.

12. Huntington Road

Huntington Road water is fed through an 8-inch main installed as part of the Richmond Development. Fire protection extends to the southwest end of Richmond Commons with a hydrant installed on Huntington Road.

13. Thompson Road

Thompson Road is fed through an 8-inch PVC main. The main provides both potable water service and fire protection via hydrants. The main is of PVC construction and in good condition.

D. Funding Sources

Funding for municipally owned water system projects in Vermont is generally available from the Vermont Agency of Natural Resources, Water Supply Division, through the Drinking Water State Revolving Fund (DWSRF) loan program. Additionally, funding is available through the U.S. Department of Agriculture, Rural Development Office in Montpelier.

1. DWSRF Funding

This project would be eligible for DWSRF funding. This will be discussed in more detail in the following paragraphs.

a). Funding Priority List

If a project is eligible for funding through the DWSRF loan program, the water system must apply for the annual DWSRF Project Priority List. Projects to correct the most serious risks to public health and public safety receive first consideration in awarding available funds. Completed applications for placement on the construction project priority list must be filed by April of each year to be eligible for the next October 1 to September 30 funding cycle. Projects are funded based on their priority points and their readiness to proceed.

If a project is not ready to proceed, it will be bypassed on the current list, and must re-apply for the next year's priority list. Through this bypass procedure, additional projects that were not initially identified for funding and are ready to proceed may be funded.

b). Planning Assistance

This preliminary study has been partially funded through the Vermont Water Supply Division at no cost to the system. In general, additional planning may require the investment of engineering design and/ or hydrogeological services before actual construction of any improvements. To help reduce the burden on small water systems, the State of Vermont can provide a 0%, 5-year DWSRF planning loan if the system is a municipality (a town, fire district or a school) or a private non-profit community water system. Planning loans are generally rolled into a construction loan.

Planning loans are typically available for preliminary engineering studies, hydrogeological services including the drilling of new sources, surveys, and the development of final design plans.

c). DWSRF Funding for Construction

As previously stated, projects requesting construction funding must apply for the annual DWSRF project priority list. Construction funding is available for municipal and private community water systems, and for non-profit non-community water systems. Interest rates and terms are determined using the community median household income, current annual operation and maintenance costs, and existing water system debt. Interest rates range from 3% to -3% and terms can range from 5 years to 30 years.

2. U.S. Department of Agriculture, Rural Development Office

Funding is also available for municipal projects through the United States Department of Agriculture Rural Development office (USDA RD) in Montpelier, VT.

Loans can be provided as strictly loan, or grant/loan combinations.

To be eligible for a grant/loan through USDA RD, the project must be located in a community with a population less than 10,000. Additionally, to receive a grant, the median household income (MHI) of the service area must be less than a statewide MHI and the project must result in a user rate greater than a target rate set by USDA RD. A municipality may use the current MHI for the Town or conduct an income survey of the user area to determine eligibility. The current lending rate from USDA RD for strictly loan projects is 4.5% for 40 years; however they should be contacted directly for current funding packages.

3. Vermont Municipal Bond Bank

Municipal water systems can go directly to the Vermont Municipal Bond Bank for funding. Current rates rate at the bond bank for a 30-year loan are 4.9%.

SECTION IV

STORMWATER SYSTEM

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STORMWATER SYSTEM

A. History / Layout

There is not much history available for the stormwater system in Richmond. A number of minor systems exist within the Town of Richmond, "Village Area". Documentation of portions of the system was only found by inspecting Record Drawings from other types of utility projects such as water, sewer and roads. A 1955 plan of the Richmond Village Drainage Area and Stormwater System in the Jericho Road, Tilden, Millet, Baker Streets area is provided in the Appendix to this report. A system upgrade installed in 1999 at the intersection of Jericho and Thompson Roads was the other plan found in the Water Resources records which indicates stormwater drainage exclusively.

B. Scope of Work Completed

Beginning in August 2004 and running to June 2005, Green Mountain Engineering gathered field data and Record Drawings to compile an inventory of existing underground stormwater lines. Catch basins, headwalls, and inlets/outlets were located by GPS equipment and Record information and then mapped. The maps are located in the Appendix to this Report.

C. Existing Conditions and Recommendations for Upgrade

The stormwater system in the Richmond village area is in a variety of conditions based on age and pipe type. The main drainage which runs through the Village from Jericho Road under Tilden Avenue and west of the Goodwin-Baker Building is made of various pipe types and ages. The metal pipe is in poor shape with the bottom completely missing due to corrosion.

The 12-inch clay to the west looks to be in good shape as well as the HDPE installed across the rear parking area for the Goodwin-Baker Building. A double 16-inch clay storm drain runs south to Main Street with an assortment of pipes entering.

Dye testing was done on the Goodwin-Baker Building as well as a number of available residences on Tilden Avenue and Baker Street. Evidence of combined sewer was found, but further testing is recommended in this area for conclusive results and to ensure the disconnection of any sewer from the storm system.

A limited amount of camera inspection was done on Bridge Street to gauge condition and verify pipe sizes and types.

In 2003, a section of the main 3'x5' stone box culvert crossing Route 2 on West Main Street was replaced as part of the "West Main Street Enhancement" project.

As development continues in the area, it would be important to perform a hydraulic study of the water shed / stormwater system and recommend upgrades to ensure the existing system can sustain runoff from appropriate design storms.

The deteriorated metal culverts which cross main roads can be lined in a similar way as the clay sewers recommended elsewhere in this Report. A comparable method as prescribed in the Appendix to this Report can be employed for the storm sewers.

D. Funding Sources

Funding is available through various sources. The most likely source for Richmond is The State of Vermont Clean Water Revolving Loan Fund (CWSRF). A description of available funding for storm drainage is consistent with that for sewage system upgrades and is described in the wastewater collection system section.

SECTION V

OVERALL "STREET BY STREET" REVIEW

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OVERALL "STREET BY STREET" REVIEW

A. Jericho Road

The installation date of the 8-inch cast iron water main on Jericho Road is unknown but it is most likely 50+ years of age. Depending on the corrosiveness of the water and its effect on 1950's cast iron, versus 1970's cast iron found on Church Street, the condition may warrant replacement. Most of the sewer is asbestos cement installed in 1972 and is in good shape. A section of 6-inch clay sewer runs for approximately 350 feet near the intersection with Main Street and should be lined. Many of the manhole frames and covers are in poor shape and should be replaced and/or reset. There is a drop manhole in the sewer system which should be replaced. The storm drain system is old, corroded ACCGMP pipe and many of the storm drain structures have no bottom and must be replaced with new structures.

B. West Main Street

The West Main Street water main is 12-inch PVC installed in 2003. It is assumed to be in the best condition of any line in Town. The 12-inch PVC should be connected to the main 10-inch transmission main or be connected to a larger main which may replace the 10-inch AC or 8-inch cast iron to the reservoir. A 2-inch PVC potable water main feeds the domestic water needs on the north side of the road to Millet Street. A 4-inch AC line feeds the five houses on the west end through a connection on Baker Street.

The sewer located in the street is made up of various age pipes and is in good condition. The clay sewers which run on private property in the rear of the buildings on the south side are considered private sewers and are assumed to be of the same age and condition as the other clay sewers in Town. The storm drain system, which is maintained by the State Highway Department, was upgraded in 2003 and is in good condition.

C. East Main Street

The East Main Street 6-inch water line pre-dates the 1968 water project and the installation of the 8-inch diameter cast iron to the 50,000 gallon reservoir. The age and reported condition of this pipe, as well as the fire hydrant on the north side of the road, indicates the need for replacement.

A conglomeration of 1 ½-inch and 2-inch PVC water pipes feed the south side, and the last 500 feet of the north side, of the road and connect to a 4-inch diameter cast iron crossing and a 4-inch diameter cast iron near Harrington's. The 4-inch former fire system line near Harrington's also connects to the 6-inch cast iron across East Main Street on the north side and the 4-inch asbestos cement line on Pleasant Street.

The sewer is made up predominantly of clay pipe and access is limited. The clay sewers which run on private property in the rear of the buildings on the south side are considered private sewers and are assumed to be of the same age and condition as the other clay sewers in Town.

The storm drain system is maintained by the State Highway Department. An enhancement project similar to that on West Main Street is contemplated and should include water main, sewer and storm drain upgrades.

D. Baker Street, Tilden Avenue and Millet Street

Tilden Avenue is served by an 8-inch cast iron water main (as per the sewer project Record Drawings) which was constructed by the Village of Richmond in the 1970's and connected to a 6-inch cast iron line from Jericho Road, subsequent to the installation of the 8-inch diameter cast iron.

Much of the sewer in this area is of asbestos cement and was installed in 1972. The original sewer which conveyed the combined storm and wastewater to the river prior to the sewer project is still in use as a storm drain. There was early evidence that a house was still connected to the storm drain and must be removed. Dye testing was performed in the immediate area of the storm drain behind the Goodwin Baker Building and it appeared all homes tested were connected to the sanitary sewer.

The storm drain which runs from the end of Tilden Avenue, along Millet Street to West Main Street, requires extensive rehabilitation or replacement.

E. Brown's Court

Brown's Court is reported to be fed by a 2-inch galvanized steel water line which is original to the development. There are no hydrants on Brown's Court but a hydrant sits at the intersection with Jericho Road, providing limited fire protection at the east end of the street. It is recommended that the line be replaced with a larger main capable of providing fire protection to the street.

Brown's Court has an asbestos cement sewer main installed in 1972. There is no storm drain system on the street.

F. Burnett Court

Burnett Court is reported to be fed by a 1 ½-inch PVC water line which seems to be adequate for potable service. The sewer is asbestos cement with a pump station and PVC force main installed for the last house on the street.

G. Bridge Street, north of Winooski River Bridge

Two (2) lines feed Bridge Street. The 10-inch diameter and 8-inch diameter asbestos cement main pipes which were installed as part of the 1968 water source, transmission and storage project should be in good shape due to age and pipe material. Asbestos cement pipe can be hard to work around but in general holds up well. Both lines have various branch connections which were installed subsequent to the 1968 water transmission project. The 10-inch main was originally intended to provide disinfection contact time after the well. This line has since been connected to and should be re-evaluated for actual contact time.

The sewer is 12-inch clay and is original to the Village area and lacks proper access. The storm drain is of various types and sizes and is in need of some repairs.

H. Bridge Street, south of Winooski River Bridge

The lines south of the bridge are all 8-inch diameter and of asbestos cement, cast iron or PVC construction. These lines appear to be of adequate size to handle the potable flows in this area. Fire flow capacity is unknown. The sewer is 8-inch diameter AC installed in 1972. The storm drain was installed in 1999.

I. Depot Street

Depot Street is fed with approximately 80 feet of 8-inch cast iron water main. A 1-inch line runs behind the Masonic Block parallel to Bridge Street and feeds the entire block from the rear of the buildings. A 1-inch galvanized line feeds the remainder of the street, fed from the 8-inch cast iron.

Sewer consists of an 8-inch gravity main which runs the length of the street and connects into the main sewer to the treatment plant at the end of the street.

J. Railroad Street

Railroad Street water is fed from the 10-inch asbestos cement pipe on Bridge Street through an 8-inch PVC main that extends to the rescue building. Fire protection is provided through hydrants on the 8-inch PVC main.

Sewer consists of 6-inch clay which runs behind the houses, and a newer sewer that feeds the condominium development on the west end of the street.

K. Church Street

Church Street water is fed through a 6-inch PVC main installed as part of the Church Street Water & Road Upgrade of 2004. Water main was installed to feed the Church Street Development and provide fire protection.

Sewer is a combination of clay and asbestos cement.

L. Pleasant Street

Pleasant Street is fed with a 4-inch diameter asbestos cement main, installed in 1956, which runs from the 4-inch diameter cast iron on Lemroy Court to a 4-inch diameter asbestos cement line on Bridge Street. 4-inch diameter pipe is not considered adequate for fire protection. The sewer is 8-inch diameter asbestos cement that was installed as part of the 1972 sewer project.

M. Cochran Road

Cochran Road water is fed through an 8-inch asbestos cement, 8-inch PVC and 1-inch PVC pipe. Fire protection extends to the hydrant through the 8-inch asbestos cement pipe.

Sewer consists of an 8-inch gravity sewer for the west end of the road and a low pressure force main system for the remainder of the houses east to the cemetery. The storm drain system consists of driveway and cross culverts draining to the Winooski River via overland routes.

N. Huntington Road

Huntington Road water is fed through an 8-inch main installed as part of the Richmond Development. Fire protection extends to the southwest end of Richmond Commons with a hydrant installed on Huntington Road.

Sewer consists of an 8-inch gravity sewer for Huntington Road and a pump station / force main for the Richmond Commons Development.

Storm drain was upgraded as part of the 1999 Upgrade which included Bridge Street.

O. Thompson Road

Thompson Road is fed through an 8-inch PVC main. The main provides both potable water service and fire protection via hydrants. The sewer is 8-inch AC and was installed in 1972. The stormwater system consists of driveway and cross culverts draining to the Winooski River via overland routes.

P. Subsurface Condition Matrix

This table is provided with a number system for relative ranking of the condition of utilities on each street so as to compare streets based on necessary improvements.

Street	Water Lines	Sewer Lines	Storm Drain	Total Points
Jericho Rd.	6	3	5	14
West Main St.	2	4	0	6
East Main St.	10	8	2	20
Tilden Ave.	0	5	0	5
Baker St.	6	0	0	6
Millet St.	6	0	5	11
Burnett Ct.	0	0	0	0
Brown's Ct.	10	0	0	10
Pleasant St.	10	0	0	10
Depot St.	5	5	0	10
Railroad St.	0	0	0	0
Bridge St. No.	4	10	4	18
Bridge St. So.	0	0	0	0
Cochran Rd.	0	0	0	0
Huntington Rd.	0	0	0	0
Thompson Rd.	3	0	0	3
Church St.	0	0	0	0

Water & Sewer Scale: 10 = Replacement or Refurbishment Required
0 = No Substantial Work Required

Storm Drain Scale: 5 = Replacement or Refurbishment Required
0 = No Substantial Work Required

Notes:

1. The higher the number of total points, the higher priority for infrastructure work.
2. The road surface conditions were not part of this matrix. It is recommended that the road condition be incorporated into the final decisions for work.