Lake Iroquois-Patrick Brook Watershed Action Plan

Final

Hinesburg, Richmond, St. George, & Williston, Vermont
Winooski Natural Resources Conservation District

Prepared by:

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SLR Project No.: 146.14439.00006

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Executive Summary

SLR International Corporation (SLR, formerly Milone & MacBroom, Inc.) was retained by the Winooski Natural Resources Conservation District (WNRCD) to perform assessments within the Lake Iroquois-Patrick Brook watershed and create a lake watershed action plan (LWAP). The methodology for watershed planning combined field assessments performed by SLR engineers and scientists, analysis of existing data on the health and condition of lakes and streams within the watershed, local knowledge from project partners and watershed residents, and collaboration between project partners to identify implementable projects and strategies to improve the overall health of the Lake Iroquois-Patrick Brook watershed.

WNRCD, the Lewis Creek Association (LCA), and the Lake Iroquois Association (LIA) were important project partners and acted as community liaisons for communication with residents within the watershed throughout the project. Following a project kickoff meeting, SLR reviewed and compiled existing data into a watershed resource library summarizing all sources of data. Additionally, SLR prepared basemaps for the watershed to visually show several datasets, including land cover, municipal road assessment data, stream geomorphic assessment data, and water quality monitoring locations.

SLR and WNRCD performed field assessments to collect additional data throughout the watershed and identify potential projects to improve water quality, habitat, and flood resiliency within the watershed. Using methods outlined by the State of Vermont, WNRCD performed Storm Smart and Lake Wise assessments on properties within the watershed. SLR completed assessments of private roads and streams draining directly to Lake Iroquois and Sunset Lake (also known as Lower Pond).

A main focus of these assessments was identification of potential projects. A total of 70 projects were identified, which includes the following types of projects: rain garden, culvert replacement, stream restoration, flood resiliency, dam removal, buffer planting, lakeshore restoration, easement, road improvement, and others. Potential projects were evaluated within a prioritization matrix to identify the highest priority projects based on numerous factors including ease of implementation, water quality benefit, landowner interest, cost, and many other factors. A unified scoring matrix was prepared for stormwater infrastructure projects fitting the State of Vermont criteria. All other projects were evaluated in a non-unified matrix. Four unified and five non-unified projects were selected by project partners to move to the concept design phase.

SLR conducted additional site visits and prepared concept designs for the selected projects. WNRCD LCA, and LIA plan to pursue funding for additional design and implementation for these projects as a next phase separate from this LWAP project. This report summarizes existing information, methods, results, and recommendations for the Lake Iroquois-Patrick Brook watershed.

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Appendices

1.0 Introduction

SLR was retained by the Winooski Natural Resources Conservation District to prepare a lake watershed action plan for the Lake Iroquois-Patrick Brook watershed. The LWAP follows guidelines set forth by the State of Vermont in a document the outlines the LWAP process and outcomes. The lake watershed planning process involves identification of sources of water quality and habitat degradation and greatest threats to the health of the lake, involvement of the community members in the planning process, identification of sediment and phosphorus inputs to the lake from each of three sectors – streams, roads, and shorelands, and identification of projects that can be implemented to address lake and watershed stressors (VDEC, 2023).

This action plan summarizes existing conditions and data within the watershed and methods for the collection of new data, as well as data analysis and project identification and prioritization. The plan identifies numerous projects and strategies that aim to improve the health of the Lake Iroquois-Patrick Brook watershed. Project materials are included as appendices to this report. A project database has been prepared that aligns with the format from the State of Vermont for watershed project development.

This project was funded by the New England Interstate Water Pollution Control Commission (NEIWPCC) through a grant awarded to the Winooski Natural Resources Conservation District by the Lake Champlain Basin Program (LCBP).

1.1 Watershed Description

Lake Iroquois is a 247-acre lake located in Williston, Richmond, St. George, and Hinesburg, Vermont (Figure 1). The main tributary that flows into and out of Lake Iroquois is Patrick Brook, a tributary to the LaPlatte River. Watershed action planning efforts for Lake Iroquois focus on the whole Patrick Brook watershed, including lands downstream of Lake Iroquois and Sunset Lake (Lower Pond). The Patrick Brook watershed is approximately 8 square miles in size. The subwatershed draining directly to Lake Iroquois is 3.5 square miles in size.

Figure 1. Lake Iroquois-Patrick Brook watershed location

Patrick Brook originates in Williston and flows southerly into Lake Iroquois. The lake, formerly known as Hinesburg Pond, was formed as a glacial kettle pond after the last ice coverage in Vermont receded about 15,000 years ago. A dam built on the lake's outlet in the mid-1800s was used to control the water supply to mills downstream in Hinesburg. Milling declined in the 20th century and in the 1960s the dam was intentionally cemented in its top position, keeping the pond at its current level throughout the year. Before the dam was built, the smaller kettle pond was located on the southern end of the current lake. The dam raised the original water level and enlarged the lake.

Below the dam, a short section of the brook is free flowing before flowing into Sunset Lake, an approximately 61-acre water body created by a second dam built in the late 1800s. Downstream, there is a series of additional small dams. Flow is split below Mechanicsville Road into a constructed canal and the natural flow channel, which has also been historically altered.

The Lake Iroquois-Patrick Brook watershed is primarily forested, with concentrated areas of agriculture and development. There are approximately 40 miles of roads within the watershed, roughly half of which are private roads (Figure 2). These private roads are concentrated around Lake Iroquois and Sunset Lake. Homes are also concentrated around the two lakes and downstream in the Village of Hinesburg.

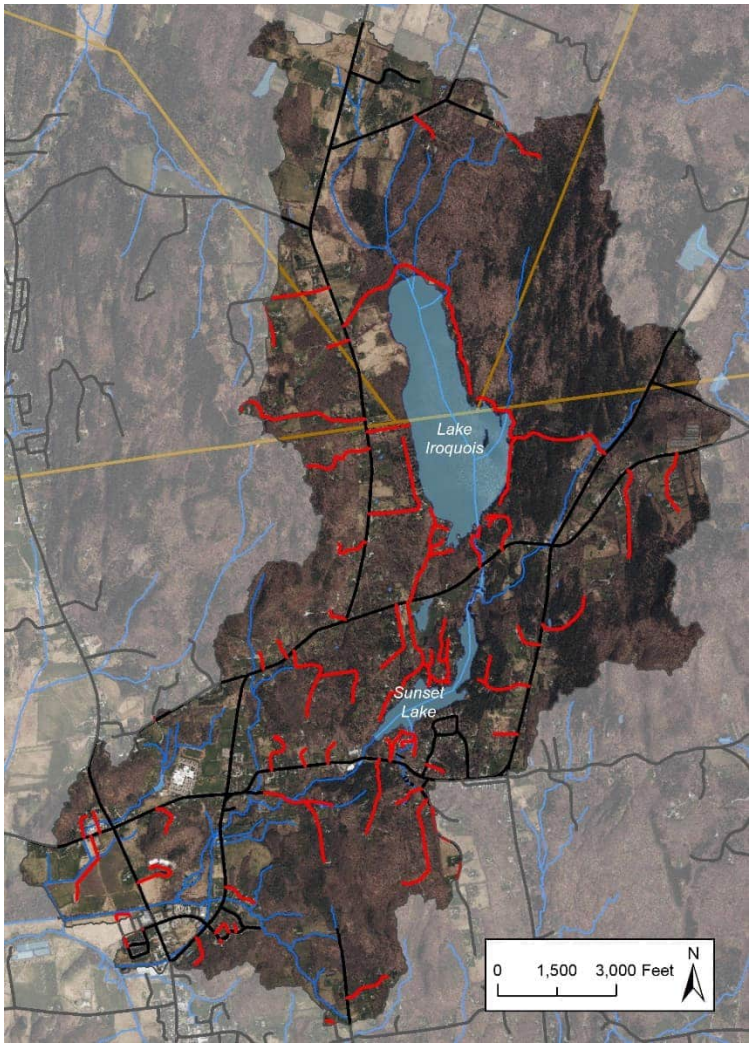


Figure 2. Private roads (red lines) within the Lake Iroquois-Patrick Brook watershed

Downstream of Sunset Lake, Patrick Brook from the dam to the confluence with the LaPlatte River is identified as a stressed waterway. The stressors identified include land development and channelization and the pollutants are sediment and physical alterations. The stressed uses are aesthetics and aquatic habitat (VDEC, 2016).

1.2 Background Data

SLR leveraged existing data from various sources and compiled them into a watershed data library. The library includes spatial data, reports, and online databases that contain information about the watershed. Included in the library are stream geomorphic assessment data, municipal road assessment data, and water quality monitoring data. The watershed data library is included in Appendix A.

The project team reviewed existing data to identify focus areas for field assessment efforts. Local knowledge of problem areas was also an important factor. Project partners facilitated communication with residents within the watershed. The Lake Iroquois Association is a

watershed organization dedicated to the protection of Lake Iroquois and its watershed. Its members include residents of the watershed as well as both in-state and out of state lake users. LIA provided valuable information on known issues within the watershed.

2.0 Field Assessment Methodology

During 2022 and 2023, SLR and WNRCD conducted field assessments to inform the watershed planning process. SLR was responsible for assessment of roads and streams within the watershed, while WNRCD completed assessments of individual properties within the watershed following the Vermont Lake Wise and Storm Smart protocols. Additional details on assessment methodologies are provided in the subsequent sections.

2.1 Road Assessment

Assessment of all municipal (town-owned) roads within the Lake Iroquois-Patrick Brook watershed was completed previously as part of the Municipal Roads General Permit process. Road assessment efforts undertaken by SLR focused on private roads, which were not covered by the previous road assessment. SLR analyzed spatial data to characterize private roads (setting, density of development, slope, etc.) and water quality data to inform selection of roads for assessment efforts. Project partners also provided important information about known erosion and sediment issues on private roads in the watershed.

SLR scientists and engineers walked/drove nearly all private roads within the watershed over the course of three field days in April 2023. Field data were collected using a tablet and GPS antenna with submeter accuracy. Problem areas were identified on the ground and solutions identified for improvement. Mapping efforts produced a GIS database of proposed actions on private roads throughout the watershed. Action types included road grading, crowning, removal of berms, installation/improvement of swales and culverts, and installation/maintenance of turnouts and sediment traps.

2.2 Stream Assessment

A Phase 1 stream geomorphic assessment was completed for the LaPlatte River watershed in the early 2000s. A Phase 2 assessment followed for Patrick Brook/the Patrick Brook Canal in 2004. Data collected at this time included stream impacts, channel dimensions, geomorphic and habitat conditions, and potential projects to improve stream condition. Both a Phase 2 report and river corridor plan were prepared that included information about the Patrick Brook reaches.

During summer 2023, SLR engineers and scientists conducted stream assessments on numerous streams within the Lake Iroquois-Patrick Brook watershed. Streams were selected for assessment based on review of existing water quality data and local knowledge from the project team. An effort was made to assess all direct tributaries to Lake Iroquois and Sunset Lake as well as other reaches of concern elsewhere in the watershed.

Locations of various features were recorded using a submeter GPS unit, including culverts, bank erosion, lacking buffer vegetation, streambed erosion, bedrock, and beaver dams. A detailed sketch was prepared for each assessment area and annotated with observations. Channel measurements were taken periodically. Stream assessment efforts focused on identification of problem areas and potential projects to improve stream health, flood resiliency, habitat, and water quality.

2.3 Lake Wise Assessment

The WNRCD conducted outreach to lakefront landowners within the watershed and worked with interested landowners to complete several Lake Wise assessments. These assessments followed methods outlined by the State of Vermont Lakes and Ponds Program. Lake Wise is a program created by the Vermont Department of Environmental Conservation. The assessment is split into four areas – shoreland, recreation area, driveway and structure, and septic. The WNRCD evaluated properties and made recommendations for improvements to each of the four areas as needed, including specific projects and practices to implement.

2.4 Storm Smart Assessment

For properties not located directly on the lake or where stormwater is of particular concern, the WNRCD performed Storm Smart assessments. These assessments focus on individual properties and examine stormwater patterns and practices. The Storm Smart program identifies green stormwater infrastructure practices that can be implemented to keep water on properties and slow down, spread out, and sink in rainfall. Practices may include installation of rain barrels, creation of rain gardens, grading to redirect water flow, and more. Many stormwater projects identified during these assessments were included in the overall project list.

3.0 Summary of Field Assessment Results & Problem Areas

The following subsections describe the results and findings from field assessments within the Lake Iroquois-Patrick Brook watershed.

3.1 Road Assessment

Thirty road improvement projects were identified from field assessments. Road improvement projects were grouped by road, with some roads having many potential improvement actions. A common issue noted on private roads within the watershed was eroding roadside swales. Swales with slopes greater than 5% should be protected with stone large enough to withstand erosion. The steeper the swale the larger the size rock required. Additionally, many roads were not well graded and without a crown, allowing water to create flow paths down the roads rather than sheet flow off into adjacent vegetated areas. The roads with the largest number of improvement actions identified included Shadow Lane, Dynamite Hill, Partridge Hill, and Mount Pritchard Lane. These roads are all very steep and have numerous homes along them. Shadow Lane runs directly into Lake Iroquois, serving as a boat launch for the residents. Dynamite Hill and Mount Pritchard Lane are farther uphill from the lake, while Partridge Hill runs along Patrick Brook lower in the watershed.

3.2 Stream Assessment

Stream assessment efforts focused on numerous tributaries to Lake Iroquois and Sunset Lake. Based on previously collected water quality monitoring data and input from project partners, the following areas were selected for assessment: Patrick Brook upstream of Lake Iroquois from its origin to South Road, an unnamed tributary to Patrick Brook northwest of Beebe Lane, an unnamed tributary to Lake Iroquois south of Shadow Lane, unnamed tributaries to Lake Iroquois between Shadow Lane and Southwest Shore Road, and Patrick Brook in the vicinity of Pond

Brook Road. Additionally, SLR assessed all tributaries to Sunset Lake that were accessible from the road network.

Many of the assessed streams were observed to be stable and without significant issues. Numerous culverts were identified as geomorphically incompatible, not fish passable, and/or in poor condition. Among those recommended for replacement are culverts under Wile Street and Jourdan Street, Richmond Road, and Old Pump Road. The streams identified as being in the poorest condition include the tributary to Lake Iroquois south of Shadow Lane and the tributary to Sunset Lake that crosses McDonald Lane, Richmond Road, Wile Street, and Jourdan Street. Both of these streams were noted as having extensive bank erosion and major channel incision.

There are numerous dams within the watershed, many of which date back to the 1800s. Some of these dams are no longer in use and may be considered for removal to improve aquatic organism passage and naturalize hydrology. Further study of the network of dams within the system is recommended to determine whether dam removal would be beneficial and feasible for dams that are no longer serving a purpose. Eighteen stream-related projects were identified within the Lake Iroquois-Patrick Brook watershed.

3.3 Property Assessments

The WNRCD completed assessments of twelve properties for the Storm Smart program and three for the Lake Wise program. Nine potential rain garden locations were identified as part of these assessments. The assessments also identified driveway improvement opportunities, potential filter berm locations, and potential lakeshore restoration areas. Property assessment reports were completed by WNRCD that detail site conditions and opportunities and are included in Appendix B.

3.4 Project Prioritization

Projects identified during field assessments were compiled into two matrices for evaluation – unified and nonunified. The Vermont DEC has developed guidelines for stormwater master planning along with a Unified Scoring Prioritization for Stormwater Master Plans table to provide standardized scoring for projects. Green stormwater infrastructure projects were evaluated using the unified scoring table. For projects that did not fit within the structure of the unified scoring matrix, a non-unified scoring method was used. The project prioritization process is further detailed in a November 13, 2023 memo authored by SLR, which is included in Appendix C.

4.0 Concept Designs

Of the 70 projects identified during the field assessment phase, four conceptual designs were prepared for rain garden projects (10% design) and five conceptual designs were prepared for stream and road projects (30% design), as detailed below in Table 1. Selection of projects for which to prepare concept designs considered project score and ranking, as well as level of design that would need to be completed prior to implementation. Generally, projects with higher scores and that would need additional engineering design were prioritized for concept designs. There are many projects (e.g. buffer plantings and land conservation) that would not need further engineering design and could be implemented directly by the WNRCD or LCA. SLR prepared cost estimates for each concept design to aid in the process of implementing selected projects. Cost estimates include both cost of future design work and implementation (construction) cost.

Table 1. Projects for which concept designs were prepared.

Project Number	Town	Name	Project Type	Total Score	Design Level
15	Hinesburg	Stabilize gully in lower Shadow Lane Tributary	Stream Restoration	21	30%
16	Hinesburg	Riparian buffer planting along Shadow Lane Tributary	Buffer Planting	25	30% - included with Project #15
24	Hinesburg	Shadow Lane Improvements	Road Improvement	23	30%
34	Williston	Lake Iroquois Boat Launch Rain Garden	Rain Garden	16	10%
43	Hinesburg	Red Pine Road Improvements	Road Improvement	15	30% - included with Project #44
44	Hinesburg	Partridge Hill Improvements	Road Improvement	23	30%
50	Hinesburg	Pine Shore Drive Rain Gardens	Rain Garden	27	10%
53	St. George	Oak Hill Road Rain Garden	Rain Garden	27	10%
62	Hinesburg	Shadow Lane Rain Garden	Rain Garden	17	10%
67	Hinesburg	Arrest incision and create settling area in upper Shadow Lane Tributary	Stream Restoration	18	30%
68	Hinesburg	Enos Road Improvements	Road Improvement	11	30%

4.1 Rain Garden Projects

All four proposed rain gardens selected for concept designs are located within 1,000 feet of the shore of Lake Iroquois. These proposed rain gardens, three on private property and one on public property, would capture currently untreated stormwater runoff and prevent it from flowing into the lake. The proposed rain garden on public land, located at the Fish and Wildlife Lake Iroquois boat launch provides an opportunity for visibility and education surrounding green stormwater infrastructure. Proposed rain gardens have individual phosphorus reduction potential of 0.04 to 0.95 kg per year.

4.2 Road and Stream Projects

Of the five concept designs prepared, two are stream projects and three are road projects. Both stream projects are on the tributary to Lake Iroquois south of Shadow Lane. The tributary has formed a deeply eroded gully that is actively incising (Figure 3). The proposed project on the

lower portion of the stream aims to stabilize the gully and reconnect the stream to its floodplain via addition of rock and large wood to the channel. An area in the riparian zone that is lacking woody vegetation has also been called out for the planting of native trees and shrubs. The upper portion of tributary is also eroding and actively incising. The tributary receives flow from a portion of the Dynamite Hill Road neighborhood, as well as wooded lands. The upper project on the tributary aims to arrest active incision via rock addition to the channel and capture water and sediment in a proposed settling basin just upstream of Pond Road.

Figure 3. Deeply eroded Shadow Lane tributary

Concept designs for road improvements were prepared for Shadow Lane, Partridge Hill, and Enos Road in Hinesburg. Shadow Lane is a very steep road that runs east-west between Pond Road and Lake Iroquois. There is dense single family development along the road. House lots are small and there is little open space between houses and their associated septic mounds. Currently, stormwater flows down the road and eroding roadside swales and directly into the lake (Figure 4). The concept design calls out numerous proposed actions, including reshaping and stone lining swales, installing new swales to direct water away from the road into naturally vegetated areas to the north and south of the road, and installing sediment traps in several locations. The design also identifies two potential locations for larger stormwater treatment areas, likely gravel wetlands, in open space along the road.

Figure 4. Stormwater from Shadow Lane flows into Lake Iroquois

Partridge Hill and adjacent Red Pine Road are additional roads with very steep sections and stormwater management challenges. Partridge Hill is in the lower portion of the watershed and runs along Patrick Brook. Recommended actions include reshaping and stone lining swales and adding check dams, installing sediment traps, and adding cross culverts to divert stormwater to naturally vegetated areas. Recommendations for nearby Enos Road just east of Partridge Hill include stone lining a steep swale and adding cross culverts to divert stormwater. A portion of stormwater from Enos Road flows downhill to Patridge Road. Improved stormwater management along Enos Road would also benefit those on Partridge Hill.

5.0 Next Steps

Partners can work with landowners and help pursue grant funding to move the concept designs forward. Some of the projects identified would not need further design work, such as the buffer planting projects, and could be implemented directly by the WNRCD or other project partners. Other projects identified would require additional landowner outreach and engineering design.

6.0 References

Vermont Department of Environmental Conservation, 2016. State of Vermont 2016 Stressed Waters List. Available at: https://dec.vermont.gov/sites/dec/files/wsm/public-notices/mapp/Stressed_2016_draft_complete.pdf

Vermont Department of Environmental Conservation (VDEC), 2023. Vermont Lake Watershed Action Plans: Technical Guidelines for Conducting a LWAP. Available at: https://dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewise/docs/LWAP%20Technical%20Guidance%20Doc%202023%20Version%205.pdf

Appendix A Watershed Data Library

Lake Iroquois-Patrick Brook Watershed Action Plan

Winooski Natural Resources Conservation District

SLR Project No.: 146.14439.00006

March 7, 2024

Memorandum

To:	Winooski Natural Resources Conservation District
From:	Jessica Louisos, PE and Alex Marcucci, SLR International Corporation
Date:	April 25, 2023, revised March 7, 2024
Subject:	Lake Iroquois-Patrick Brook Watershed Action Plan Watershed Resource Library SLR # 14439.00006

INTRODUCTION

The Winooski Natural Resources Conservation District with partners Lewis Creek Association and Lake Iroquois Association have contracted with SLR to create a Lake Watershed Action Plan (LWAP) for the Lake Iroquois-Patrick Brook watershed. The LWAP will combine existing data with newly collected data from 2023 to create a document for management activities and projects aimed at protecting and improving conditions in the watershed. The lake watershed planning process involves identification of sources of water quality and habitat degradation and greatest threats to the health of the lake, involvement of the community members in the planning process, identification of sediment and phosphorus sources to the lake from each of three sectors – streams, roads, and shorelands, and identification of projects that can be implemented to address lake and watershed stressors. This report details data sources reviewed for the watershed during the data collection phase of the project.

LAKE IROQUOIS WATERSHED DESCRIPTION

Lake Iroquois is a 247-acre lake located in Williston, Richmond, St. George, and Hinesburg, Vermont (Figure 1). The main tributary that flows into and out of Lake Iroquois is Patrick Brook, a tributary to the LaPlatte River. Watershed action planning efforts for Lake Iroquois focus on the whole Patrick Brook watershed, including lands downstream of Lake Iroquois and Lower Pond. The Patrick Brook watershed is approximately 8 square miles in size. The subwatershed draining directly to Lake Iroquois is 3.5 square miles in size.

Figure 1. Lake Iroquois Watershed Location Map

Patrick Brook originates in Williston and flows southerly into Lake Iroquois, which is outlet-regulated by a 7-foot-tall stone and concrete dam (VT ID-97.01) (VANR, Dams Inventory). The lake, formerly known as Hinesburg Pond, was formed as a glacial kettle pond after the last ice coverage in Vermont receded about 15,000 years ago. A dam built on the lake's outlet in the mid-1800s was used to control the water supply to mills downstream in Hinesburg. Milling declined in the 20th century and in the 1960s the dam was intentionally cemented in its top position, keeping the pond at its current level throughout the year. Before the dam was built, the smaller kettle pond was located on the southern end of the current lake. The dam raised the original water level and enlarged the lake.

Below the dam, a short section of the brook is free flowing before flowing into Lower Pond (also known as Sunset Lake), an approximately 61-acre water body created by a 12-foot tall earthen/stone dam built in 1867 (VT ID-97.02) (VANR, Dams Inventory). The brook flows over a series of smaller dams before flowing under Mechanicsville Road in Hinesburg. During the 1800s, there were numerous mills situated along Patrick Brook from Richmond Road to Mechanicsville Road. A map showing the locations of dams within the watershed is provided in the attachment.

Downstream, a portion of flow is diverted southerly to a canal through Hinesburg Village to the LaPlatte River. The natural brook flows westerly to meet the LaPlatte River, along an altered path with flow to this

channel controlled by a failing concrete block wall diversion structure along Mechanicsville Road. The diverted flow path, known as the Patrick Brook Canal, was hand dug in the early 1800s parallel to Mechanicsville Road to power a mill that was situated near where the canal crosses Route 116. Dredging and maintenance of the canal occurred until the 1980s and kept the majority of the water from Patrick Brook flowing through the canal, with little in the natural channel to the west. Since then, deterioration of upstream diversion structures and reduced canal maintenance have led to most of the water from Patrick Brook flowing through the natural channel and diversion channel toward the Route 116 culvert at Hinesburg Center, which is not adequately sized to handle the increased proportion of flow now reaching it (Patrick Brook Canal History). Both the natural flow path and the canal flow into the LaPlatte River, which is a direct tributary to Lake Champlain, flowing into Lake Champlain near Shelburne Bay (Basin 5).

The Patrick Brook watershed is primarily forested, with concentrated areas of agriculture and development (Table 1, attached map). There are nearly 40 miles of road within the watershed, with a relatively even split of town-owned and private roads (Table 2). A short section of State Route 116 passes through the lower watershed. Private roads are concentrated around the shores of Lake Iroquois and Lower Pond.

Table 1. Land Cover Summary for Patrick Brook Watershed

Land Cover Class (2016)	Percentage of Watershed Coverage
Tree Canopy	62%
Grass/Shrub	27%
Bare Earth	0.1%
Water	6%
Buildings	1%
Roads	1%
Other Paved Surfaces	2%

Table 2. Roads Summary for Patrick Brook Watershed

Road Type	Mileage	Percent of Total Road Mileage
Class 2 Town Highway	11.4	30%
Class 3 Town Highway	8.0	21%
Class 4 Town Highway	0.4	1%
State Highway	1.2	3%
Private Road	17.6	46%

SPATIAL DATA

Numerous spatial data sources were used during data collection for Lake Iroquois-Patrick Brook watershed action planning. The VANR Natural Resources Atlas is a useful mapping tool hosting over 150 map layers and was used during data collection (VANR, 2020). Spatial data were obtained from various sources, including the Vermont Open Geodata Portal (VCGI). Key datasets are highlighted below.

Municipal Roads General Permit Scoring (segments)
Available here, data shown on attached map, https://geodata.vermont.gov/datasets/VTANR::municipal-roads-general-permit-scoring-segments/explore?location=43.858183%2C-72.455050%2C9.00

This dataset published by the VANR contains the results of road erosion inventory data collection across Vermont. The layer is based on an analysis conducted in 2017 and updated in 2018 and 2019 that divided the state's road network into segments and evaluated hydrologic connectivity of each individual segment. Hydrologic connectivity is defined as being located within 100 feet of a river corridor, perennial or intermittent stream, wetland, lake, or pond. As part of the Municipal Roads General Permit, municipalities have been required to conduct road erosion inventories for all hydrologically connected segments on municipality-owned roads. The Chittenden County RPC has led the effort to assess roads in its member municipalities. This dataset provides scoring data for each road segment in the state. Segments are assigned one of the following scores: not connected, fully meets, partially meets, does not meet, or incomplete data.

Stream Geomorphic Assessment Data
Available here, data shown on attached map,
https://anrweb.vt.gov/DEC/SGA/projects/phase1/themes.aspx?pid=75

A Phase 1 Stream Geomorphic Assessment of the LaPlatte River watershed was conducted in 2004. A Phase 2 Stream Geomorphic Assessment of Patrick Brook was conducted for the reaches between Lake Iroquois and Lower Pond and downstream of Lower Pond to the confluence with the LaPlatte shortly thereafter. Several layers containing stream geomorphic assessment data were used. All data were obtained through the Vermont Stream Geomorphic Assessment Data Management System (DMS).

- Reach points (s06rpts) – reach points dividing sections of stream for evaluation
- Segment centerlines (seg01swseg) – stream centerline divided by Phase 2 segment points
- Segment line impacts (fit01lnimpactseg) – feature indexing tool (FIT) line impact data
- Segment point impacts (fit01ptimpactseg) – feature indexing tool (FIT) point impact data

LiDAR Data
Available here, https://maps.vcgi.vermont.gov/LidarFinder/

Several LiDAR products published by the Vermont Center for Geographic Information were used including digital elevation model, contours, and hillshade layers. LiDAR data were collected in 2014 for the area. Raster data have a resolution of 0.7 meters.

VSWI Wetlands Class Layer
Available here, https://geodata.vermont.gov/datasets/VTANR::vswi-wetlands-class-layer/explore?location=43.858794%2C-72.459550%2C9.00

The Vermont Significant Wetlands Inventory (VSWI) dataset is based on 2010 mapping that combined National Wetland Inventory maps with wetlands hand digitized from 1:24,000 topographic maps. The layer represents Vermont's regulatory wetlands.

VT Hydrography Dataset – High Resolution NHD
Available here, https://geodata.vermont.gov/documents/vt-hydrography-dataset-high-resolution-nhd/about

The Vermont Hydrography Dataset (VHD) is a local resolution component of the National Hydrography Dataset (NHD). The VHD provides a database of stream segments within Vermont and is based on the following components: Vermont Mapping Program (VMP) digital orthophotos (1994-2000), vmp "break line" features, historical surface water data, NAPP cir multi-spectral aerial photography and CIR satellite imagery.

E911 Road Centerlines
Available here, https://geodata.vermont.gov/datasets/vt-data-e911-road-centerlines-1/explore?location=43.864817%2C-72.455244%2C9.14

This layer contains Enhanced 9-1-1 road centerline locations statewide. The base data contained in this dataset were originally manually digitized using a combination of paper and RC Kodak RF 5000 orthophotos. VTrans highway maps and state forest maps were also used to locate additional road segments. The dataset provides unique coding to filter roads by town and county and has field to locate riad segments by address.

Stormwater Infrastructure
Available here & here (VANR data), https://geodata.vermont.gov/datasets/VTANR::stormwater-infrastructure-line-features/explore?location=43.891236%2C-72.403850%2C9.00 , https://geodata.vermont.gov/datasets/VTANR::stormwater-infrastructure-point-features/explore?location=43.906164%2C-72.414150%2C9.00

Both public data from the VANR and in-house data from previous SLR mapping were used to identify the locations and types of stormwater infrastructure within the Patrick Brook watershed. The majority of mapped stormwater infrastructure is concentrated in Hinesburg Village, near Champlain Valley Union School, and in some small subdivisions. Stormwater infrastructure mapping was completed by this project team for Lewis Creek Association (MMI, 2010).

Parcel data
Available here,
https://maps.vcgi.vermont.gov/opendata/tileselect_opendata.html?IndexLayerName=Index_CadastralParcels_VTPARCELS&FolderURL=https://maps.vcgi.vermont.gov/gisdata/vcgi/packaged_zips/CadastralParcels_VTPARCELS/&cdownload=-1&InputLayerName=CadastralParcels_VTPARCELS&InputFtype=Parcels

Parcel boundary data were obtained from VCGI and downloaded for the towns of interest. The parcel data are standardized and joined with grandlist data. Parcel layers used are listed below by town and date.

- VTPARCELS_WILLISTON – 2022
- VTPARCELS_RICHMOND – 2018
- VTPARCELS_HINESBURG – 2021
- VTPARCELS_STGEORGE – 2021

Water Quality Monitoring Stations
Available here (VANR data), data shown on attached map,
https://geodata.vermont.gov/datasets/VTANR::water-quality-monitoring-sites/explore?location=43.923594%2C-70.839400%2C7.89

Spatial data for water quality monitoring programs within the Lake Iroquois watershed were obtained from multiple sources. Several organizations conduct water quality sampling within the watershed and include the following:

- Vermont Department of Environmental Conservation biomonitoring (BASS)
- Lake Iroquois Association
- Lewis Creek Association
- South Chittenden Riverwatch

2016 Land Cover
Available here, https://geodata.vermont.gov/pages/land-cover

Land cover was mapped statewide for Vermont in 2016 by the University of Vermont based on 2013-2017 LiDAR data and 2016 NAIP imagery using object-based image analysis (OBIA). Eight land cover classes were mapped: (1) tree canopy, (2) grass/shrub, (3) bare earth, (4) water, (5) buildings, (6) roads, (7) other paved surfaces, and (8) railroads.

REPORTS

Water Quality Monitoring – LaRosa Program
Tributary Water Quality Monitoring – 2019, Lake Iroquois Association
Available here,
https://www.lakeiroquois.org/fileadmin/files/Tributary_Sampling/2019_LaRosa_Report.pdf?0baa84e91259dc2949b5319d596a197f7150d354

This report outlines water quality monitoring efforts and results for 2019 in the Lake Iroquois watershed. Monitoring was carried out through the LaRosa Partnership Program, funded by the Vermont Department of Environmental Conservation. Monitoring also occurred during 2020 and 2021, but no report was prepared for those years. The 2019 report highlights a couple of locations with elevated phosphorus results (tributaries from the north and west of the lake). Water quality monitoring has been carried out in the watershed by Lake Iroquois Association since 2011.

Water Quality Monitoring – South Chittenden River Watch
Summary Report: 2019 Water Quality Sampling Results

The South Chittenden River Watch (SCRW) has been monitoring water quality in four watersheds in Chittenden County since 2004. SCRW has several stations located on Patrick Brook, all downstream of Lake Iroquois and Lower Pond.

Northern Lake Champlain Direct Drainages Tactical Basin Plan
Available here,
https://www.lakeiroquois.org/fileadmin/files/Tributary_Sampling/2019_LaRosa_Report.pdf?0baa84e91259dc2949b5319d596a197f7150d354

The basin plan for all direct tributaries to Lake Champlain was published in 2020 by the Vermont Agency of Natural Resources. The plan covers all direct drainages from Ferrisburgh to Swanton including the Lake Champlain Islands. The plan outlines water quality issues in the basin, strategies to protect and restore waterways, and funding opportunities for watershed projects.

Stream Geomorphic Assessment
Stream Corridor Plan – LaPlatte River and Tributaries
Available here, https://anrweb.vt.gov/DEC/SGA/finalReports.aspx

A river corridor plan was prepared for the Hinesburg section of the LaPlatte River watershed in 2007. The study area includes Patrick Brook downstream of Lake Iroquois. The plan identifies several potential projects that could be implemented for the protection and restoration of Patrick Brook, including removal of obsolete dams and river corridor protection.

ADDITIONAL RESOURCES

Lake Iroquois Report Card
Available here,
https://anrweb.vt.gov/DEC/IWIS/ReportViewer3.aspx?Report=LakeScoreCard_Current_TrendsAndStatus&ViewParms=True&LakeID=IROQUOIS

The Lake Iroquois Report card summarizes long term later quality monitoring data within Lake Iroquois from 1980 through 2020. The report card classifies Lake Iroquois with the following scores: trend score – good, water quality standards status – stressed, and watershed score – highly disturbed. It identifies phosphorus as a stressor.

Vermont Integrated Watershed Information System
Available here,
https://anrweb.vt.gov/DEC/IWIS/ReportViewer3.aspx?Report=LakeScoreCard_Current_TrendsAndStatus&ViewParms=True&LakeID=IROQUOIS

The Vermont Integrated Watershed Information System (IWIS) provides an online portal for water quality data across the state. Raw data for sampling from a variety of sources are hosted here, including monitoring data for Lake Iroquois and its tributaries.

Lewis Creek Association 2021 Water Quality Monitoring Data
Available here, https://storymaps.arcgis.com/stories/8ab94a52bc4447308f5bd6a326d15cfa

Water quality monitoring data for the 2021 season are presented in a story map. Only one station in the Patrick Brook watershed was monitored in 2021, located in the lower reaches well downstream of the two lakes.

CITATIONS

MMI, 2010. LaPlatte River Watershed Stormwater Infrastructure Study. Prepared for the LaPlatte Watershed Partnership/ Lewis Creek Association by Milone & MacBroom, Inc., Chittenden County, Vermont.

Morgante, Andrea and Town of Hinesburg. Patrick Brook and Canal History. Available at: https://anrweb.vt.gov/ANR/Act250/ViewFile.aspx?filename=Patrick%20Brook%20and%20Canal%20History.pdf&fileid=248413

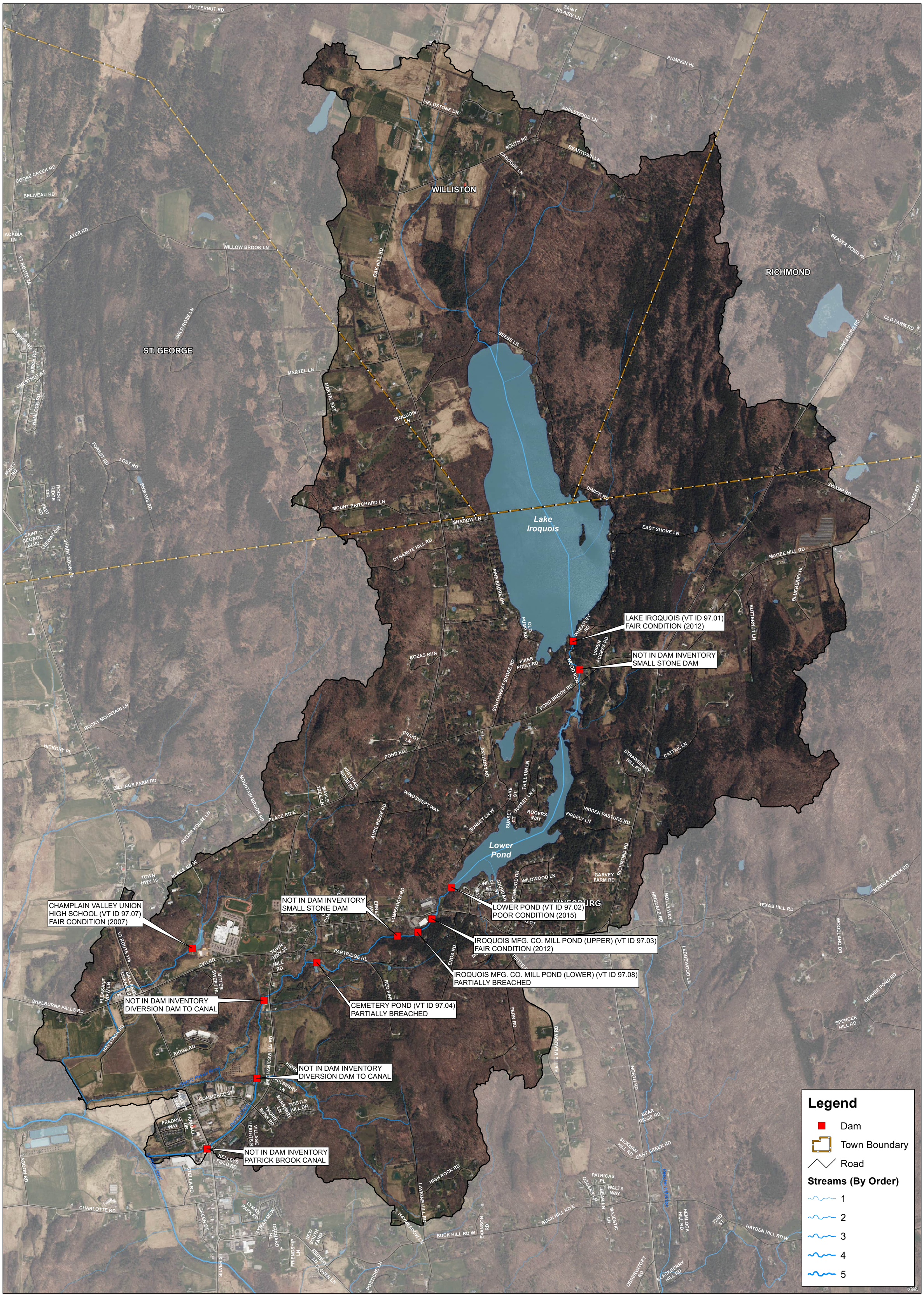
Vermont Agency of Natural Resources (VANR). Dams Inventory. Available at: https://anrweb.vt.gov/DEC/DamsInventory/ListDams.aspx

Vermont Agency of Natural Resources (VANR). 2020. Natural Resources Atlas. Available at: https://anrmaps.vermont.gov/websites/anra5/

Vermont Center for Geographic Information (VCGI). Vermont Open Geodata Portal. Available at: https://geodata.vermont.gov/

ATTACHMENT

WATERSHED MAPS



LAKE IROQUOIS & PATRICK BROOK WATERSHED DAM LOCATIONS

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 1,800 3,600

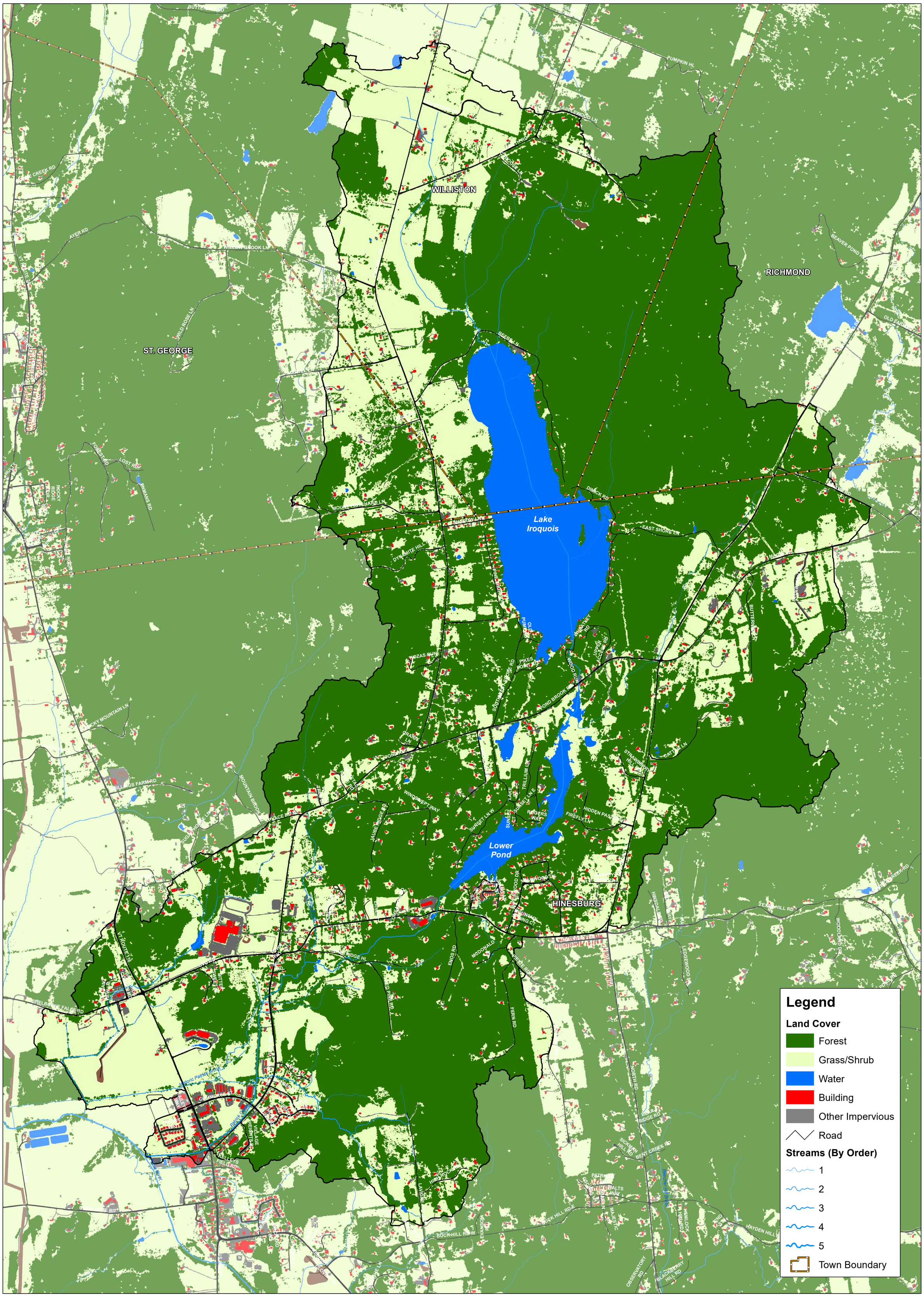
Feet

1 in = 900 feet

N

SLR

1 SOUTH MAIN ST
WATERBURY, VT 05676
802.882.8335



Legend

Land Cover

- Forest
- Grass/Shrub
- Water
- Building
- Other Impervious
- Road

Streams (By Order)

- 1
- 2
- 3
- 4
- 5
- Town Boundary

LAKE IROQUOIS & PATRICK BROOK WATERSHED LAND COVER (2016)

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 1,800 3,600

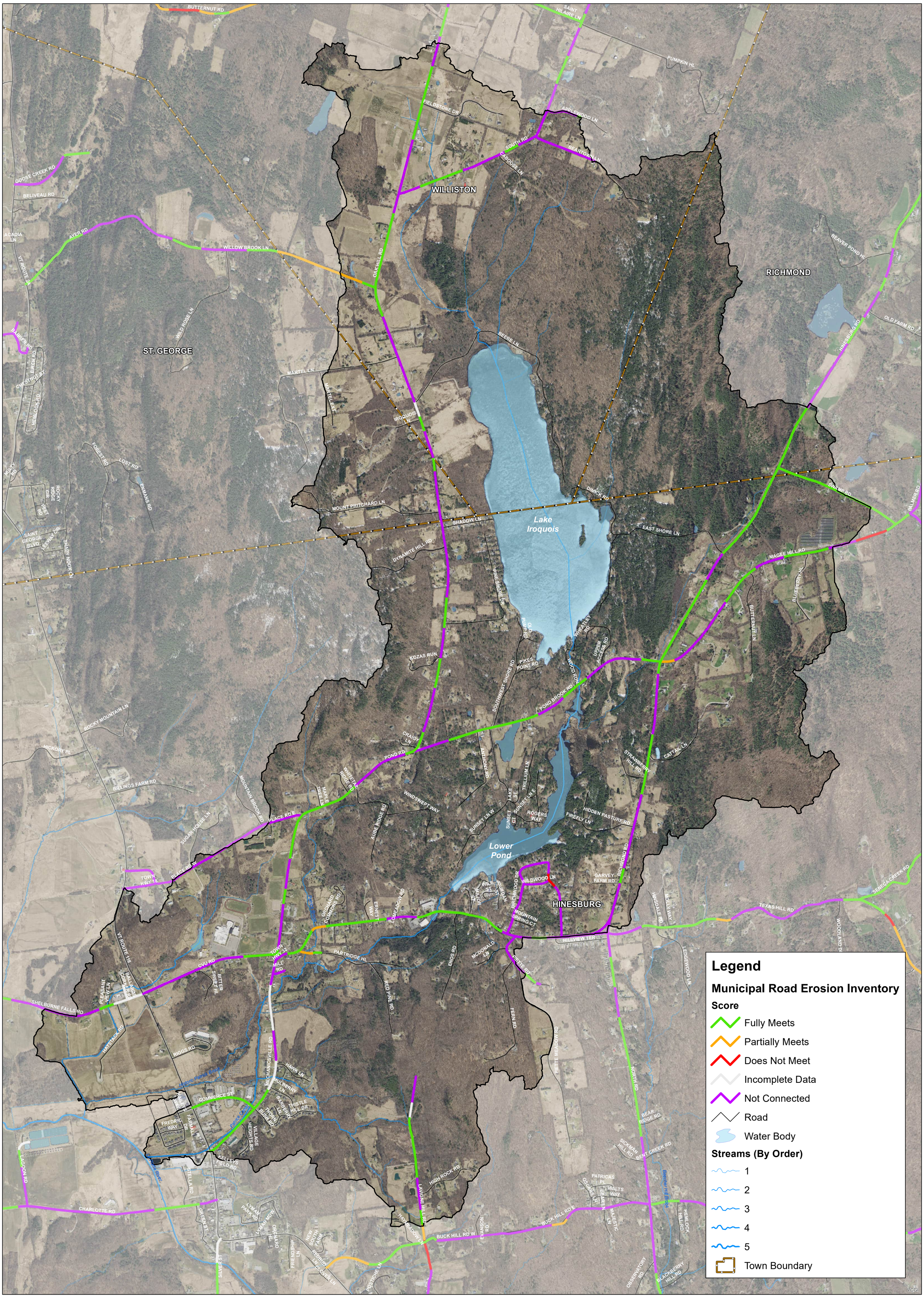
Feet

1 in = 900 feet

N

SLR

1 SOUTH MAIN ST
WATERBURY, VT 05676
802.882.8335



LAKE IROQUOIS & PATRICK BROOK WATERSHED MUNICIPAL ROAD EROSION INVENTORY

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 1,800 3,600

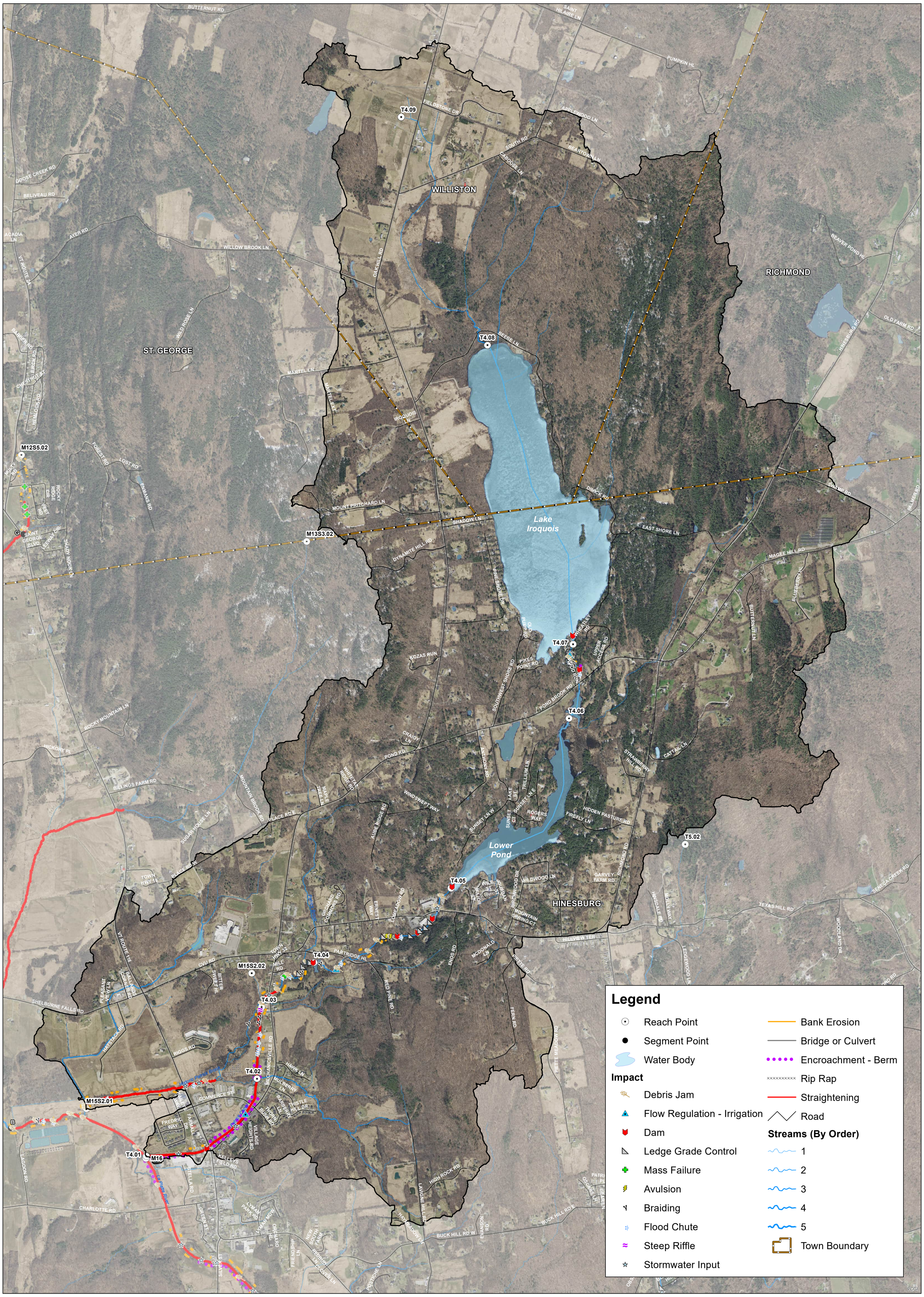
Feet

1 in = 900 feet

N

SLR

1 SOUTH MAIN ST
WATERBURY, VT 05676
802.882.8335



LAKE IROQUOIS & PATRICK BROOK WATERSHED
PHASE 2 STREAM GEOMORPHIC ASSESSMENT DATA

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 1,800 3,600

Feet

1 in = 900 feet

N

SLR

1 SOUTH MAIN ST
WATERBURY, VT 05676
802.882.8335

LAKE IROQUOIS & PATRICK BROOK WATERSHED WATER QUALITY MONITORING

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 1,800 3,600

Feet

1 in = 900 feet

N

SLR

1 SOUTH MAIN ST
WATERBURY, VT 05676
802.882.8335

Legend

Water Quality Monitoring Station

- LaRosa 2022
- BASS WQ Site
- Previous Site - LCA
- LaRosa 2021
- Previous Site - LIA
- Water Body
- VT Significant Wetland Inventory
- Road

Streams (By Order)

- 1
- 2
- 3
- 4
- 5
- Impervious Surface
- Town Boundary

VCGI

Appendix B WNRCD Property Assessment Reports

Lake Iroquois-Patrick Brook Watershed Action Plan

Winooski Natural Resources Conservation District

SLR Project No.: 146.14439.00006

March 7, 2024

Jane Clifford – Lake Iroquois

Lake Wise Evaluation
Date: August 15th 2023

Lake Wise Evaluator: Casey Spencer, WNRCD
Report completed by Adelaide Dumm, WNRCD

Address: 56 Dimick Road, Hinesburg, VT
Permanent Address: 6147 Vt Route 116, Starksboro, VT,

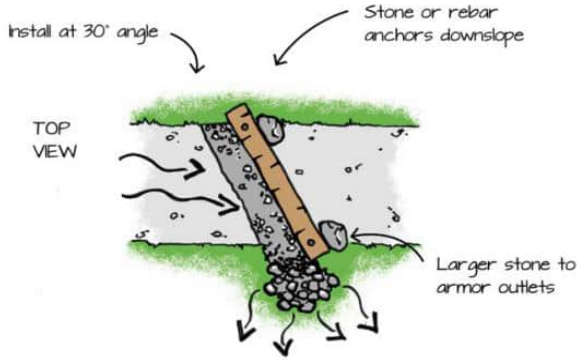
Overall Results: There are improvements that can be made on your property to meet the Lake Wise award standards. You passed in the Structures & Septic and Recreational sections of the assessment, but there are improvements that can be made in the Driveway and Shorefront and Lake Access sections. Homeowners need to have best management practices (BMPs) in all four sections to promote lake-friendly living and achieve a Lake Wise award. This report includes suggestions to improve stormwater management. You will receive a certificate of recognition for the sections which passed and this report details the BMPs you can implement to receive a Lake Wise award in the future.

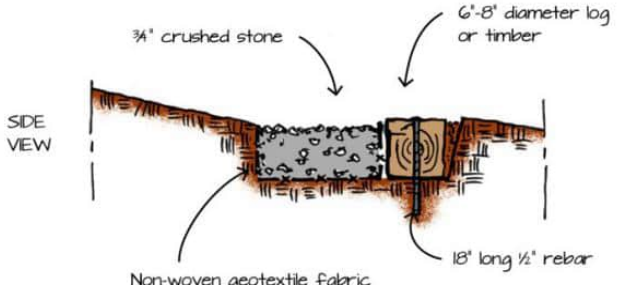
Driveway Area: The driveway section did not pass in the Lake Wise assessment section, and there are improvements that can be made. The driveway and parking areas are slightly defined and excessive in size. There are signs of erosion on the driveway and parking area due to frequent use resulting in stormwater runoff that is more channelized than sheet flow. Some of the runoff is directed to a stable vegetated buffer or BMP, but adding green stormwater infrastructure (GSI) would help to better manage runoff.

Adding a water bar will divert stormwater to a more stable vegetated area. Additionally, you could plant shrubs or trees to help absorb some of that water. We encourage you to fix the channelized erosion on the shoulder of the driveway and incorporate perennial vegetation.

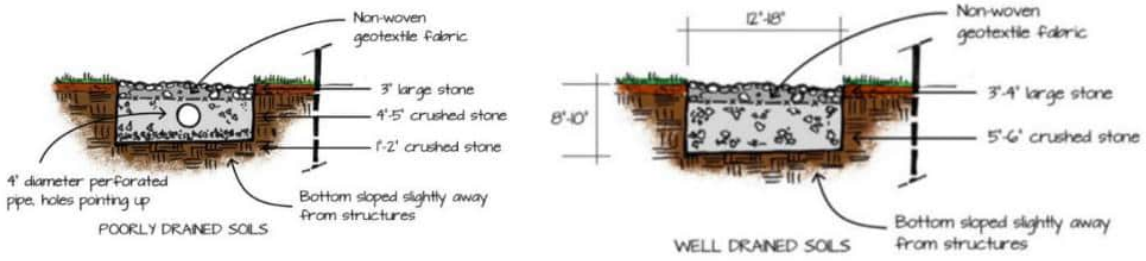
Water Bars:

Water bars intercept water flowing down unpaved paths or driveways and redirect it to stable, vegetated areas. This helps mitigate erosion, prevents sediment from reaching waterways, and slows and infiltrates stormwater. You can read more about water bars in the VT Guide for Stormwater Management on Page 24.



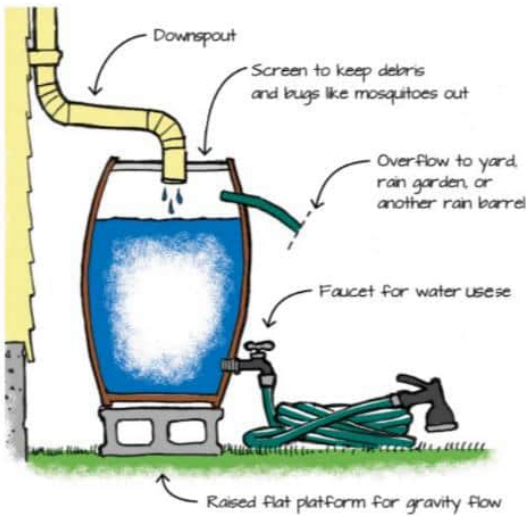


Structures and Septic Systems: Your property passed the criteria for the Structures and Septic section of the Lake Wise evaluation, but again there are a few best management practices that can be made for lake stewardship. The septic system shows no evidence of failure, and you maintain the system regularly. BMPs are critical to maintaining a healthy lake ecosystem. The drainage system around the house is a good BMP for roof drips. The addition of an infiltration trench around the home will increase the water holding capacity and slow down runoff during heavy rain events. Consider adding gutters and rain barrels to keep runoff on site. See the Vermont Guide to Stormwater Management for Homeowners and Small Business Owners for more information. Overall, the impervious surface of the developed area was less than 20% of the total area of the property.



Infiltration trenches are shallow, stone lined channels that capture water from impervious surfaces (likeroof tops) and infiltrate it into the ground. In less well drained soils an Infiltration Trench is outfitted with a pipe to convey water that risks pooling. More information on this can be found in the VT Guide to Storm Water Management for Homeowners and Small Businesses, listed in the Further Resources section on page 13.

Rain Barrels are relatively easy to install, help retain water on your property, and give you a great resource for gardening. A barrel can come in many shapes and sizes and attach directly to the gutter downspout or be filled with a rain chain. Keeping your barrel covered stops mosquitos from reproducing in it. Check the barrel before a big storm comes to make sure it can handle the water coming its way.
Rain barrels can be purchased new from local hardware stores or online vendors, or you can build one yourself. Visit www.rethinkrunoff.org to download detailed instructions for a DIY project.



For more information see the VT Guide to Storm Water Management for Homeowners and Small Business-
es—page 18

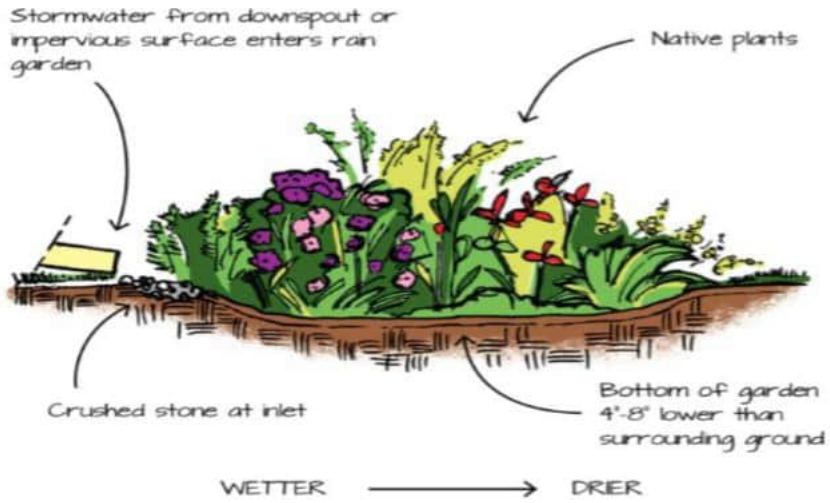
Recreation Area: There was little to no signs of erosion in the recreation area. Some of the stormwater flows through an effective buffer, including the existing vegetation on the property. However, the grass lawns that make up most of the recreation area do not slow down stormwater as it moves over the property. All of the recreation areas are defined and limited in space, but the lawn makes up 20 % of the recreation area. All gardens are mulched, planted with native vegetation and show no signs of no runoff. An improvement would be to minimize this lawn space by creating low mow zones or no mow zone and adding in more dynamic structural vegetation that will slow down and absorb runoff and create wildlife habitat. Paths on the property are limited, defined, and not showing erosion or direct runoff into the lake.

Recommendations for improvement include creating low mow or no mow zones, especially near the septic mound, and adding more perennial plants on site to absorb stormwater runoff. We disused adding birch trees along the lake edge during the Lake Wise assessment.

You could consider adding a native clover mix to the grassy area. Grass has relatively short root system and a clover mix may slow down stormwater as it moves in a sheet flow across the recreation area.

The grass lawn is a great example of a potential low-mow zone, especially on this steep slope that can be challenging to mow. Letting the grass grow above 3” can help to slow stormwater that falls on your property, giving it more time to sink into the ground. Lawns can be compacted by everyday use and the weight of the lawn mower. This compaction limits the ability of the lawn to absorb water. By aerating the soil (punching holes through the surface material) you can give water an easier route into instead of across the lawn.

During the assessment we discussed extending the perennial gardens down to the lakes edge. This may be a good opportunity to incorporate a rain garden into the landscape. Rain Gardens capture and slow water that runs off parking lots, driveways, and walkways. They use native plants to slow and filter water. Ultimately water is either infiltrated into the ground or is absorbed by the plants and release back into the atmosphere. Plants used in rain gardens should be both drought resistant and able to handle prolonged periods of submersion in water.



Shorefront and Lake Access: It is important to have a well-established vegetative buffer along the lake shoreline to slow down, spread out and stormwater as it moves across the property. The currently buffer covers only 15ft but covers 50% of the shore and is composed of three tiers of vegetation on average and but most of the duff layer is still intact. The vegetation along the shoreline is made up of native species, continue to be vigilant of invasive species and consider management if you see then begin to creep in from the surrounding area. We encourage you to reduce the amount of grass that leads down to the lake and adopt a low mow zone. Planting trees, like birches, will contribute to holding soil in place and creating a stable shoreland area. The cattails are great wildlife habitat continue to let them grow and expand! Maintaining a native buffer along the lake shore through planting native species you will be able to create a more natural lake shoreline and maintain the ecological health of Lake Iroquois.

A few small changes on the property will help in the sections that you did not pass for the Lake Wise award. The recommendations are designs to help improve your overall score and contribute to a more lake friendly property!

Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Vermont Agency of Natural Resources Lake Wise Program – Promoting Lake Friendly Practices

Kim Conant – Lake Iroquois

Lake Wise Evaluation
Date: October 5th 2022
Re-evaluated July 7th, 2023

Lake Wise Evaluator: Adelaide Dumm, WNRCD Conservation Specialist and Remy Crettol, WNRCD District Manager
Re-evaluated by Casey Spencer, WNRCD
and Report written by Adelaide Dumm, WNRCD

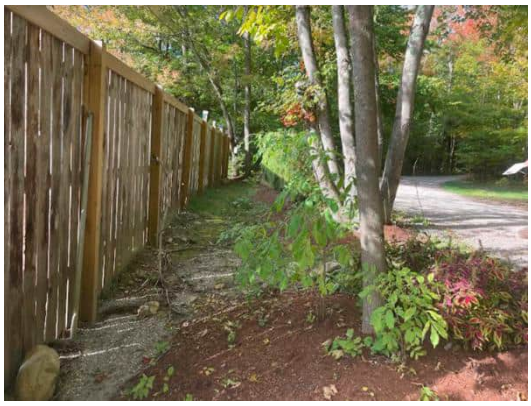
Address: 746 Beebe Lane Williston, VT 05495
Permanent Address: Same

Overall Results: When your property was originally evaluated in October 2022 there were improvements that could be made to meet the Lake Wise award standards. You passed in Structures & Septic section of the assessment, but there was work to be done in the Driveway, Recreation Area and Shoreland sections. Homeowners need to have best management practices in all four sections to promote lake-friendly living and achieve a Lake Wise award. Over the course of one year, you made several improvements and we are pleased to announce that your property has met the Lake Wise awards standards, congratulations! This report includes a few more suggestions to improve stormwater management on your property.

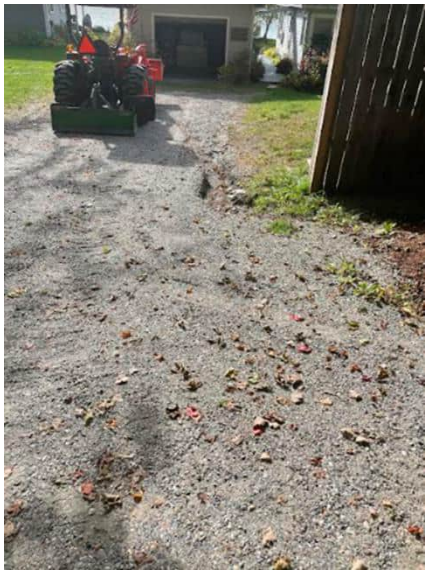
Driveway Area: The driveway and parking areas are well defined and well maintained but are still somewhat excessive in size. Decreasing the size of the driveway or parking areas and increasing the amount of vegetation or green space on the property would improve filtration of stormwater before it enters the lake. We still recommend adding a rain garden or more established vegetation buffer along the driveway. This is an approach that will help filter stormwater as it moves across the driveway and parking area. There were severe signs of erosion on the driveway and parking area in2022, and stormwater was more channelized than a sheet flow across this area.

You dug a gravel lined trench to divert the water into a more stable vegetated, mitigating the area of erosion. Nice job! You could still add a vegetated swale behind the existing row of shrubs at the front of the property. The shoulders and ditches showed signs of erosion in 2022, and although there was still some erosion in 2023 it was significantly less than last year. Adding a gravel lined trench to divert water or adding more perennial plants on the bank of the driveway will stabilize surfaces and prevent erosion down the driveway slope. We recommend you minimize the shared driveway area- post construction, but the driveway is improved significantly from the first visit. The following page shows before and after photos from 2022 to 2023.

2022



2022

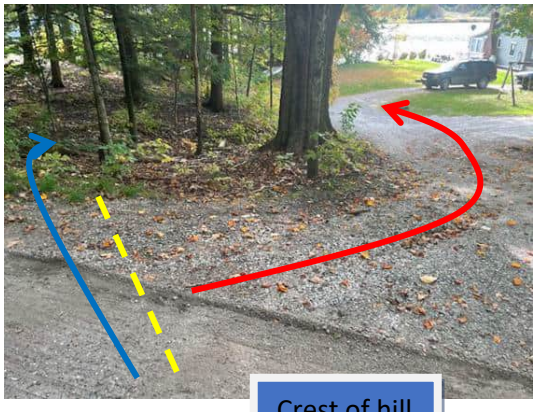


2022

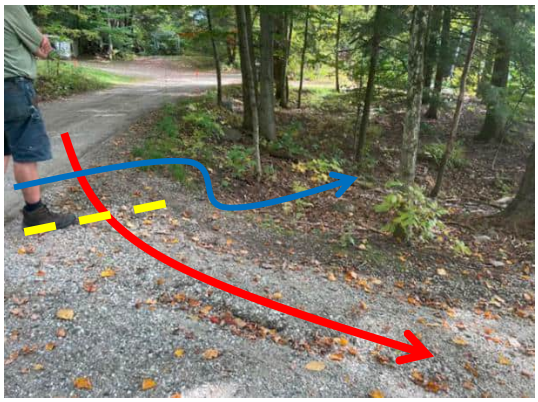
2023

2023

Adding a gravel lined trench to divert stormwater at the crest of the slope has helped to direct stormwater runoff to the wooded areas on the side of the driveway and has mitigated the erosion on the driveway.



2022



2022

2023

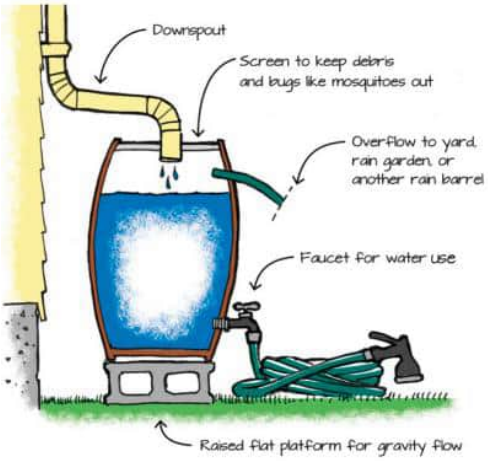
Structures and Septic Systems: Your property passed the criteria for the Structures and Septic portion of the Lake Wise Evaluation. While the septic system is older, there is no evidence of failure, and you maintain the system regularly. The tank is sited more than 50 feet away from the water and the leach field is free of woody vegetation that could cause any damage to the system.

The foundation of your home shows little sign of erosion from roof runoff. You could add more shrubbery and gardens around the home that would act as water filtration and sponges to soak up stormwater. I suggest adding a rain barrel to the downspout and using the harvested rainwater to water your flower beds. See the Vermont Guide to Stormwater Management for Homeowners and Small Business Owners for more information. You could also add a dry well or infiltration trench around the home to increase water folding capacity as it runs off the impervious surfaces (roof of the house, decks/patio, garage roof, etc.) before making its way to the lake. Overall, the impervious surface of the developed area was about than 20-25% of the total area of the property. Good job!

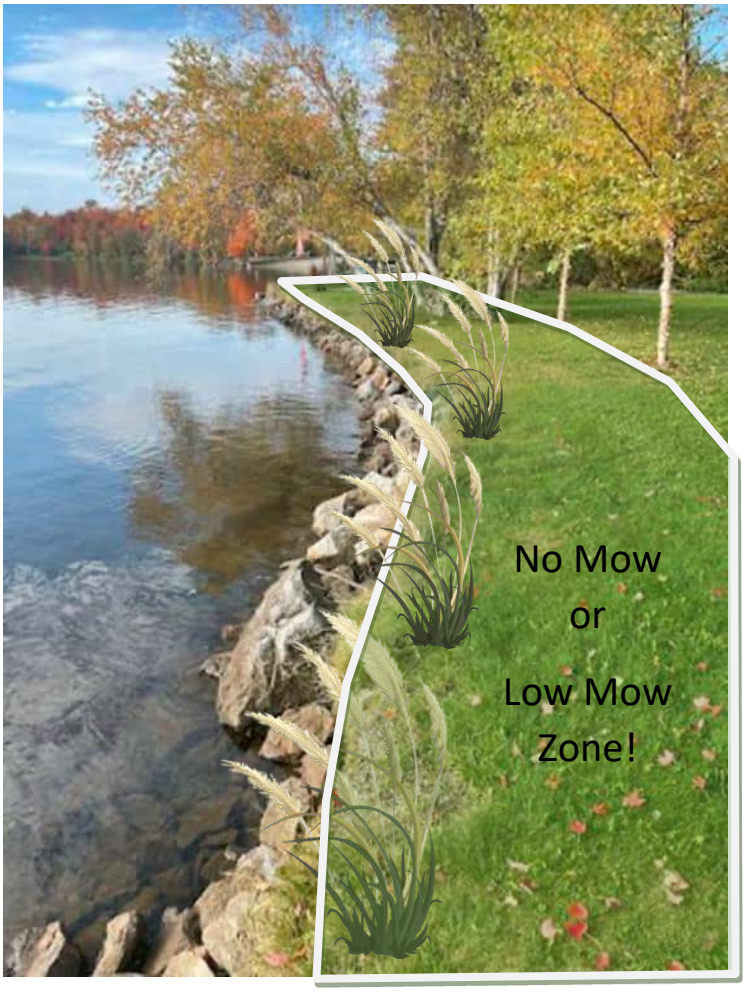
2023

2023

2023



Recreation Area: The recreation area is a section where you made great improvements on your property by installing best management practices to achieve the Lake Wise award. There are little to no signs of erosion in the recreation area and you've decreased the large grass from 40% to 20-30% of the property. This area is well defined but is still not as limited in size as we'd like to see; grass has relatively short root systems and has a minimal impact on slowing down, spreading out, or helping stormwater sink into the ground before entering the lake. We recommended you adopt a no mow zone or low mow zone and you've done this. Great job! You've improved your Lake Wise assessment score by doing less! Continue to reduce lawn size by placing gardens and vegetation throughout the property The birch trees are a huge improvement. Consider planting a rain garden between two houses where water was collecting.



Shorefront and Lake Access: The ideal shoreline has a naturally vegetated buffer, with multiple tiers of vegetation present including a tree canopy, shrubs, understory, ground cover and duff layer. It is important to have a well-established vegetative buffer to slow down, spread out and stormwater as it moves across the property. The vegetation along the shoreline at your property used to grass down to the water with few maple and birch trees, but you've added gardens, perennial grasses and more trees. Way to go! You've done a nice job of adding perennial garden

beds and tall grasses which will buffer stormwater runoff from your lawn. We recommend you also allow the native vegetation to fill in areas will contribute to soil stability. Establishing a permanent low /no mow zone along the shoreline the area will allow for natural re-vegetated in a few years.

The retaining wall is still contributing to severe shoreline erosion, as wave energy pushes against the wall it is diverted to the left and right of the barrier and causes erosion on either side. A living shoreline is the best option for a healthy lake ecosystem. After vegetation has been removed, shorelines erode. Homeowners often install hard structures to protect their property. However, these walls create many problems including:

- **Wave flanking:** When waves hit the walls, the energy is deflected sideways, causing more concentrated and intensive erosion down shore.
- **Lakebed scouring:** Wave energy is also deflected downwards, scooping out sediments on the lake bottom. This can severely compromise vital shallow water habitat as well as the structural integrity of the wall.
- **Wildlife barriers:** Vertical walls break the interface between the lake and shore and cause barriers for wildlife to reach the shore to feed, nest, and rest, such as turtles laying eggs on shore.

"Eroding banks were often stabilized by constructing sea walls and other hardscape techniques. However, now we know that clearing shoreland vegetation and hard armoring the shoreline degrades the lake system, including its water quality, aquatic and terrestrial habitat, and overall resiliency.

The once conventional shoreland practices are rapidly being replaced with a suite of lake-friendly shoreland Best Management Practices including bioengineering techniques for lake-friendly development. Bioengineering techniques are restorative practices for stabilizing shorelands while offering multiple clean water and wildlife benefits. Bioengineering practices increase the resilience of our lake ecosystems in the face of climate change, filter and clean upland runoff before it reaches the lake, and provide critical wildlife habitat." Vermont Bio-engineering Manual, page 3.

Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Vermont Agency of Natural Resources Lake Wise Program – Promoting Lake Friendly Practices

Kim Conant – Lake Iroquois

Lake Wise Evaluation
Date: October 5th 2022

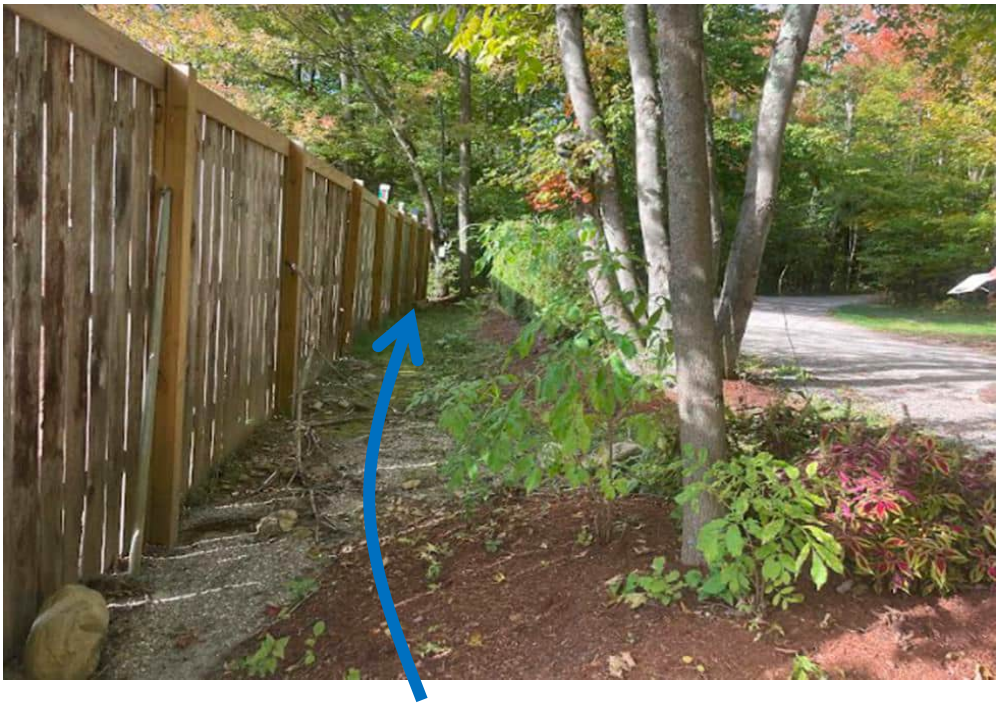
Lake Wise Evaluator: Adelaide Dumm, WNRCD Conservation Specialist and Remy Crettol, WNRCD District Manager

Address: 746 Beebe Lane Williston, VT 05495
Permanent Address: Same

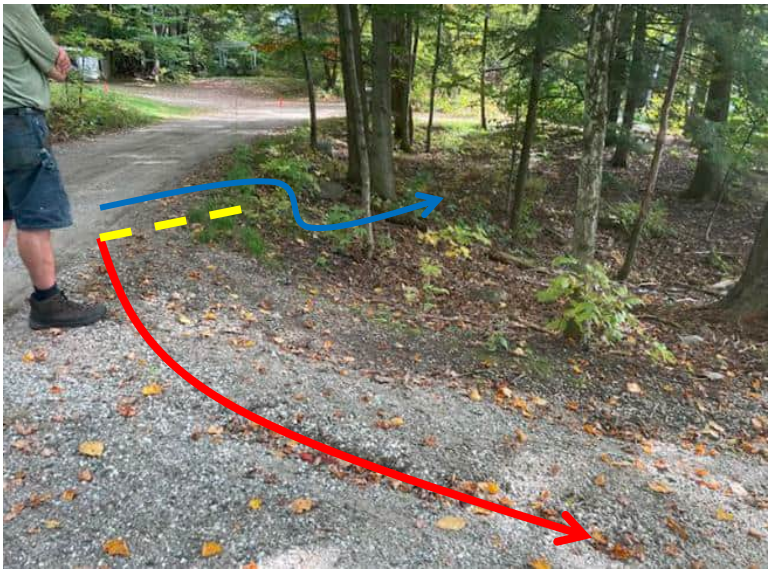
Overall Results: There are improvements that can be made on your property to meet the Lake Wise award standards. You passed in Structures & Septic section of the assessment, but there are improvements that can be made in the Driveway, Recreation Area and Shoreland sections. Homeowners need to have best management practices in all four sections to promote lake-friendly living and achieve a Lake Wise award. This report includes suggestions to improve stormwater management in the sections that you passed.

Driveway Area: The driveway and parking areas are well defined and well maintained but are somewhat excessive in size. Decreasing the size of the driveway or parking areas and increasing the amount of vegetation or green space on the property would improve filtration of stormwater before it enters the lake. Adding a rain garden or more established vegetation buffer along the driveway is another approach that will help filter stormwater as it moves across the driveway and parking area. There are severe signs of erosion on the driveway and parking area, as indicated in the red circles. Stormwater is more channelized than a sheet flow across this area.

Digging gravel lined trenches to divert the water into a more stable vegetated area before it reaches this area of erosion is one solution. Adding a vegetated swale behind the existing row of shrubs at the front of the property with a French drain or other diversion system would also move water way from this area prone to erosion on the driveway. The shoulders and ditches show moderate signs of erosion. Adding a gravel lined trench to divert water or adding more perennial plants on the bank of the driveway will stabilize surfaces and prevent erosion down the driveway slope, instead directing to a more stable area in the woods.

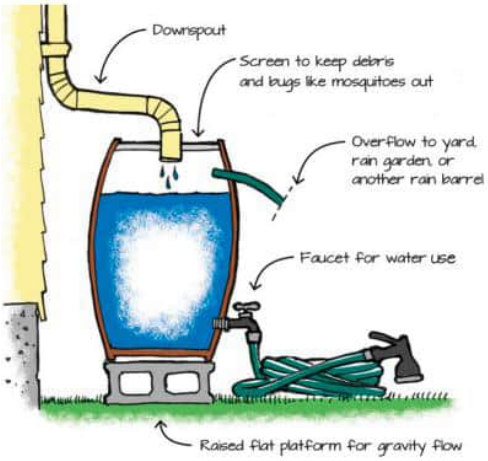


Adding a gravel lined trench to divert stormwater at the crest of the slope will direct it to the wooded areas on the side of the driveway and will help in mitigating the erosion you are seeing in this area.



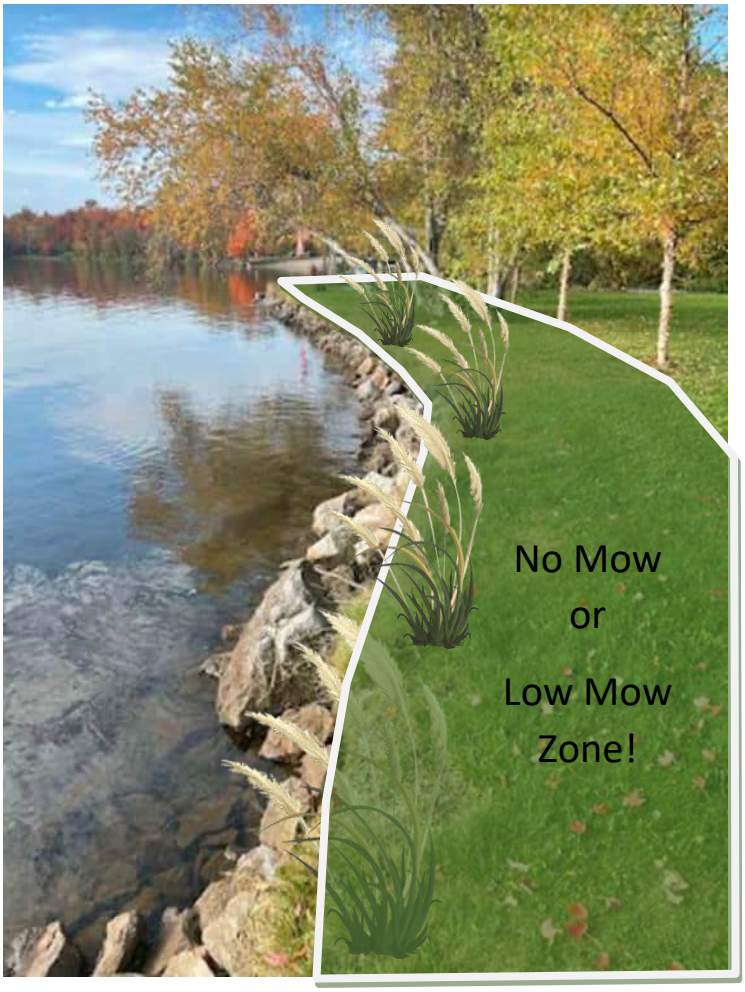
<u>Structures and Septic Systems:</u> Your property passed the criteria for the Structures and Septic portion of the Lake Wise Evaluation. While the septic system is older, there is no evidence of failure, and you maintain the system regularly. The tank is sited more than 50 feet away from the water and the leach field is free of woody vegetation that could cause any damage to the system.

The house shows little signs of erosion from roof drips and erosion. Yu could add more shrubbery and gardens around the home that would act as water filtration and sponges to soak up stormwater. I suggest adding a rain barrel to the downspout and using the harvested rainwater to water your flower beds. See the Vermont Guide to Stormwater Management for Homeowners and Small Business Owners for more information. You could also add a dry well or infiltration trench around the home to increase water folding capacity as it runs off the impervious surfaces (roof of the house, decks/patio, garage roof, etc.) before making its way to the lake. Overall, the impervious surface of the developed area was about than 20-25% of the total area of the property. Good job!



Recreation Area: The recreation area is a section where you would enhance your property through best management practices to achieve the Lake Wise award. There are minimal signs of erosion in the recreation area and mainly consists of a large grass lawn right up to the lake shoreline. This area is well defined but is not limited in space- more than 40% of the property is grass. Grass has relatively short root systems and has a minimal impact on slowing down, spreading out, or helping stormwater sink into the ground before entering the lake. An easy best management practice you could adopt a no mow zone, or low mow zone! Improve your Lake Wise assessment score by doing less!

The patch of grass in the side yard is a great example of a potential no mow or low mow zone with a minimum of approximately 15 ft buffer on the lake shore. Letting the grass grow above 3" can help to slow stormwater that falls on your property, giving it more time to sink into the ground. Lawns can be compacted by everyday use and the weight of the lawn mower. This compaction limits the ability of the lawn to absorb water. By aerating the soil (punching holes through the surface material) you can give water an easier route into instead of across the lawn.



Shorefront and Lake Access: The ideal shoreline has a naturally vegetated buffer, with multiple tiers of vegetation present including a tree canopy, shrubs, understory, ground cover and duff layer. It is important to have a well-established vegetative buffer to slow down, spread out and stormwater as it moves across the property. The vegetation along the shoreline at your property is mostly grass down to the water and there are a few maple and birch trees, but the yard is very manicured. Allowing the native vegetation to fill in areas will contribute to soil stability. You could also add in some plants like tall perennial grasses, sedges, or native shrubs if there is adequate soil depth, but if you choose to no mow along the shoreline the area will be naturally re-vegetated in a few years.

The retaining wall is contributing to severe shoreline erosion, as wave energy pushes against the wall it is diverted to the left and right of the barrier and causes erosion on either side. A living shoreline is the best option for a healthy lake ecosystem. After vegetation has been removed, shorelines erode. Homeowners often install hard structures to protect their property. However, these walls create many problems including:

- **Wave flanking:** When waves hit the walls, the energy is deflected sideways, causing more concentrated and intensive erosion down shore.
- **Lakebed scouring:** Wave energy is also deflected downwards, scooping out sediments on the lake bottom. This can severely compromise vital shallow water habitat as well as the structural integrity of the wall.
- **Wildlife barriers:** Vertical walls break the interface between the lake and shore and cause barriers for wildlife to reach the shore to feed, nest, and rest, such as turtles laying eggs on shore.

"Eroding banks were often stabilized by constructing sea walls and other hardscape techniques. However, now we know that clearing shoreland vegetation and hard armoring the shoreline degrades the lake system, including its water quality, aquatic and terrestrial habitat, and overall resiliency.

The once conventional shoreland practices are rapidly being replaced with a suite of lake-friendly shoreland Best Management Practices including bioengineering techniques for lake-friendly development. Bioengineering techniques are restorative practices for stabilizing shorelands while offering multiple clean water and wildlife benefits. Bioengineering practices increase the resilience of our lake ecosystems in the face of climate change, filter and clean upland runoff before it reaches the lake, and provide critical wildlife habitat."

Vermont Bio-engineering Manual, page 3.

Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org or Remy Crettol at Remy@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Vermont Agency of Natural Resources Lake Wise Program – Promoting Lake Friendly Practices

Thomas Hall – Lake Iroquois

Lake Wise Evaluation
Date: September 1st, 2023

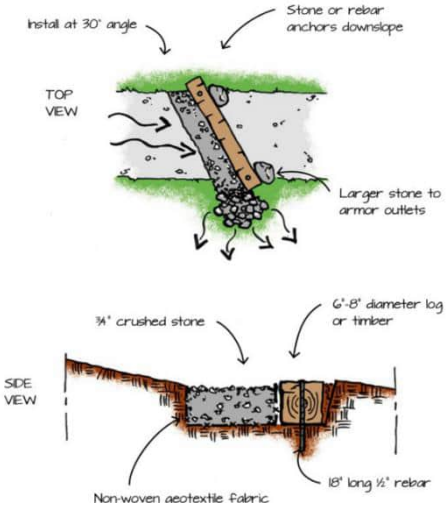
Lake Wise Evaluator: Casey Spencer, WNRCD
Report completed by Adelaide Dumm, WNRCD

Address: 1140 Beebe Ln, Williston, VT, 05495
Permanent Address: 71 E Redrock Drive unit 104, Burlington, VT, 05401

Overall Results: Your property passed in all four Lake Wise assessment sections! Driveway, Structures & Septic, Recreation Area and Shoreland all passed. Homeowners need to have best management practices in all four sections to promote lake-friendly living and achieve a Lake Wise award. This report includes suggestions to improve stormwater management in the sections that you passed. Congratulations!

Driveway Area: The driveway and parking areas are mostly defined, but the size of the driveway and parking area is somewhat excessive. The driveway and parking surfaces as well as the driveway shoulder and ditch areas are all stable and show little to no signs of erosion. The stormwater runoff is entirely sheet flow and any channelized runoff is directed to a stable vegetated buffer or BMP.

There were some issues on the private road, but not on your driveway. There is significant channelized erosion down the hill, we suggest adding water bars to divert stormwater to a more stable vegetated area. Additionally, you could plant shrubs or trees to help absorb some of that water.

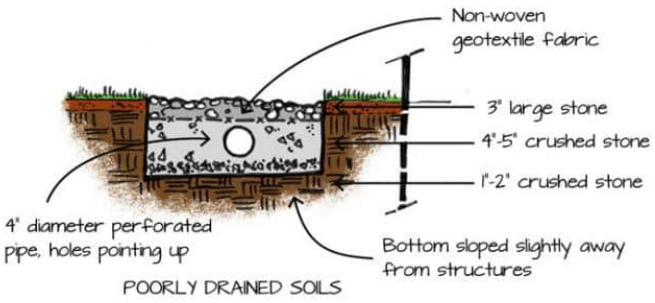


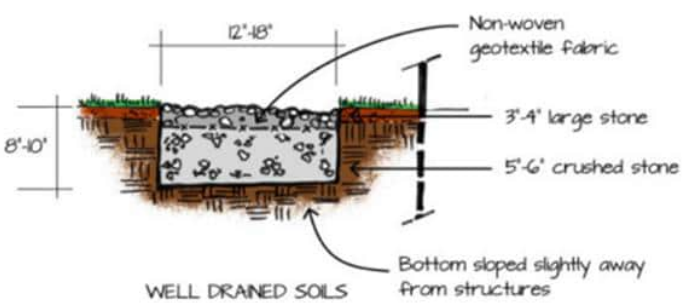
Water bars intercept water flowing down unpaved paths or driveways and redirect it to stable, vegetated areas. This helps mitigate erosion, prevents sediment from reaching waterways, and slows and infiltrates stormwater. You can read more about water bars in the VT Guide for Stormwater Management on Page 24.

Structures and Septic Systems: Your property passed the criteria for the Structures and Septic section of the Lake Wise evaluation, but again there are a few best management practices that can be made for lake stewardship. The septic system shows no evidence of failure, and you maintain the system regularly. The stones around the foundation of the house are a good BMP for roof runoff. A more effective stormwater best management practice would be to establish an infiltration trench, and expand it around the perimeter of the entire house. This will mitigate soil erosion in this area. You could also add shade tolerant plants like ferns, as this vegetation would absorb stormwater runoff and look aesthetically pleasing. See the Vermont Guide to Stormwater Management for Homeowners and Small Business Owners for more information. Overall, the impervious surface of the developed area was about than 25-30% of the total area of the property, so BMPs are critical to maintaining a healthy lake ecosystem. By expanding the existing infiltration trench all the way around the home will increase the water holding capacity and slow down runoff during heavy rain events.



Infiltration trench:





Recreation Area: There are moderate signs of erosion in the recreation area. Although, most of the stormwater flows through an effective buffer, including the existing vegetation on the property. The grass lawn makes up only 20% of the recreation area, which is good as grass does not effectively slow down stormwater as it moves over the property. The recreation areas are defined and limited in space. All gardens are mulched, planted with native vegetation and show no signs of runoff. An improvement would be to minimize this lawn space by creating low mow zones or no mow zone and adding in more dynamic structural vegetation, including trees and shrubs, that will slow down and absorb runoff and create wildlife habitat. Most paths on the property are limited, defined, and not showing erosion or direct runoff into the lake. We encourage you to install a rain garden to improve the pooling in front of house, as this will aid in stormwater infiltration. There is some soil compaction occurring on site, you could minimize your path and patio to a defined sitting area to reduce this. You could also punch holes in the lawn with a pitch fork to improve stormwater infiltration. In general, we recommend creating fewer defined paths and using them to reduce erosion problems in recreation area.

You could consider adding a native clover mix to the grassy area. Grass has relatively short root system and a clover mix may slow down stormwater as it moves in a sheet flow across the recreation area.

Letting the grass grow above 3” can help to slow stormwater that falls on your property, giving it more time to sink into the ground. Lawns can be compacted by everyday use and the weight of the lawn mower. This compaction limits the ability of the lawn to absorb water. By aerating the soil (punching holes through the surface material) you can give water an easier route into instead of across the lawn.

Shorefront and Lake Access: It is important to have a well-established vegetative buffer along the lake shoreline to slow down, spread out and stormwater as it moves across the property. The currently buffer is about 30-40ft, covers 50% of the shore, and is composed of four tiers of vegetation on average. The vegetation along the shoreline is made up of native species, continue to be vigilant of invasive species and consider management if you see then begin to creep in from the surrounding area. By seeding with native ground cover around the path and maintaining a native buffer along the lake shore through planting native species you will be able to create a more natural lake shoreline and maintain the ecological health of Lake Iroquois. We encourage you to improve the dock area to redirect water towards vegetation. You've noticed that the shoreline is slowly eroding due to wake boats and weather, but there are best management practices you can do to prevent the erosion and improve the shoreline and lake health.

A few small changes on the property will help in the sections that you did not pass for the Lake Wise award. The recommendations are designs to help improve your overall score and contribute to a more lake friendly property!

Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Vermont Agency of Natural Resources Lake Wise Program – Promoting Lake Friendly Practices

Roger Jones – Lake Iroquois

Lake Wise Evaluation
Date: October 5th 2022

Lake Wise Evaluator: Adelaide Dumm, WNRCD Conservation Specialist and Remy Crettol, WNRCD District Manager

Address: 277 Dimick Rd, Hinesburg, VT 05461
Permanent Address: Po Box 187 Arlington, VT 05250

Overall Results: Your property passed in all four Lake Wise Assessment Sections! Driveway, Structures & Septic, Recreation Area and Shoreland all passed. Homeowners need to have best management practices in all four sections to promote lake-friendly living and achieve a Lake Wise award. This report includes suggestions to improve stormwater management in the sections that you passed. Congratulations!

Driveway Area: The driveway and parking areas are well defined and suitable in size of the structure, especially with many families visiting throughout the season. There are no signs of erosion on the driveway and parking area, all surfaces are stable. Most of the stormwater moves as sheet flow. The recent re-grading and addition of crushed stone helps infiltrate water and allows excess to move as a sheet flow to the stable vegetated banks on the side. The shoulders and ditches show minimal signs of erosion. Most of the stormwater from the road surface is directed to an effective vegetated buffer in the woods.

Structures and Septic Systems: Your property passed the criteria for the Structures and Septic portion of the Lake Wise Evaluation. While the septic system is older, there is no evidence of failure, and you maintain the system regularly. The tank and pump station are sited far from the water. There is some woody vegetation within 10' of the leach field, I recommend clearing some of this vegetation to mitigate the threat of roots to the system. Additionally, pet waste has lot of phosphorus in it, be sure to pick up any pet waste and dispose of it properly to keep the lake clear and safe for all to use now and into the future.

The house has shown signs of erosion from roof drips. I suggest adding a rain barrel to the downspout on the front porch and using the harvested rainwater to water your flower beds. An added benefit would be to add an infiltration trench along the foundation of the home, it looks like there was one at some point in time, but it likely needs to be repaired and filled back in with stone. This will allow for infiltration of the stormwater runoff and reduce erosion around the foundation of the house. See the Vermont Guide to Stormwater Management for Homeowners and Small Business Owners for more information.

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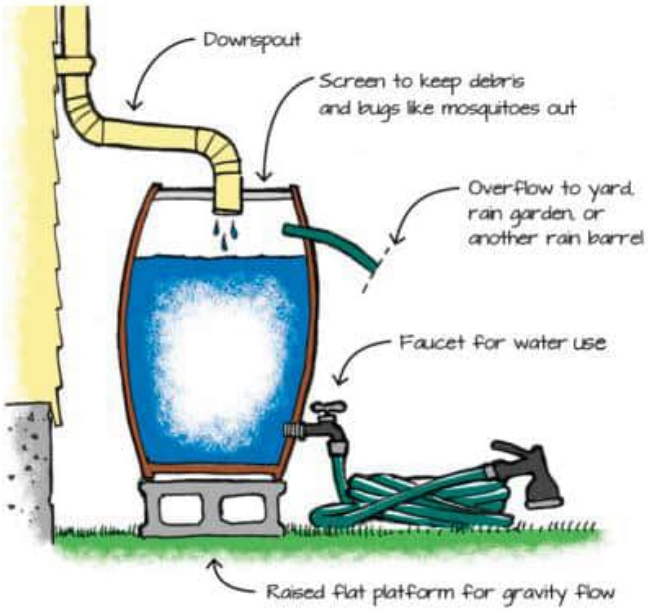
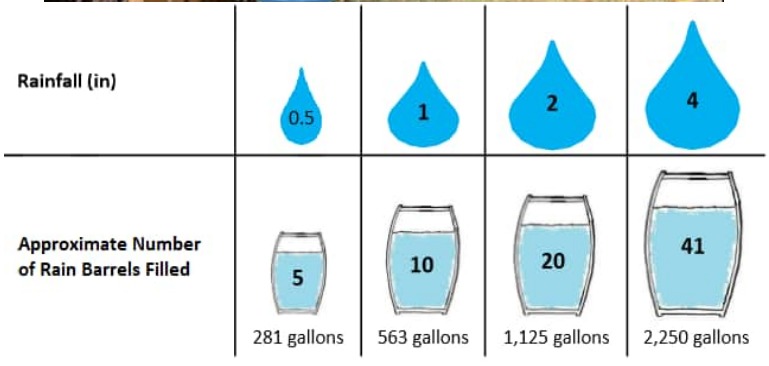
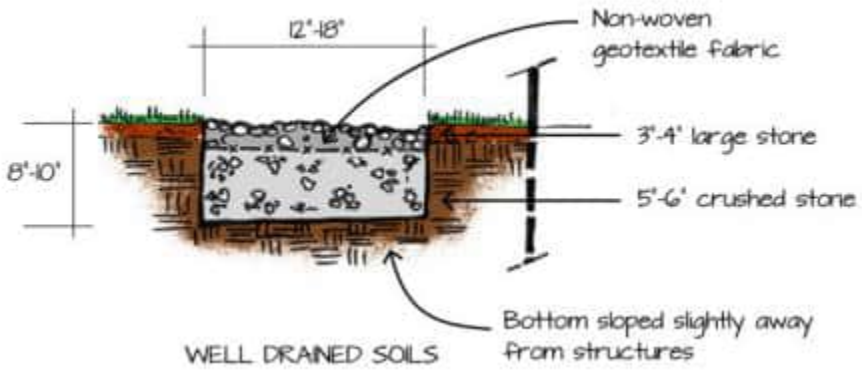




Rain Barrels are relatively easy to install, help retain water on your property, and give you a great resource for gardening. A barrel can come in many shapes and sizes and attach directly to the gutter downspout or be filled with a rain chain. Keeping your barrel covered stops mosquitos from reproducing in it. Be sure to use the water between rainstorms to make sure it can handle the water coming its way. The WNRCD has instructions for building your own if you are interested in a do-it-yourself project.

By expanding the existing infiltration trench all the way around the home will increase the water holding capacity and slow down runoff during heavy rain events.

More information on this can be found in the VT Guide to Storm Water Management for Homeowners and Small Businesses, listed in the Further Resources section on page 13.



There was little to no erosion was seen around the front of the home, and it appears most of the stormwater is absorbed by the vegetation around the property before making its way to the lake. Overall, the impervious surface of the developed area was less than 20% of the total area of the property. Good job!

Recreation Area: The recreation area is a section where your property scored very high due to the limited size. The recreation area is well defined and limited in space, and paths show no signs of erosion and do not convey runoff directly into the lake. There are minimal signs of erosion in the recreation area, and the rose bushes and flower gardens are serving as an effective vegetated buffer, a good example of a best management practice. You could add more vegetation like seasonal grasses to increase the buffering capacity in this area. Overall, this area looks good and serves as a good place for family to gather at the camp, though is not excessive in size.

The patch of grass in the recreation area is a great example of a potential low-mow zone. Letting the grass grow above 3" can help to slow stormwater that falls on your property, giving it more time to sink into the ground before to runs down to the beach area and into the lake. Lawns can be compacted by everyday use and the weight of the lawn mower. This compaction limits the ability of the lawn to absorb water. By aerating the soil (punching holes through the surface material) you can give water an easier route into instead of across the lawn.

Shorefront and Lake Access: The shoreline has a naturally vegetated buffer, with an average width of approximately 40-50ft. Additionally, there are multiple tiers of vegetation present including a tree canopy, shrubs, understory, ground cover and duff layer. It is important to have a well-established vegetative buffer to slow down, spread out and stormwater as it moves across the property. This also creates a more dynamic and aesthetically pleasing view of the lake as he trees frame the view, but do not obstruct it! The vegetation along the shoreline is composed of native species, continue to be vigilant of invasive species and consider management if you see then begin to creep in from the surrounding area. The small foot paths allow for stormwater to move across the land in a sheet flow into vegetated areas and follow the natural topography of the lakeshore area. Allowing the native vegetation to continue to fill in areas of exposed soil will contribute to soil stability. There is some shoreline erosion and undercutting occurring, you could also add in some plants if there is adequate soil depth, but it looks like the area will be naturally re-vegetated in a few years.

If shoreline bank undercutting persists, consider taking a bioengineered approach to fix the problem. The Vermont Bioengineering manual is a useful guide for landowners and resources professionals.

Regrade and slope back, install erosion control blanket, fiber log, & rock toe.

Build encapsulated soil lifts over rock base & toe, plant native woody species.

Leave & patch with erosion control blankets, fiber logs, & stone toe. Plant live stakes.

Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org or Remy Crettol at Remy@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Vermont Agency of Natural Resources Lake Wise Program – Promoting Lake Friendly Practices

Randy Kay– Lake Iroquois

Lake Wise Evaluation
Date: August 4th, 2023

Lake Wise Evaluator: Casey Spencer, WNRCD
Report prepared by Adelaide Dumm, WNRCD

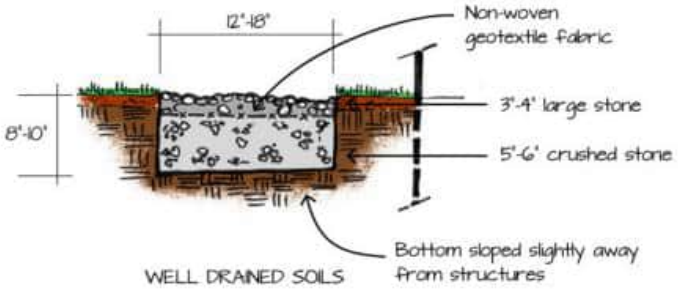
Address: 129 Wood Run, Hinesburg, VT, 05461
Permanent Address: 28 Old Cross Rd, South Burlington, VT, 05403

Overall Results: Your property passed in all four Lake Wise Assessment Sections! Driveway, Structures & Septic, Recreation Area and Shoreland all passed. Homeowners need to have best management practices in all four sections to promote lake-friendly living and achieve a Lake Wise award. This report includes suggestions to improve stormwater management in the sections that you passed. Congratulations!

Driveway Area: The driveway and parking areas are well defined and minimal in size. There are no signs of erosion on the driveway and parking area, all surfaces are stable. Most of the stormwater moves as sheet flow. The grading and addition of crushed stone helps infiltrate water and allows excess to move as a sheet flow to the stable vegetated banks on the side. The shoulders and ditches show minimal signs of erosion. Most of the stormwater from the road surface is directed to an effective vegetated buffer in the woods. Recommendations to this area include the addition of water bars diverting water to the woods before entering the grass area.

Structures and Septic Systems: Your property passed the criteria for the Structures and Septic portion of the Lake Wise Evaluation. There is no evidence of septic system failure, and it is maintained regularly. There was a little pet waste on the property, pet waste has lot of phosphorus in it, be sure to pick up any waste and dispose of it properly to keep the lake clear and safe for all to use now and into the future.

All of the rooftop runoff enters the lake through infiltration or BMPs that are designed to reduce direct runoff. The land around the house shows no signs of erosion from roof drips due to the infiltration trench along the foundation. The infiltration trench you have installed allows for stormwater runoff to be retained on site and reduces erosion around the foundation of the house. See the Vermont Guide to Stormwater Management for Homeowners and Small Business Owners for more information.



By expanding the existing infiltration trench all the way around the home will increase the water holding capacity and slow down runoff during heavy rain events.

More information on this can be found in the VT Guide to Storm Water Management for Homeowners and Small Businesses, listed in the Further Resources section on page 13.

There was little to no erosion seen around the home, and it appears most of the stormwater is absorbed by the vegetation around the property before making its way to the lake. Overall, the impervious surface of the developed area was only 25-30% of the total area of the property. Good job!

Recreation Area: The recreation area is well defined and limited in space, and paths show no signs of erosion and do not convey runoff directly into the lake. There are minimal signs of erosion in the recreation area. You could add more vegetation to increase the buffering capacity in this area. Overall, this area looks good and serves as a good place for family to gather at the camp, though is not excessive in size. One recommendation is to increase no mow or low mow zones to filter stormwater runoff as it travels down to the lake. Letting the grass grow above 3" can help to slow stormwater that falls on your property, giving it more time to sink into the ground before to runs down to the beach area and into the lake. Lawns can be compacted by everyday use and the weight of the lawn mower. This compaction limits the ability of the lawn to absorb water. By aerating the soil (punching holes through the surface material) you can give water an easier route into instead of across the lawn.

Shorefront and Lake Access: The shoreline has a naturally vegetated buffer, with an average width of approximately 15-20ft. Additionally, there are multiple tiers of vegetation present including a tree canopy, shrubs, understory, ground cover and duff layer. It is important to have a well-established vegetative buffer to slow down, spread out and stormwater as it moves across the property. This also creates a more dynamic and aesthetically pleasing view of the lake as he trees frame the view, but do not obstruct it! The vegetation along the shoreline is composed of native species, continue to be vigilant of invasive species and consider management if you see then begin to creep in from the surrounding area. The small foot paths allow for stormwater to move across the land in a sheet flow into vegetated areas and follow the natural topography of the lakeshore area. Allowing the native vegetation to continue to fill in areas of exposed soil will contribute to soil stability. There is some shoreline erosion and undercutting occurring, you could also add in some plants if there is adequate soil depth, but it looks like the area will be naturally re-vegetated in a few years.





Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Vermont Agency of Natural Resources Lake Wise Program – Promoting Lake Friendly Practices

Stacy and Rodney Putnum

Lake Iroquois

Lake Wise Evaluation
Date: May 18th 2023

Lake Wise Evaluator: Adelaide Dumm, WNRCD Conservation Specialist and Casey Spencer, WNRCD District Manager

Address: 332 Pine Shore Drive, Hinesburg VT
Permanent Address: Same

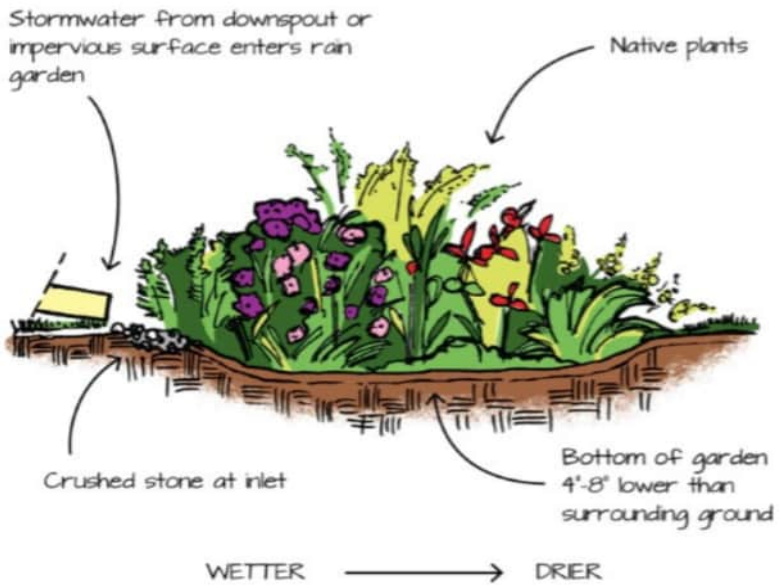
Overall Results: There are improvements that can be made on your property to meet the Lake Wise award standards. You passed in Driveway and Structures & Septic sections of the assessment, but there are improvements that can be made in the Recreation Area and Shoreland sections. Homeowners need to have best management practices in all four sections to promote lake-friendly living and achieve a Lake Wise award. This report includes suggestions to improve stormwater management in the sections that you passed.

Driveway Area: Your property passed in the driveway area section of the Lake Wise assessment. The driveway and parking areas are mostly defined and well maintained but are somewhat excessive in size. Decreasing the size of the driveway or parking areas and increasing the amount of vegetation or green space on the property would improve filtration of stormwater before it enters the lake. It is good that you are directing some of the stormwater off the driveway and into the lawn, but grass has a relatively short root system and doesn't do much to slow down stormwater. Adding a rain garden or more established vegetation buffer along the driveway is another approach that will help filter stormwater as it moves across the driveway and parking area.

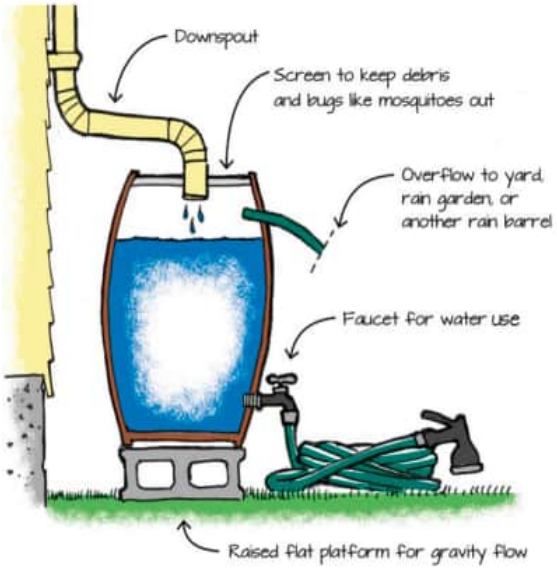
Digging gravel lined trenches along the road edge to divert the water into a more stable vegetated area, like the gardens at the top of the lawn, before it reaches the driveway is one solution to preventing erosion along the roadway and the top of your driveway. Adding a gravel lined trench to divert water or adding more perennial plants on the bank of the driveway will stabilize surfaces and prevent erosion down the driveway slope.

Rain Gardens capture and slow water that runs off parking lots, driveways, and walkways. They use native plants to slow and filter water. Ultimately water is either infiltrated into the ground or is absorbed by the plants and release back into the atmosphere. Plants used in rain gardens should be both drought resistant and able to handle prolonged periods of submersion in water.

You could add a rain garden in your yard where water from the drive way is diverted to, so that it is being absorbed by vegetation instead of running across the lawn and into the brook.



Structures and Septic Systems: Your property passed the criteria for the Structures and Septic portion of the Lake Wise Evaluation. While the septic system is older (2007), there is no evidence of failure, and you maintain the system regularly and the system is more than 50 feet away from the water. We encourage you to disconnect your downspout and add a rain barrel. The other downspout could be directed to the cedars at the edge of the lawn as they will absorb water much more than the grass in the lawn will. Additionally, adding more vegetation at the lower garden at the base of the deck to absorb water coming off the deck and from the downspout that is buried in the garden.



The house shows little signs of erosion from roof drips and erosion. You could add more shrubbery and gardens around the home that would act as water filtration and sponges to soak up stormwater. I suggest adding a rain barrel to the downspout and using the harvested rainwater to water your flower beds. See the Vermont Guide to Stormwater Management for

Homeowners and Small Business Owners for more information. You could also add a dry well or infiltration trench around the home to increase water folding capacity as it runs off the impervious surfaces (roof of the house, decks/patio, garage roof, etc.) before making its way to the lake. Overall, the impervious surface of the developed area was about than 20-25% of the total area of the property. Good job!

Recreation Area: The recreation area is a section where you would enhance your property through best management practices to achieve the Lake Wise award. There are minimal signs of erosion in the recreation area and mainly consists of a large grass lawn right up to the lake shoreline. This area is well defined but is not limited in space, 30-40% of the property is grass. Grass has relatively short root systems and has a minimal impact on slowing down, spreading out, or helping stormwater sink into the ground before entering the lake. An easy best management practice you could adopt a no mow zone, or low mow zone especially in the upper parcel! Improve your Lake Wise assessment score by doing less!

The patch of grass in the side yard and the back parcel across the road is a great example of a potential no mow or low mow zones with a minimum of approximately 15 ft buffer on the lake shore. Letting the grass grow above 3" can help to slow stormwater that falls on your property, giving it more time to sink into the ground. Lawns can be compacted by everyday use and the weight of the lawn mower. This compaction limits the ability of the lawn to absorb water. By aerating the soil (punching holes through the surface material) you can give water an easier route into instead of across the lawn.

Shorefront and Lake Access: The ideal shoreline has a naturally vegetated buffer, with multiple tiers of vegetation present including a tree canopy, shrubs, understory, ground cover and duff layer. It is important to have a well-established vegetative buffer to slow down, spread out and stormwater as it moves across the property. The vegetation along the shoreline at your property is mostly grass down to the water. Allowing the native vegetation to fill in areas will contribute to soil stability. You could also add in some plants like tall perennial grasses, sedges, or native shrubs if there is adequate soil depth, but if you choose to no mow along the shoreline the area will be naturally re-vegetated in a few years.

	Well Drained Soils	Wet or Moist Soils	Shallow, Rocky Soils	Tolerant of Varying Soils
Tall Trees	Sugar maple Black cherry American beech Red oak Paper birch	Red maple Swamp white oak Hemlock Cedar Black willow	Red spruce White pine Black cherry Balsam fir Eastern red cedar White oak Burr oak	Yellow birch Red maple Sugar maple Eastern red cedar Oaks
Shrubs	Highbush cranberry Serviceberry Highbush blueberry Hobble bush* Alternative leaf dogwood	Nannyberry Winterberry Highbush cranberry Witch hazel Silky dogwood Elderberry Sweetgale Black chokeberry Willows	Witch hazel Serviceberry Lowbush blueberries Sweet fern Low grow fragrant sumac Meadowsweet (white spirea) Snowberry	Highbush cranberry Nannyberry Gray dogwood Sweet fern Arrowwood Snowberry Maple leaf viburnum
Perennials	Foxglove beardtongue New England aster Blue flag Iris Big bluestem Columbine Christmas fern Lady fern Appalachian sedge Pennsylvania sedge	Cardinal flower Blue flag iris Cinnamon fern Turtlehead Joe pye weed Swamp milkweed Boneset	All asters Sarsaparilla Wild bergamot (wild bee balm) Little blue stem Christmas fern Common yarrow	Partridgeberry* Canadian mayflower* New England aster Sarsaparilla Blue flag iris Cinnamon fern Big bluestem Little bluestem Wild bergamot (wild bee balm)

* requires shade

The retaining walls contribute to shoreline erosion, as wave energy pushes against the wall it is diverted to the left and right of the barrier and causes erosion on either side. A living shoreline is the best option for a healthy lake ecosystem. After vegetation has been removed, shorelines erode. Homeowners often install hard structures to protect their property. However, these walls create many problems including:

■ **Wave flanking:** When waves hit the walls, the energy is deflected sideways, causing more concentrated and intensive erosion down shore.

■ **Lakebed scouring:** Wave energy is also deflected downwards, scooping out sediments on the lake bottom. This can severely compromise vital shallow water habitat as well as the structural integrity of the wall.

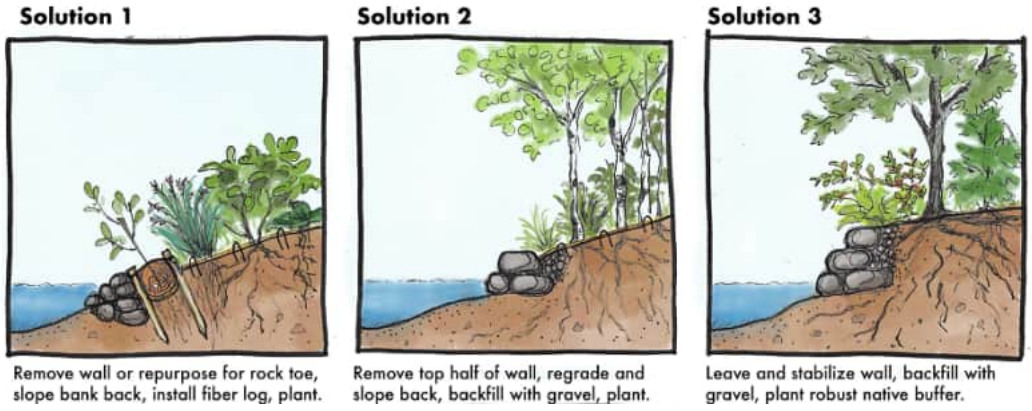
■ **Wildlife barriers:** Vertical walls break the interface between the lake and shore and cause barriers for wildlife to reach the shore to feed, nest, and rest, such as turtles laying eggs on shore.

"Eroding banks were often stabilized by constructing sea walls and other hardscape techniques. However, now we know that clearing shoreland vegetation and hard armoring the shoreline degrades the lake system, including its water quality, aquatic and terrestrial habitat, and overall resiliency.

The once conventional shoreland practices are rapidly being replaced with a suite of lake-friendly shoreland Best Management Practices including bioengineering techniques for lake-friendly development. Bioengineering techniques are restorative practices for stabilizing shorelands while offering multiple clean water and wildlife benefits. Bioengineering practices increase the resilience of our lake ecosystems in the face of climate change, filter and clean upland runoff before it reaches the lake, and provide critical wildlife habitat."

Vermont Bio-engineering Manual, page 3.

As part of the Lake Iroquois and Patrick Brook Watershed Action Plan, WNRCD and our partners are scoping potential DEC Clean Water projects for prioritization and proposal. This may be a good candidate! Be sure to acquire any necessary permitting, to determine which permits you may need visit DEC Permit Navigator tool and review the Vermont Bioengineering manual to review options for retaining wall mitigations, below are a few options.



Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org or Casey Spencer at Casey@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Vermont Agency of Natural Resources Lake Wise Program – Promoting Lake Friendly Practices

Additional Resources:

Be sure to acquire any necessary permitting, to determine which permits you may need visit DEC Permit Navigator tool: https://permitnavigator.my.vermont.gov/s/

The Vermont Shoreland Protection Act Summary: https://dec.vermont.gov/sites/dec/files/wsm/lakes/docs/Shoreland/ShorelandProtectionActSummary_2272017.pdf

Vermont Bio-engineering Manual:https://dec.vermont.gov/content/vermont-bioengineering-manual

Sharing the Edge, a guide for lake shore property owners in Vermont: https://dec.vermont.gov/content/sharing-edge-guide-lakeshore-property-owners-vermont

VT Guide to Stormwater Management— A document with great information about managing stormwater at home: https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/2018-06-14%20VT_Guide_to_Stormwater_for_Homeowners.pdf

Lake Iroquois Association- Lake Shore Property Owners Manual: https://www.lakeiroquois.org/fileadmin/files/Shoreline_Health/Property_Owners_Manual_07.25.22.pdf

Agency of Natural Resources Atlas– Free online mapping software to explore the natural resources around your home: https://anrmaps.vermont.gov/websites/anra5/

Vermont Department of Environmental Conservation Stormwater—Information about green stormwater infrastructure: http://dec.vermont.gov/watershed/cwi/green-infrastructure

The Vermont Rain Garden Manual: Gardening to Absorb the Storm—A guide to building your own rain garden with emphasis on using plants that are native to Vermont: http://winooskinrcd.org/wp-content/uploads/VTRainGardenManual.pdf

Better Backroads Manual—A guide to managing dirt and gravel roads that can be useful if you have a long driveway: https://vtrans.vermont.gov/sites/aot/files/highway/2009%20Better%20Backroads%20Manual.pdf

Household Septic Maintenance Factsheet — WNRCD: http://winooskinrcd.org/wp-content/uploads/managing-HH-septic-factsheet.pdf

Winooski Natural Resources Conservation District —Find other ways to get involved at our website www.winooskinrcd.org

Mark and Michelle Reid

Lake Iroquois

Lake Wise Evaluation
Date: May 18th 2023

Lake Wise Evaluator: Adelaide Dumm, WNRCD Conservation Specialist and Casey Spencer, WNRCD District Manager

Address: 310 Pine Shore Drive Hinesburg, VT
Permanent Address: Same

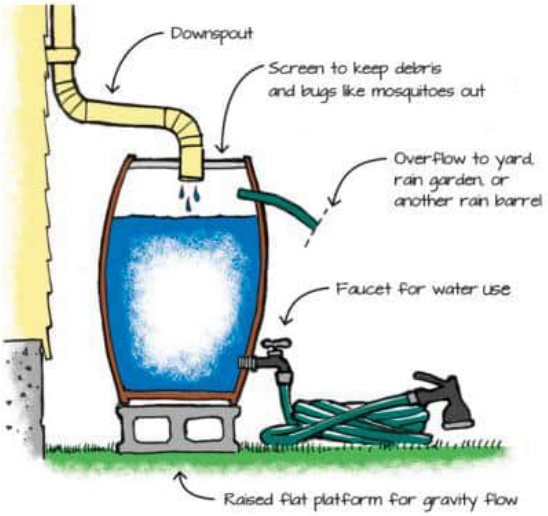
Overall Results: There are improvements that can be made on your property to meet the Lake Wise award standards. You passed in the Driveway, Structures & Septic section of the assessment, but there are improvements that can be made in the Recreation Area and Shoreland sections. Homeowners need to have best management practices in all four sections to promote lake-friendly living and achieve a Lake Wise award. This report includes suggestions to improve stormwater management in the sections that you passed.

Driveway Area: Your property passed in the driveway and parking area section. They are mostly defined and well maintained but are slightly excessive in size. Decreasing the size of the driveway or parking areas and increasing the amount of vegetation or green space on the property would improve filtration of stormwater before it enters the lake. Adding a rain garden or more established vegetated swale along the bottom or sides of the driveway is another approach that will help filter stormwater as it moves across the driveway and parking area. There are severe signs of erosion on the bottom driveway and parking area, as indicated in the red circles. Stormwater is more channelized than a sheet flow across this area.

Be sure to keep this culvert cleared out so that is remains functional. The gravel lined trench is an effective way of capturing and slowing down stormwater as it moves off the road surface.

The gravel lined trenches that are near the top of the driveway have the potential to divert the water into a more stable vegetated area. We recommend partnering with your neighbor, Lisa Thompson, and adding a vegetated filter berms to direct stormwater to the large bushes she has on her property if she is amenable to this practice. From the conversation we had during our visit she sounds like she is! Another solution could be to add more perennial plants on the bank of the driveway as they will stabilize surfaces and prevent erosion down the driveway slope. The shoulders and ditches show minimal signs of erosion. The gravel lined trench at the front of the property with the French drainage system below in the yard is a good best management practice for stormwater! These gravel lined trench to divert stormwater at the crest of the slope and direct runoff from the road to areas on the side of the driveway/top of your yard and help in mitigating the erosion you are seeing in this area.

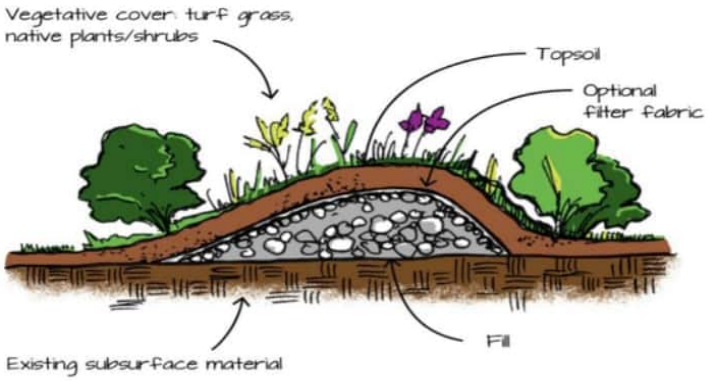
<u>Structures and Septic Systems:</u> Your property passed the criteria for the Structures and Septic portion of the Lake Wise Evaluation. There is no evidence of septic system failure, and you maintain the system regularly. The tank is sited more than 50 feet away from the water and the leach field is free of woody vegetation that could cause any damage to the system.



The house shows little signs of erosion from roof drips and erosion. You could add more shrubbery and gardens around the home that would act as water filtration and sponges to soak up stormwater. I suggest adding a rain barrel to the downspout and using the harvested rainwater to water your flower beds. See the Vermont Guide to Stormwater Management for Homeowners and Small Business Owners for more information. The infiltration trench around the home is great at increasing stormwater folding capacity as it runs off the impervious surfaces before making its way to the lake. Overall, the impervious surface of the developed area was about than 20-25% of the total area of the property. Good job!

You could plant some vegetation in front of this drain so that the stormwater rom the roof is absorbed before it goes into the lake.

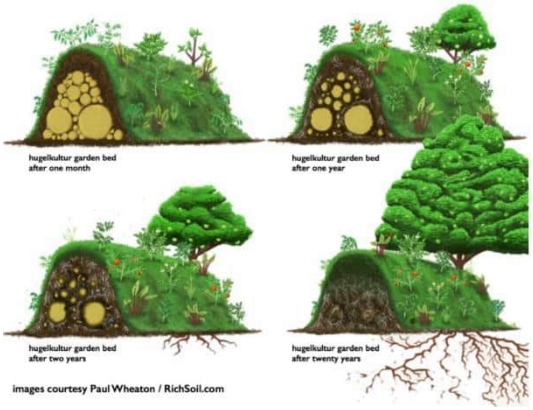
Recreation Area: The recreation area is a section where you would enhance your property through best management practices to achieve the Lake Wise award. There are minimal signs of erosion in the recreation area and mainly consists of a large grass lawn right up to the lake shoreline. This area is well defined but is not limited in space- more than 40% of the property is grass. Grass has relatively short root systems and has a minimal impact on slowing down, spreading out, or helping stormwater sink into the ground before entering the lake. An easy best management practice you could adopt a no mow zone, or low mow zone! Improve your Lake Wise assessment score by doing less!



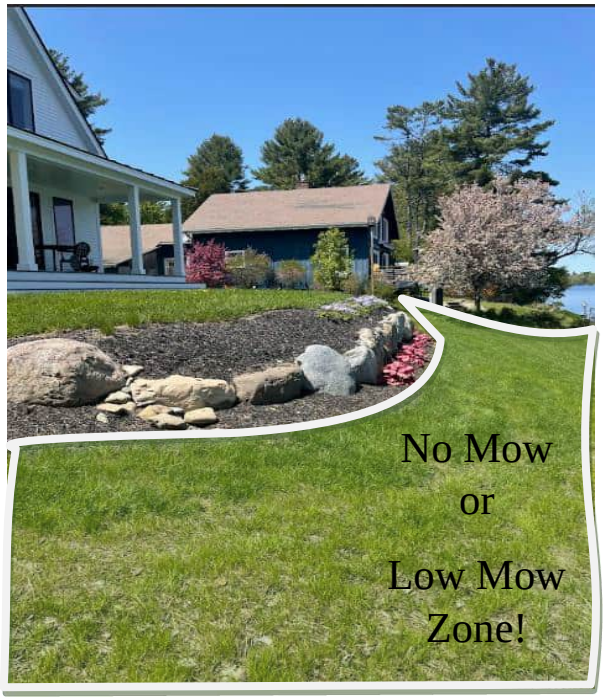
VT Guide to Storm Water Management for Homeowners and Small Businesses—page 26

Filter berms capture and slow water that runs off parking lots, driveways, and walkways. Their interior is filled with stable, well drained material that absorbs and slows stormwater runoff. Vegetation on the outside of the berm provides more structure and helps further slow stormwater. You could use these in a terraced fashion to both slow down runoff as it makes it way down your grass lawn and divert it to a more table area to be absorbed by plants in Lisa's yard.

Hügelkultur a common permaculture practice is an innovative way to create these filter berms, these mounded beds are a horticultural technique where a mound constructed from decaying wood debris and other compostable biomass plant materials is later planted as a raised bed. By incorporating these in terraced fashion you can slow down stormwater and divert it to a more stable vegetated area.



The natural topography of the landscape has been maintained and enhanced as you created the berm off the back deck overlooking the lake. This acts as a speed lump in your lawn as water flows over the landscape, and adding vegetation will help absorb stormwater as it moves across the landscape! By partnering with your neighbor Lisa and adding vegetated filter berms to direct water to a more stable area to be absorbed before it enters the lake will help improve your recreation area score. The French drainage system in the yard at the front of the house is an effective Best Management Practice (BMP) for that stormwater from the road runs through as it makes it way down the watershed and into the lake.



The patch of grass in the front/side yard is a great example of a potential no mow or low mow zone with a minimum of approximately 15 ft buffer on the lake shore. Letting the grass grow above 3” can help to slow stormwater that falls on your property, giving it more time to sink into the ground. Lawns can be compacted by everyday use and the weight of the lawn mower. This compaction limits the ability of the lawn to absorb water. By aerating the soil (punching holes through the surface material) you can give water an easier route into instead of across the lawn.

Shorefront and Lake Access: The ideal shoreline has a naturally vegetated buffer, with multiple tiers of vegetation present including a tree canopy, shrubs, understory, ground cover and duff layer. It is important to have a well-established vegetative buffer to slow down, spread out and stormwater as it moves across the property. The vegetation along the shoreline at your property is mostly grass down to the water and there are a few garden beds that are planted with perennial flowers, but the yard is very manicured. Allowing the native vegetation to fill in areas will contribute to soil stability. You could also add in some plants like tall perennial grasses, sedges, or native shrubs along the waterfront if there is adequate soil depth, but if you choose to no mow along the shoreline the area may become naturally re-vegetated in a few years.

Retaining walls contribute to shoreline erosion, as wave energy pushes against the wall it is diverted to the left and right of the barrier and causes erosion on either side. A living shoreline is the best option for a healthy lake ecosystem. After vegetation has been removed, shorelines erode. Homeowners often install hard structures to protect their property. However, these walls create many problems including:

■ **Wave flanking:** When waves hit the walls, the energy is deflected sideways, causing more concentrated and intensive erosion down shore.

■ **Lakebed scouring:** Wave energy is also deflected downwards, scooping out sediments on the lake bottom. This can severely compromise vital shallow water habitat as well as the structural integrity of the wall.

■ **Wildlife barriers:** Vertical walls break the interface between the lake and shore and cause barriers for wildlife to reach the shore to feed, nest, and rest, such as turtles laying eggs on shore.

Prioritize making improvements to this side first as the other side of the retaining wall is in better condition than this side.

As part of the Lake Iroquois and Patrick Brook Watershed Action Plan, WNRCD and our partners are scoping potential DEC Clean Water projects for prioritization and proposal. This may be a good candidate!

"Eroding banks were often stabilized by constructing sea walls and other hardscape techniques. However, now we know that clearing shoreland vegetation and hard armoring the shoreline degrades the lake system, including its water quality, aquatic and terrestrial habitat, and overall resiliency.

The once conventional shoreland practices are rapidly being replaced with a suite of lake-friendly shoreland Best Management Practices including bioengineering techniques for lake-friendly development. Bioengineering techniques are restorative practices for stabilizing shorelands while offering multiple clean water and wildlife benefits. Bioengineering practices increase the resilience of our lake ecosystems in the face of climate change, filter and clean upland runoff before it reaches the lake, and provide critical wildlife habitat." Vermont Bio-engineering Manual, page 3.

Additional Resources:

Be sure to acquire any necessary permitting, to determine which permits you may need visit DEC Permit Navigator tool: https://permitnavigator.my.vermont.gov/s/

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Household Septic Maintenance Factsheet — WNRCD: http://winooskinrcd.org/wp-content/uploads/managing-HH-septic-factsheet.pdf

Winooski Natural Resources Conservation District —Find other ways to get involved at our website www.winooskinrcd.org

Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org or Casey Spencer at Casey@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at

Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Vermont Agency of Natural Resources Lake Wise Program – Promoting Lake Friendly Practices

Katherine Riley – Lake Iroquois

Lake Wise Evaluation
Date: October 5th 2022

Lake Wise Evaluator: Adelaide Dumm, WNRCD Conservation Specialist and Remy Crettol, WNRCD District Manager

Address: 452 Southwest Shore Road Hinesburg, VT 05461
Permanent Address: Same

Overall Results: There are improvements that can be made on your property to meet the Lake Wise award standards. You passed in Driveway and Structures & Septic sections of the assessment, but there are improvements that can be made in the Recreation and Shoreland sections. Homeowners need to have best management practices in all four sections to promote lake-friendly living and achieve a Lake Wise award. This report includes suggestions to improve stormwater management in the sections that you passed.

<u>Driveway Area:</u> The driveway section passed for the Lake Wise Award section, but this was by a very thin margin and there are still improvements that can be made. We have included recommendations within this report. The driveway and parking areas are well defined and suitable in size. There are minimal signs of erosion on the driveway and parking area, all surfaces are stable. Most of the stormwater moves as sheet flow. The shoulders and ditches do not show signs of erosion. The stormwater from the road surface is directed to an effective vegetated buffer in the woods.

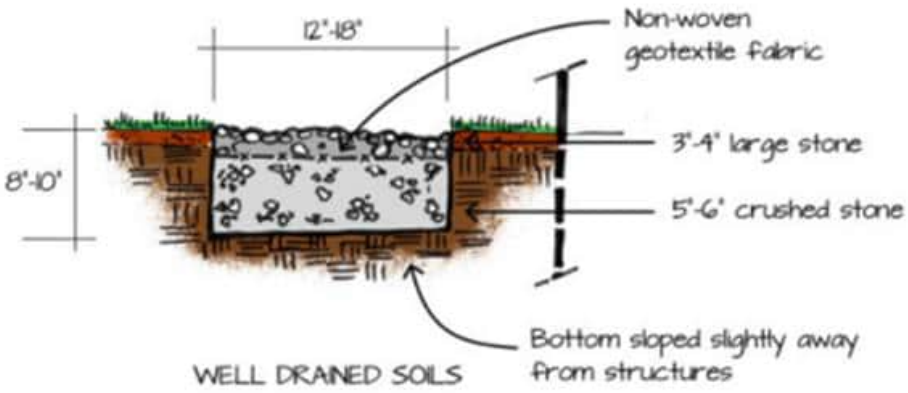
Adding a water bar above the stone walkway to the home will divert stormwater to a more stable vegetated area of the yard. Additionally, you could plant some shrubs or trees, we chatted about a red osier dogwood, to help absorb some of that water.

Structures and Septic Systems: Your property passed the criteria for the Structures and Septic section of the Lake Wise evaluation, but again there are a few best management practices that can be made for lake stewardship. While the septic system is older, there is no evidence of failure, and you maintain the system regularly. I do recommend you continue to have someone come out to clear the vegetation (large woody vegetation: trees and shrubs) growing on the leach field to prevent damage to the system on the future.

The roof drips from the house and garage enters the lake through infiltration trenches, an effective stormwater best management practice. I recommend expanding the infiltration trenches to the other sides of the structures. See the Vermont Guide to Stormwater Management for Homeowners and Small Business Owners for more information. Overall, the impervious surface of the developed area was about than 25-30% of the total area of the property, so BMPs are critical to maintaining a healthy lake ecosystem.

By expanding the existing infiltration trench all the way around the home will increase the water holding capacity and slow down runoff during heavy rain events. An infiltration trench will increase the water holding capacity and slow down runoff during heavy rain events

The steppingstones are a good way to define the pathway and prevent erosion, but the mulched areas with little vegetation have the potential to get washed out during heavy rains or spring snow melt. Add more vegetation to fill in mulched areas to improve this section.



You could expand the infiltration trench or add more vegetation to the lake facing side of the home. This will help absorb storm water runoff before it enters the lake, a rain garden or shrubs might be a good choice for this spot.

Recreation Area: There are minimal signs of erosion in the recreation area. Some of the stormwater flows through an effective buffer, including the existing vegetation on the property. However, the grass lawns that make up most of the recreation area do not slow down stormwater as it moves over the property. The recreation area is somewhat defined and limited in space, but the lawn makes up 30-40 % of the recreation area. An improvement would be to minimize this lawn space by adding in more dynamic structural vegetation that will slow down and absorb runoff and create wildlife habitat. The main path from the driveway to the home is the main established path on the property and are signs of erosion from the driveway indicating that runoff is occurring. Other pathways are limited like the steppingstones, and no not convey show signs of erosion or convey runoff directly to the lake.

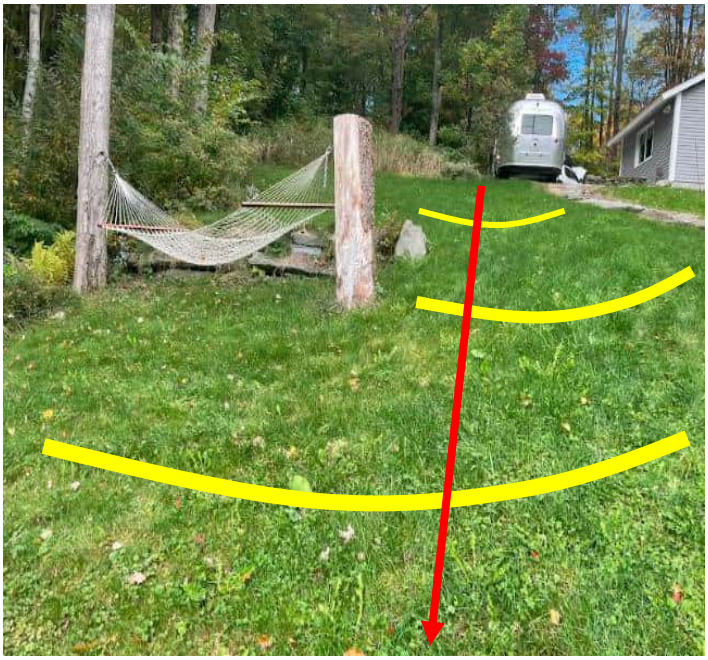
The garden beds that are planted with shrubs and native perennials are holding soil in place and slowing down stormwater as it moves over the property.

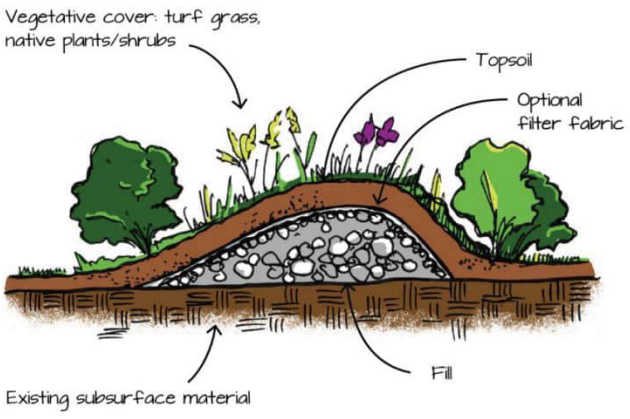
In a heavy rain the mulch will run off on this steep of a slope and deliver nutrients to the lake. Adding more vegetation in this are will help fill in the garden bed and prevent future runoff.

You could consider adding a native clover mix to the grassy area. Grass has relatively short root system and a clover mix may slow down stormwater as it moves in a sheet flow across the recreation area.

The grass lawn is a great example of a potential low-mow zone, especially on this steep slope that can be challenging to mow. Letting the grass grow above 3" can help to slow stormwater that falls on your property, giving it more time to sink into the ground. Lawns can be compacted by everyday use and the weight of the lawn mower. This compaction limits the ability of the lawn to absorb water. By aerating the soil (punching holes through the surface material) you can give water an easier route into instead of across the lawn.

Adding a series of filter berms is another excellent option to slow down, spread out, and allow stormwater to sink in. A berm is a mound of earth with gradually sloping sides between areas of similar elevation. Composing the inner portion of the berm with stable, well-drained fill or sand enables this feature to redirect and retain flow while slowing, filtering, and infiltrating stormwater runoff. See the Vt Guide to stormwater management guide for more details, page 26.





The firepit is well defined, and the wood reinforced boarder helps to divert water to the grassy area on the side which prevents the small stones from washing into the lake. The back side of the firepit area, closest to the lake, does show some signs of erosion and by planting along the edge you would be establishing a buffer for the lake and creating some privacy. Tall grasses or sedges would be a good option! You could also ass plants atop the rock file, which would increase aesthetics and function as wildlife habitat for pollinators. The Vermont wetland supply company has many native seed mixes that you could try along the shoreline.

Shorefront and Lake Access: It is important to have a well-established vegetative buffer along the lake shoreline to slow down, spread out and stormwater as it moves across the property. The currently buffer covers only 25% of the shore and is composed of just one or two tiers of vegetation. The vegetation along the shoreline is made up of native species, continue to be vigilant of invasive species and consider management if you see then begin to creep in from the surrounding area. By adding a native buffer along the lake shore through planting native species, participating in a no-mow zone or other creative ideas like linear rain garden along the shore you will be able to create a more natural lake shoreline and maintain the ecological health of Lake Iroquois.

A few small changes on the property will help in the sections that you did not pass for the Lake Wise award. The recommendations are designs to help improve your overall score and contribute to a more lake friendly property!

Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org or Remy Crettol at Remy@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Vermont Agency of Natural Resources Lake Wise Program – Promoting Lake Friendly Practices

Chris Scott – Lake Iroquois

Lake Wise Evaluation
Date: August 8th 2023

Lake Wise Evaluator: Casey Spencer, WNRCD
Report completed by Adelaide Dumm, WNRCD

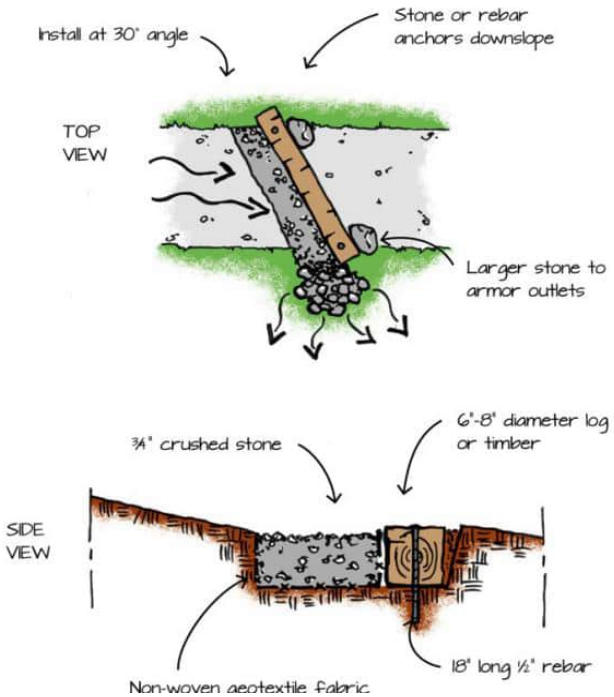
Address: 840 Beebe Ln, Williston, VT, 05495
Permanent Address: 76 Iroquois Ln, Williston, VT, 05495

Overall Results: There are improvements that can be made on your property to meet the Lake Wise award standards. You passed in the Structures & Septic, Recreational and Shoreland sections of the assessment, but there are improvements that can be made in the Driveway section. Homeowners need to have best management practices (BMPs) in all four sections to promote lake-friendly living and achieve a Lake Wise award. This report includes suggestions to improve stormwater management. You will receive a certificate of recognition for the sections which passed and this report details the BMPs you can implement to receive a Lake Wise award in the future.

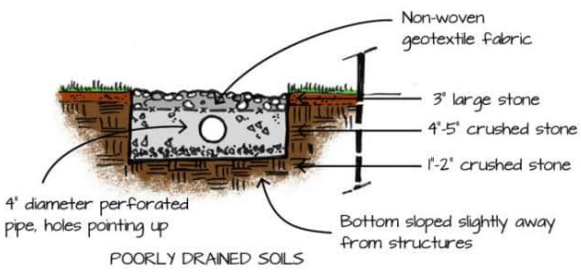
Driveway Area: The driveway section did not pass in the Lake Wise assessment section, and there are improvements that can be made. The driveway and parking areas are well defined and minimal in size, but there are signs of erosion on the driveway and parking area. Although the driveway and parking surfaces are not eroding and unstable, over 10% of the driveway shoulder and ditch areas are eroding and unstable. The stormwater runoff is more sheet flow than channelized in this area and some of the runoff is directed to a stable vegetated buffer or BMP.

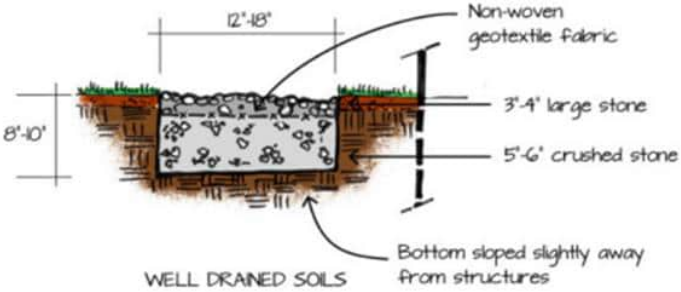
Adding a water bar will divert stormwater to a more stable vegetated area. Additionally, you could plant shrubs or trees to help absorb some of that water. We encourage you to fix the channelized erosion on the shoulder of the driveway and incorporate perennial vegetation at the top of driveway and continue to plant vegetation at bottom by septic system.

Water Bars:
Water bars intercept water flowing down unpaved paths or driveways and redirect it to stable, vegetated areas. This helps mitigate erosion, prevents sediment from reaching waterways, and slows and infiltrates stormwater. You can read more about water bars in the VT Guide for Stormwater Management on Page 24.



<u>Structures and Septic Systems:</u> Your property passed the criteria for the Structures and Septic section of the Lake Wise evaluation, but again there are a few best management practices that can be made for lake stewardship. The septic system shows no evidence of failure, and you maintain the system regularly. The infiltration trench around the structure is a good BMP for roof drips. A more effective stormwater best management practice would be to expand the stones as a walkway, to mitigate soil erosion in this area. You could also construct a retaining wall for the wooded bank that has exposed soil. The retain wall could be built out of stone and shade tolerant plants like ferns added to the top of the wall, as this vegetation would absorb stormwater runoff and look aesthetically pleasing. See the Vermont Guide to Stormwater Management for Homeowners and Small Business Owners for more information. Overall, the impervious surface of the developed area was about than 20-25% of the total area of the property, so BMPs are critical to maintaining a healthy lake ecosystem. By expanding the existing infiltration trench all the way around the home will increase the water holding capacity and slow down runoff during heavy rain events.





Recreation Area: There are some significant signs of erosion in the recreation area. Some of the stormwater flows through an effective buffer, including the existing vegetation on the property. However, the grass lawns that make up most of the recreation area do not slow down stormwater as it moves over the property. All of the recreation areas are defined and limited in space, but the lawn makes up 20 % of the recreation area. All gardens are mulched, planted with native vegetation and show no signs of no runoff. An improvement would be to minimize this lawn space by creating low mow zones or no mow zone and adding in more dynamic structural vegetation that will slow down and absorb runoff and create wildlife habitat. The main path is a well-established stone path and are signs of erosion with exposed soil. Other paths on the property are limited, defined, and not showing erosion or direct runoff into the lake.

You could consider adding a native clover mix to the grassy area. Grass has relatively short root system and a clover mix may slow down stormwater as it moves in a sheet flow across the recreation area.

The grass lawn is a great example of a potential low-mow zone, especially on this steep slope that can be challenging to mow. Letting the grass grow above 3” can help to slow stormwater that falls on your property, giving it more time to sink into the ground. Lawns can be compacted by everyday use and the weight of the lawn mower. This compaction limits the ability of the lawn to absorb water. By aerating the soil (punching holes through the surface material) you can give water an easier route into instead of across the lawn.

Shorefront and Lake Access: It is important to have a well-established vegetative buffer along the lake shoreline to slow down, spread out and stormwater as it moves across the property. The currently buffer covers only 15-20ft but covers 50% of the shore and is composed of five tiers of vegetation on average. The vegetation along the shoreline is made up of native species, continue to be vigilant of invasive species and consider management if you see then begin to creep in from the surrounding area. By seeding with native ground cover around the path and maintaining a native buffer along the lake shore through planting native species you will be able to create a more natural lake shoreline and maintain the ecological health of Lake Iroquois.

A few small changes on the property will help in the sections that you did not pass for the Lake Wise award. The recommendations are designs to help improve your overall score and contribute to a more lake friendly property!

Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Karen Villanti – Lake Iroquois

Lake Wise Evaluation
Date: October 6th 2022

Lake Wise Evaluator: Adelaide Dumm, WNRCD Conservation Specialist and Remy Crettol, WNRCD District Manager

Address: 1004 Beebe Lane Williston, VT
Permanent Address: 112 Primrose Lane Williston, VT

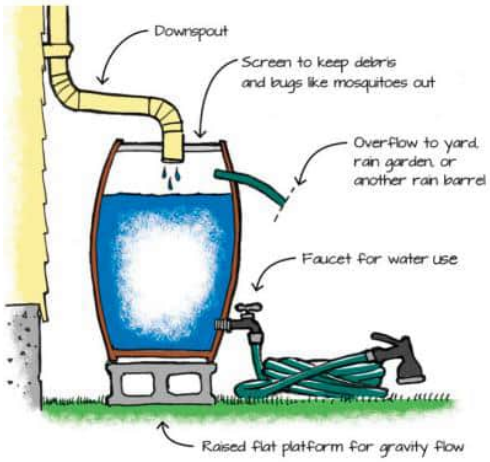
Overall Results: Your property passed in all four Lake Wise Assessment Sections! Driveway, Structures & Septic, Recreation Area and Shoreland all passed. Homeowners need to have best management practices in all four sections to promote lake-friendly living and achieve a Lake Wise award. This report includes suggestions to improve stormwater management in the sections that you passed. Congratulations!

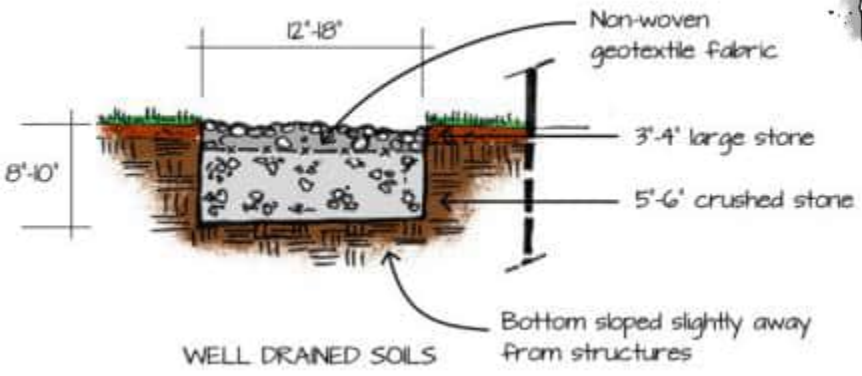
Driveway Area: The driveway and parking areas are well defined and suitable in size. There are no signs of erosion on the driveway and parking area, all surfaces are stable. Most of the stormwater moves as sheet flow. The shoulders and ditches show minimal signs of erosion. Adding stones and perennial plants on the bank of the driveway will stabilize surfaces and prevent erosion down the driveway slope. The stormwater from the road surface is directed to an effective vegetated buffer in the woods.

The patch of grass in the side yard is a great example of a potential low-mow zone. Letting the grass grow above 3" can help to slow stormwater that falls on your property, giving it more time to sink into the ground. Lawns can be compacted by everyday use and the weight of the lawn mower. This compaction limits the ability of the lawn to absorb water. By aerating the soil (punching holes through the surface material) you can give water an easier route into instead of across the lawn.

<u>Structures and Septic Systems:</u> Your property passed the criteria for the Structures and Septic portion of the Lake Wise Evaluation. While the septic system is older, there is no evidence of failure, and you maintain the system regularly. The tank is sited far from the water. I do recommend you have someone come out to determine exactly where the leach field and pipelines are.

The house has shown signs of erosion from roof drips and erosion along the steep bank leading down to the lake. I suggest adding gutters and rain barrel to the other downspout and using the harvested rainwater to water your flower beds. An alternative is to add an infiltration trench along the foundation of the home on the lakefront side. This will allow for infiltration of the stormwater runoff and reduce erosion along the banks. See the Vermont Guide to Stormwater Management for Homeowners and Small Business Owners for more information.





An infiltration trench will increase the water holding capacity and slow down runoff during heavy rain events

There was little to no erosion was seen around the front of the home, and it appears most of the stormwater is absorbed by the vegetation along the road. Overall, the impervious surface of the developed area was about than 20-25% of the total area of the property. Good job!

Recreation Area: The recreation area is a section where your property scored very high. The improvements you've made since purchasing the property has paid off! There are no signs of erosion in the recreation area, and the rock retaining wall with flower garden are serving as an effective vegetated buffer, a good example of a best management practice. The recreation area is well defined and limited in space, and paths show no signs of erosion and do not convey runoff directly into the lake. You could add some blueberry bushes, or other native vegetation along the slope to help stabilize soil on the downslope side of the retaining wall. Overall, this area looks good and serves as a good stormwater management example.

You could consider adding a native clover mix to the grassy area. Grass has relatively short root system and a clover mix may slow down stormwater as it moves in a sheet flow across the recreation area.

Shorefront and Lake Access: The shoreline has a naturally vegetated buffer, with an average width of approximately 30-40 ft. Additionally, there are multiple tiers of vegetation present including a tree canopy, shrubs, understory, ground cover and duff layer. It is important to have a well-established vegetative buffer to slow down, spread out and stormwater as it moves across the property. The vegetation along the shoreline is composed of native species, continue to be vigilant of invasive species and consider management if you see then begin to creep in from the surrounding area

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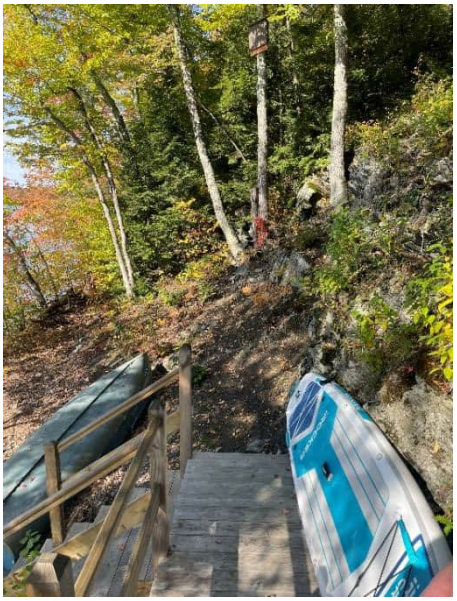


The wooden staircase is a great replacement over the old stone steps! These stairs allow for sheet flow runoff to vegetated areas and work with the natural topography of the lakeshore area. Allowing the native vegetation to continue to fill in areas of exposed soil will contribute to soil stability. You could also add in some plants if there is adequate soil depth, but it looks like the area will be naturally re-vegetated in a few years.

Thank you for being a part of the Lake Wise Program! If you have any questions about this report or the Lake Wise criteria, please contact Adelaide Dumm at Adelaide@winooskinrcd.org or Remy Crettol at Remy@winooskinrcd.org. Additional resources include Alison Marchione, the VTDEC Lake Shoreland Coordinator at Alison.Marchione@vermont.gov, or Matt Stromecki, the VTDEC Lake Wise Assistant at Matthew.Stromecki@vermont.gov. For further information see the Vermont Guide to Stormwater management for homeowners and small business owners or the Lake Shore Property Owner's Manual by the Lake Iroquois Association.

Vermont Agency of Natural Resources Lake Wise Program – Promoting Lake Friendly Practices

Storm Smart Assessment

Tim Hunt

5327 Oak Hill Road, St. George, Vermont

Thank you for your time and commitment to healthy land,

clean water, and a vibrant community!

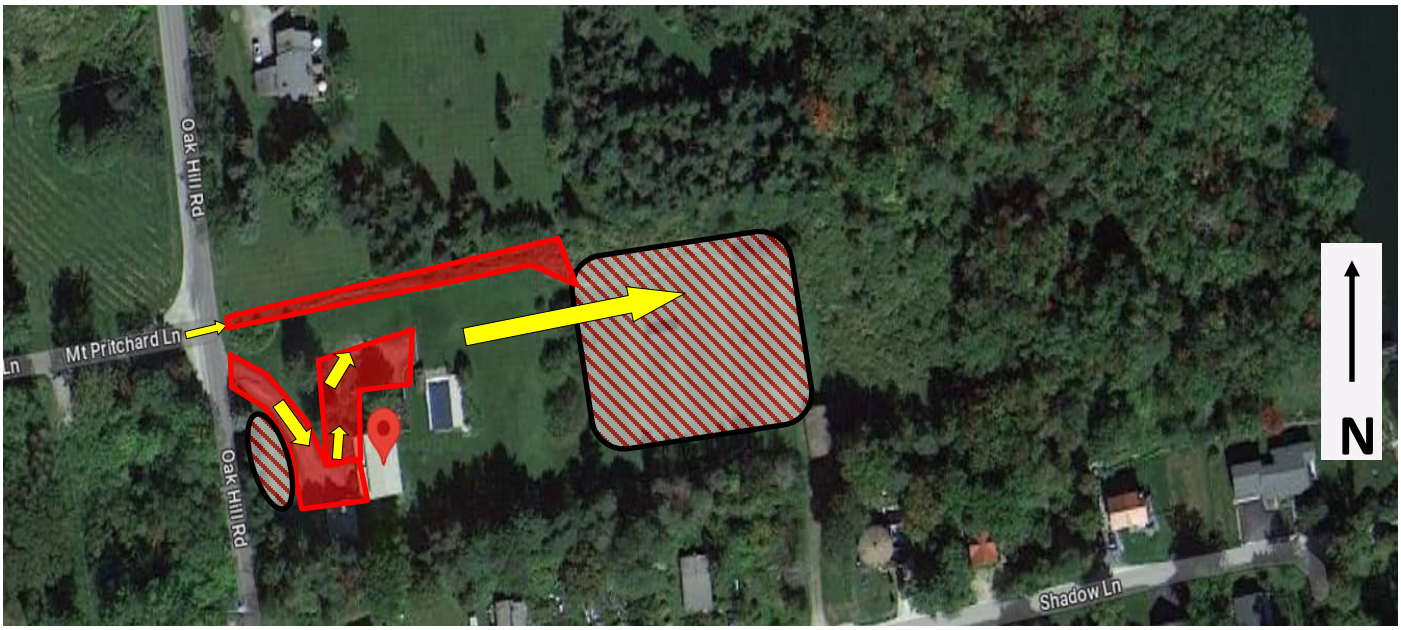
Contents

1. Summary of Visit

On May 15th 2023 the Winooski Natural Resources Conservation District (WNRCD) Conservation Specialist, Adelaide Dumm, visited Tim Hunt's property at 5327 Oak Hill Road in St. Georg, Vermont. The property is in the Lake Iroquois Patrick Brook Watershed, that drains to the LaPlatte River and eventually drains into Lake Champlain. The Stormwater runoff from the Mt. Pritchard Road flows onto Tim's property and has deposited a substantial amount of sediment into the drainage swale on his property and has caused erosion issues on its way into Lake Iroquois. The run-off occurring is of particular concern due to the close proximity to Lake Iroquois, this assessment was conducted as part of the Lake Iroquois Watershed Action Plan. There were a few storm smart solutions identified that can be implemented on the property. The property owner expressed interest in improving storm water management to prevent future soil erosion and seasonal flooding on the property. The stewardship of the land will contribute to the greater well-being of plants, animals and people downstream.

There are opportunities for improved stormwater management on this property which are outlined in more detail in the following pages. Tim recently regraded the driveway, which is a big improvement for directing water to a more stable buffer. Green Stormwater Infrastructure (GSI) solutions to the current runoff issues include installing a rain garden or drywell to capture water from the upper hillside along Oak Hill Road, planting shrubs in the steep section of lawn or adding rain barrels or infiltration trenches to manage stormwater flowing from the roofs of structures including the house and garage. Maintaining the drainage swale and increasing vegetation will also absorb and slow down runoff. By implementing the following BMPs on the property Tim will be able to keep Stormwater on site. Constructing a rain garden will help increase the water holding capacity on site by promoting the infiltration of storm water. Planting more perennials, like trees and shrubs, creating filter berms and establishing low mow zones is a low maintenance solution and will aid in decreasing the volume of Stormwater making its way into the lake. The maintenance and instillation of native plants along the sloped edges of the property will slow water down, allow for more soil infiltration, and increase water uptake by roots of perennial plants. Increasing the presence of native plants on site in the rain garden and incorporating vegetated "speed bumps" will also promote pollinators and create wildlife habitat. Overall, there are improvements to be made but the landowner is motivated and has already started on some of the projects mentioned.

Site Map– Areas of Concern

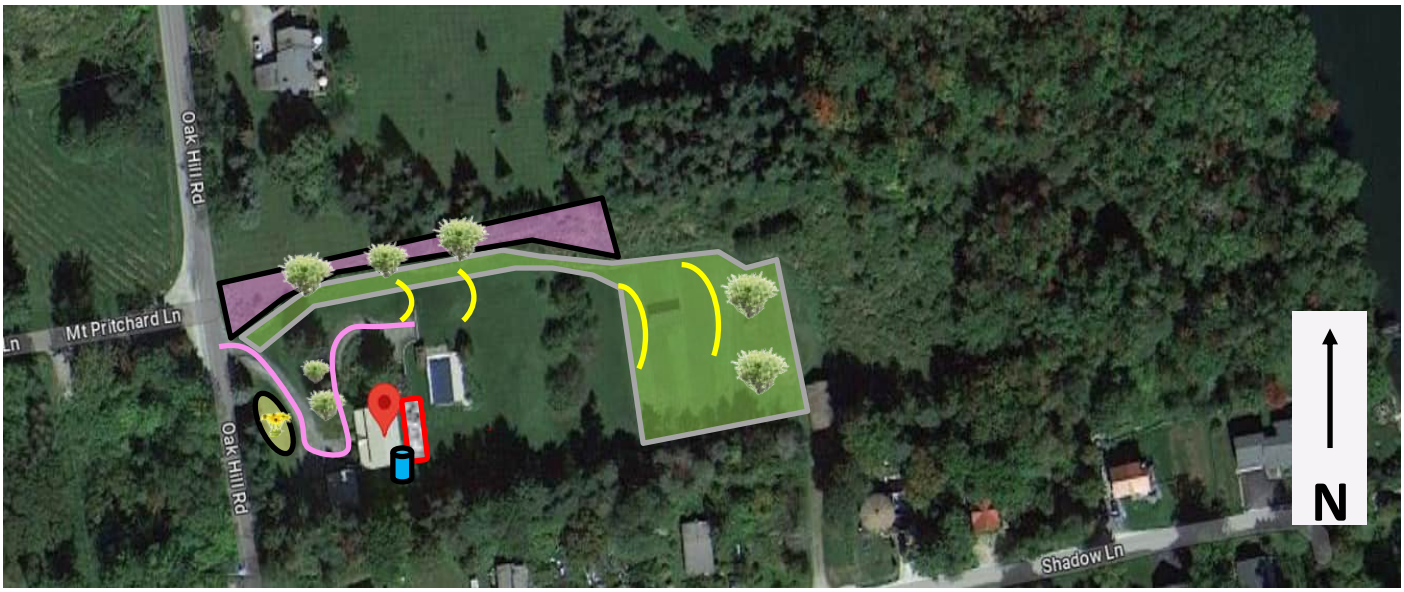


Area prone to seasonal flooding

Directional flow of water on the property

Area of erosion with bare soil exposed

Opportunity Map



Establish a vegetated swale with native perennial shrubs

Regrade /Maintain Driveway

Plant native perennials

Construct “speed bumps” or Filter Berms to slow down runoff from house and lawn

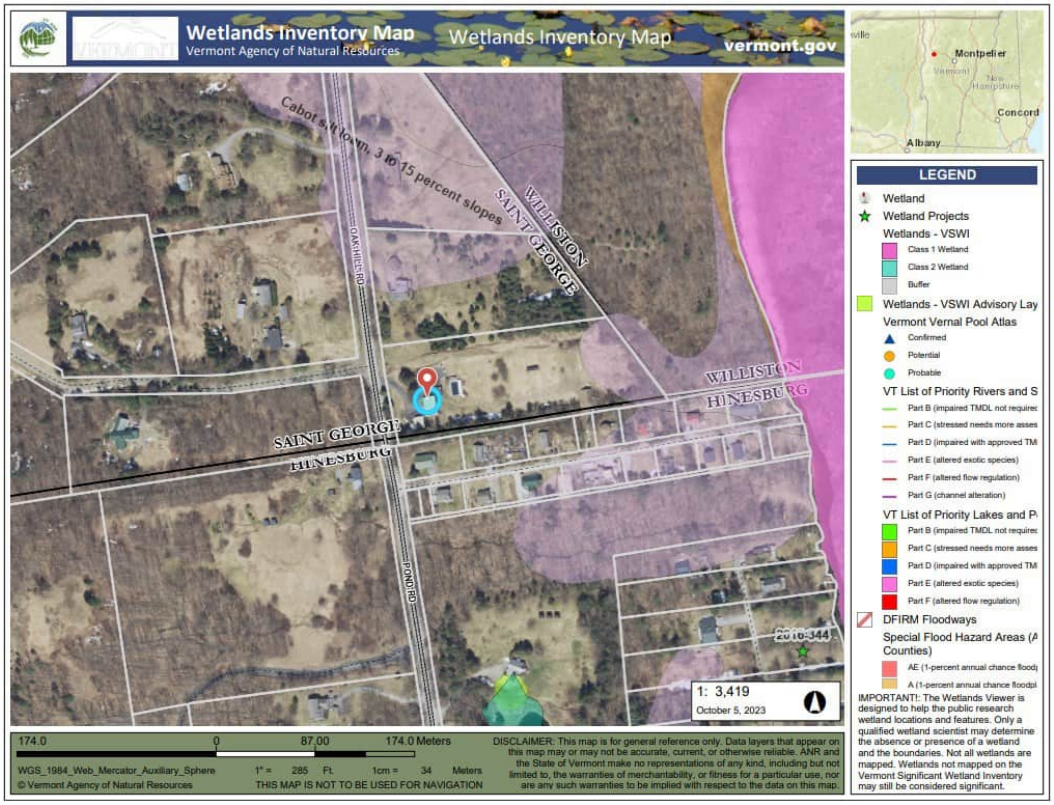
Install rain a barrel

Install rain garden or catchment area

Construct an infiltration infrastructure around foundation

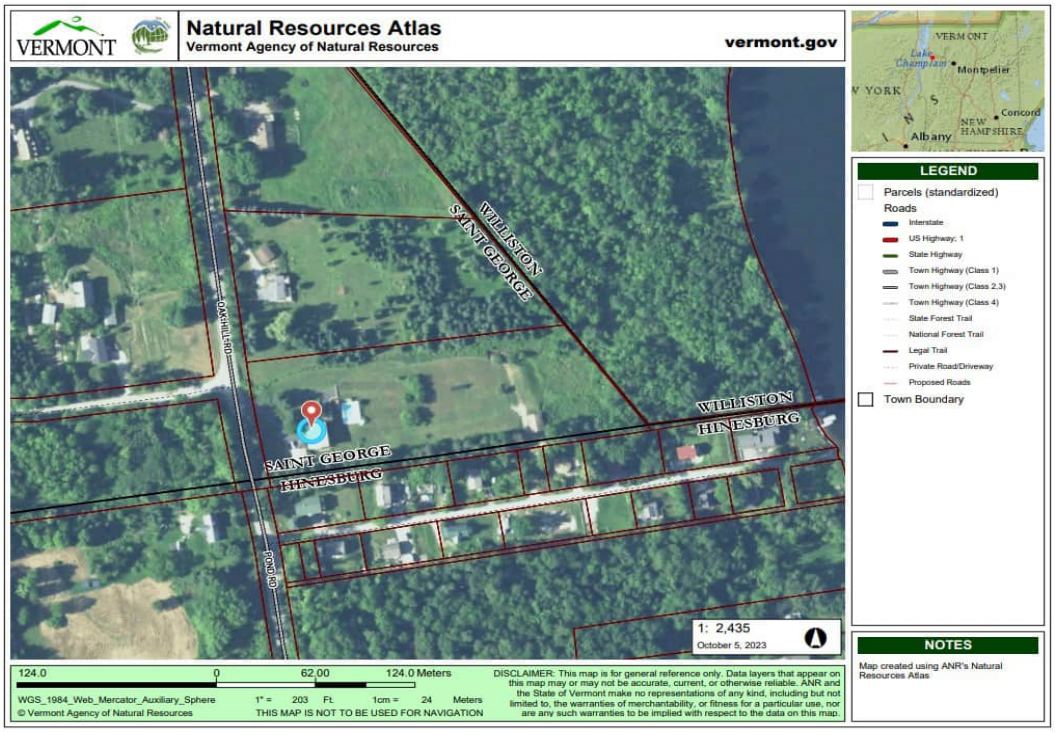
Establish “No Mow or Low Mow” zones

Property Maps Continued



As shown in the map above, there have been wetland features identified near your property. You can view this information with the VT DEC wetlands inventory map. Wetlands provide many ecosystem services, including water quality improvements through infiltration and nutrient filtration, flood resiliency, carbon sequestration, critical wildlife habitat and are aesthetically pleasing!

To learn more about wetlands in Vermont and permits/ regulations please visit the Vermont Department of Environmental Conservation Wetlands website, https://dec.vermont.gov/watershed/wetlands.



3. Recommendations and Maintenance

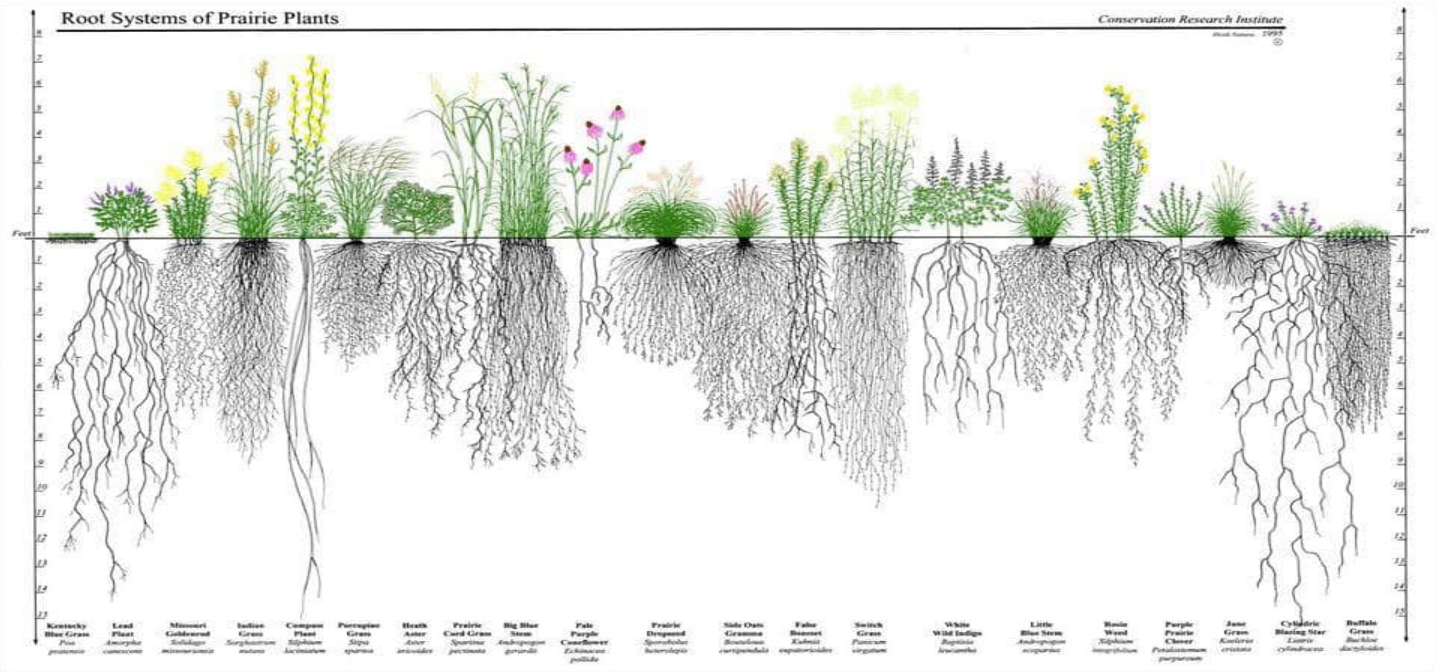
Green Stormwater Infrastructure (GSI) and Best Management Practices (BMP) are management methods that help stormwater runoff sink in, spread out, and slow down on your property, stopping erosion and keeping our streams clear. These recommendations for one time fixes and regular maintenance are steps you can take on your property to make your home Storm Smart.

Yard Area

The amount and size of plants in a yard has a direct impact on the amount of surface runoff during storms. Generally, plants that absorb rainfall well are deep-rooted perennials and woody shrubs and trees. When selecting plants it is important to choose "the right plant for the right place" by paying attention to each species' soil moisture and sun/shade requirements. Native plants are recommended since they are adapted to Vermont's climate, provide the appropriate food sources for birds and butterflies, and fit well aesthetically into the landscape.

Low Mow Zones and Native Plants

- In comparison to Kentucky Blue Grass most native plants have deeper more complex root systems that do a better job stabilizing soil and absorbing water. These plants are slower growing than many of their foreign counterparts and by letting whole areas of your lawn grow tall they can have a chance to establish themselves.
- Native plants can be sourced from a variety of businesses and organizations. Below is a brief list. Check this website to be sure that the species you select are not invasive to the region https://www.vtinvasives.org/
- Winooski NRCD Annual Tree Sale http://winooskinrcd.org/trees-and-trout-sale/
- Intervale Conservation Nursery https://www.intervale.org/intervale-conservation-nursery



Alliance for the Chesapeake Bay

Raise the Blade

By simply raising the setting of your lawnmower blade to 3” you can encourage deeper root growth and therefore better infiltration in the frequently-used areas of your lawn that you decide to keep. Visit lawntolake.com for more information about the benefits of this practice.

Yard Area continued

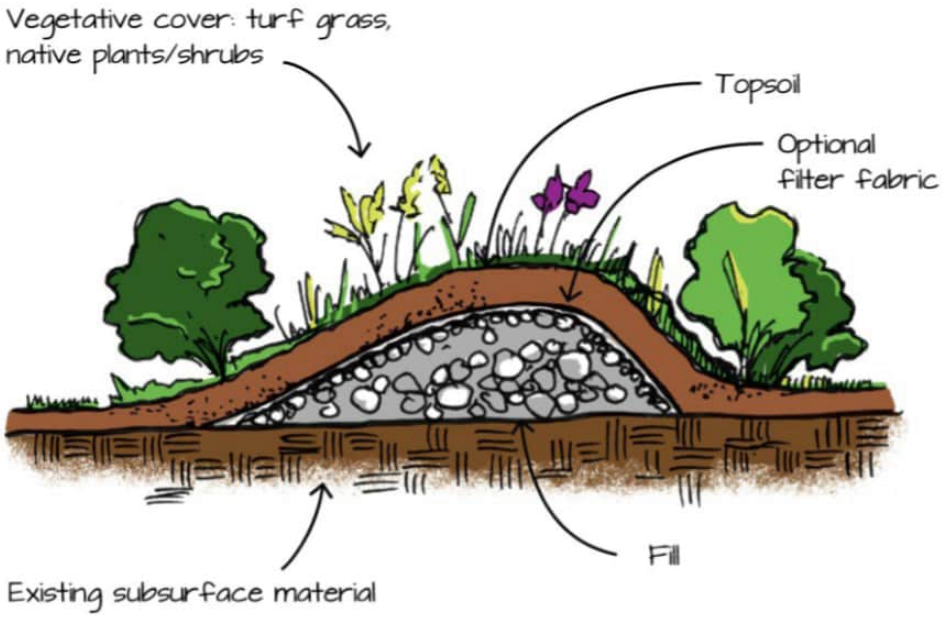
Create “road bumps” or terraces in the steepest areas with high erosion to slow the flow of water during rainstorms and help it infiltrate into the soil. These “road bumps” could be created by placing logs along contour lines to create a terraced effect or following design instructions for filter berms.

You could use the hügelkultur technique with all the invasive buckthorn you’re irradicating on the property!

https://www.almanac.com/what-hugelkultur-ultimate-raised-bed

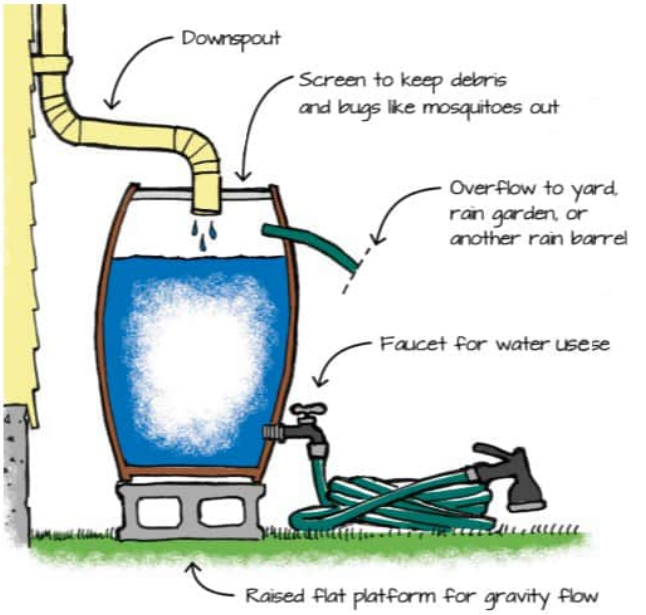
Consider constructing filter berms with all the buckthorn you’ve been removing!

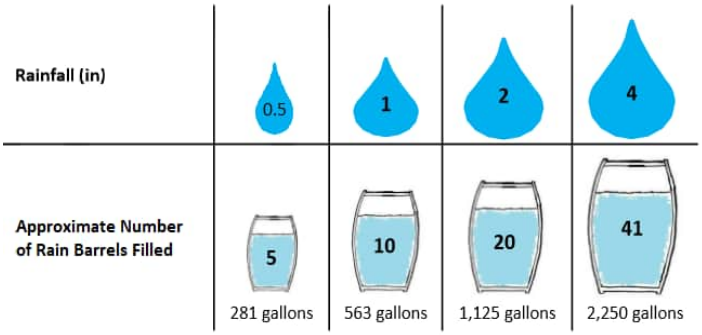
Filter berms capture and slow water that runs off parking lots, driveways, and walkways. Their interior is filled with stable, well drained material that absorbs and slows stormwater runoff. Vegetation on the outside of the berm provides more structure and helps further slow storm-water.



Rain Barrels

Rain Barrels are relatively easy to install, help retain water on your property, and give you a great resource for gardening. A barrel can come in many shapes and sizes and attach directly to the gutter downspout or be filled with a rain chain. Keeping your barrel covered stops mosquitos from reproducing in it. Check the barrel before a big storm comes to make sure it can handle the water coming its way.

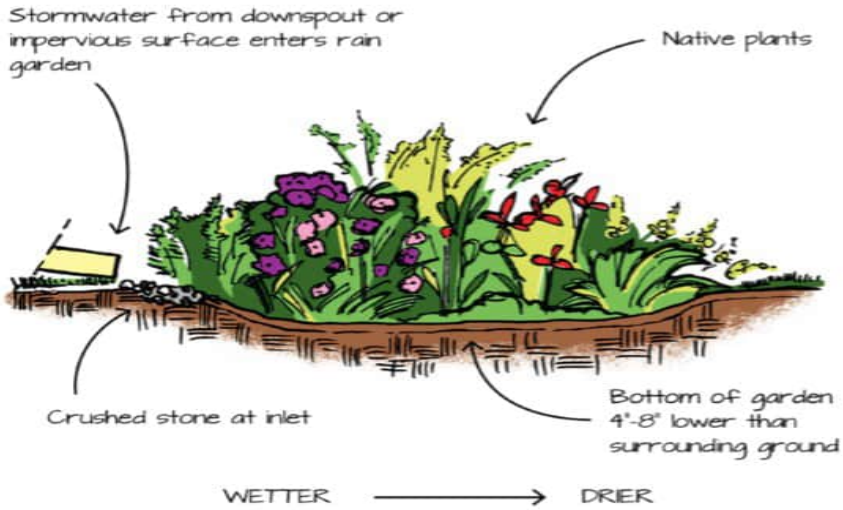




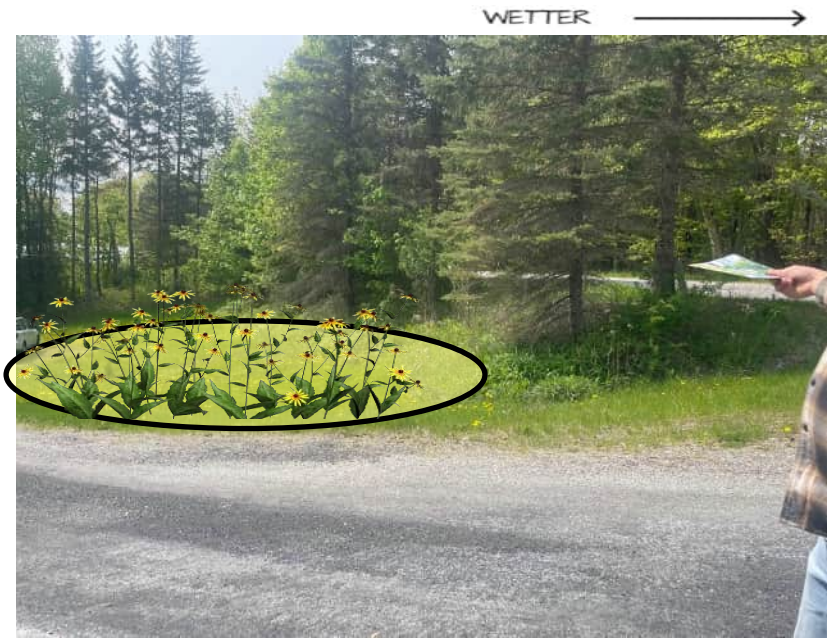
Rain barrels can be purchased new from local hardware stores or online vendors, or you can build one yourself. Visit http://rethinkrunoff.org/educational-resources/install-a-rain-barrel/ to download detailed instructions for a DIY project or check out our instructional video at https://www.youtube.com/watch?v=5zWy5MGR724&t=30s

For more information see the VT Guide to Storm Water Management for Homeowners and Small Businesses—page 18.

Rain Gardens capture and slow water that runs off parking lots, driveways, and walkways. They use native plants to slow and filter water. Ultimately water is either infiltrated into the ground or is absorbed by the plants and release back into the atmosphere. Plants used in rain gardens should be both drought resistant and able to handle prolonged periods of submersion in water.



VT Guide to Storm Water Management for Homeowners and Small Businesses—page 30



A significant amount of runoff flows through this point of your property before exiting through the storm drain. Capturing as much water as possible here could significantly impact the volume of water that ultimately moves down the watershed and into Lake Iroquois.

To build the rain garden, consult the VT Rain Garden Manual for specific instructions. Building a Rain Garden involves digging the garden to size, adding a layer of crushed stone at the bottom for improved infiltration. Next, add some additional soil and plant water-loving native species like: Blue flag iris, Black Eyed Susan, New England Aster, Milkweed, Coneflower, Daylilies, and Bee Balm (monarda).

Driveway

During the assessment the drive way was identified as an area on the property that can be improved to be more Storm Smart. It had some erosion from regular use and excessive runoff from Mt. Pritchard Rd. The historic July flooding prompted Tim to have the driveway regarded. Now that the driveway is properly crowned, water is diverted to the sides where it is absorbed by vegetation. Regrading the driveway was a great BMP to do as it now allows for more on site stormwater runoff infiltration. Planting native perennials along the edge of the drive way or establishing a low mow zone on the steep slope will also increase the water retention potential on site, as the vegetation will absorb excess runoff. More information on regrading a driveway can be found in the VT Guide to Storm Water Management for Homeowners and Small Businesses—page 42.

To prevent erosion, flowing water should be directed off driveway surfaces as quickly as possible. Properly graded driveways have a crown (high point) to do this. Crowns are generally located in the middle of the driveway, although a high point can be established on either side. See cross-sections below. Additionally, water bars can direct runoff away from driveways. See page 23 for water bar instructions. INSTRUCTIONS Grade your driveway based on one of the following cross-sections. Shaping is site-specific and any of these variations will direct flow off your driveway.

CROWNED DRIVEWAY
High point in the center

IN-SLOPED DRIVEWAY
High point on outside edge

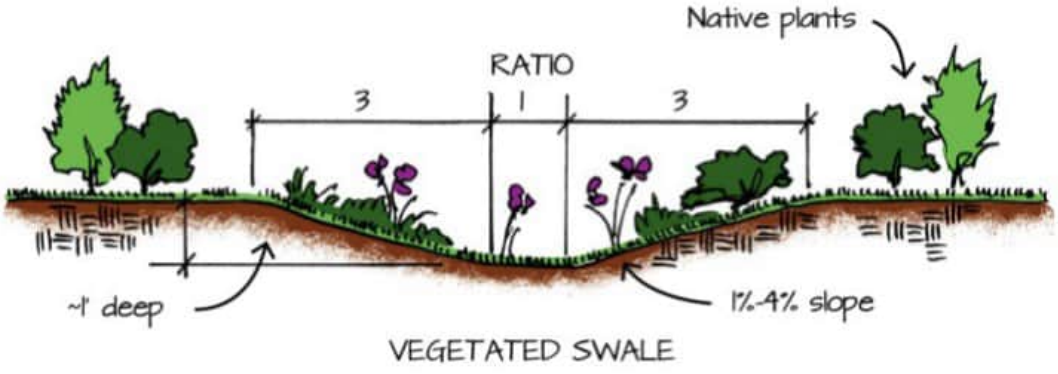
OUT-SLOPED DRIVEWAY
High point on inside edge

Vegetated Swale

Vegetated Swales are broad channels that slow, infiltrate, and direct water. They are often used in conjunction with check dams to improve their ability to slow water and capture sediment. Swales are a good choice for relatively flat parking areas or driveways and can be used to direct water towards more stable ground.

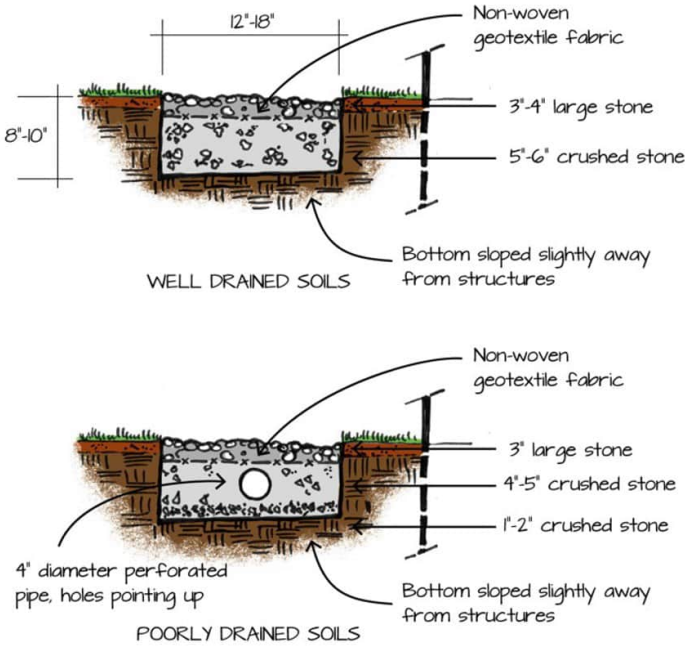
This channel has severe erosion occurring from the high volume of stormwater runoff coming down Mt. Pritchard Road. Planting a vegetated swale will contribute to slowing down, sinking, and spreading out run-off. The swale will also improve water quality as it moves though the watershed and down into Lake Iro-quois.

VT Guide to Storm Water Management for Homeowners and Small Businesses—page 28



Infiltration trench

Infiltration trenches are shallow, stone lined channels that capture water from impervious surfaces (like roof tops) and infiltrate it into the ground. In less well drained soils an Infiltration Trench is outfitted with a pipe to convey water that risks pooling. More information on this can be found in the VT Guide to Storm Water Management for Homeowners and Small Businesses, listed in the Further Resources section on page 13.



Invasive Species Removal

During the site visit we noticed the invasive species filling in along the wooded fence row. The species identified included Buckthorn and the invasive ground cover, bishops weed. Irradicating these species will make room for native ground cover and small pine saplings to grow. Keep up the good work of removal!

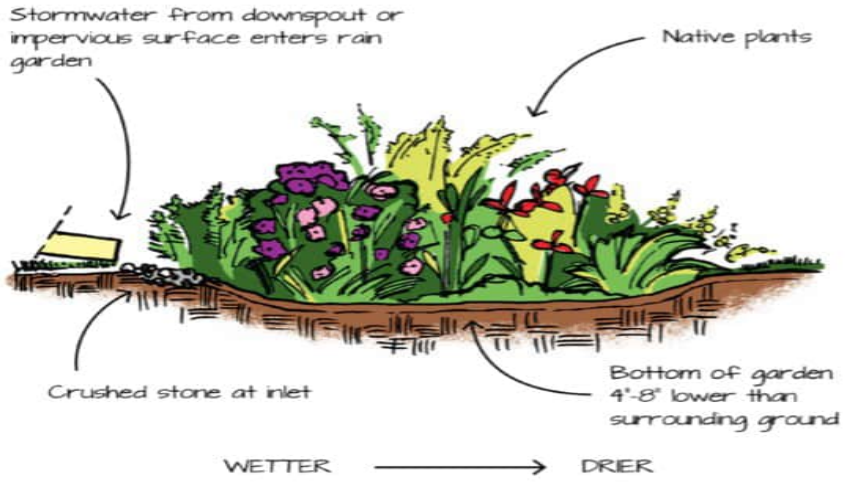
Consider planting a native shrub near end of the drainage pipes from the gutter system on the home. A native shrub will absorb some of the stormwater runoff being directed to the wooded fence row and decrease soil erosion in this area.

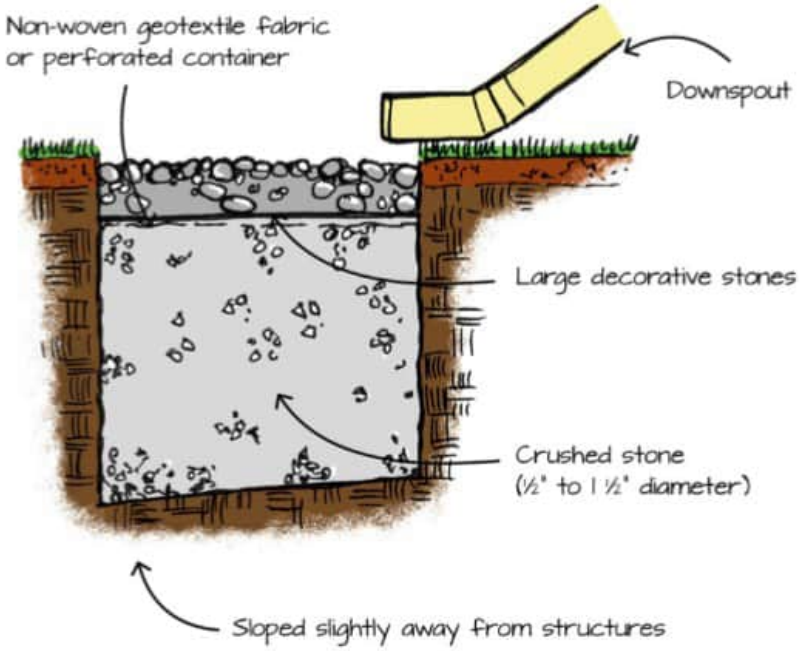
4. Construction Details

Being Storm Smart can save you time and money cleaning up after storms, help keep your downstream neighbors safe, protect fish and other aquatic life, and give us all more summer days of swimming in crystal clear water. These diagrams incorporated in the recommendation sections and more below can help you make being Storm Smart a reality.

Rain Garden

Rain Gardens capture and slow water that runs off parking lots, driveways, and walkways. They use native plants to slow and filter water. Ultimately water is either infiltrated into the ground or is absorbed by the plants and release back into the atmosphere. Plants used in rain gardens should be both drought resistant and able to handle prolonged periods of submersion in water.



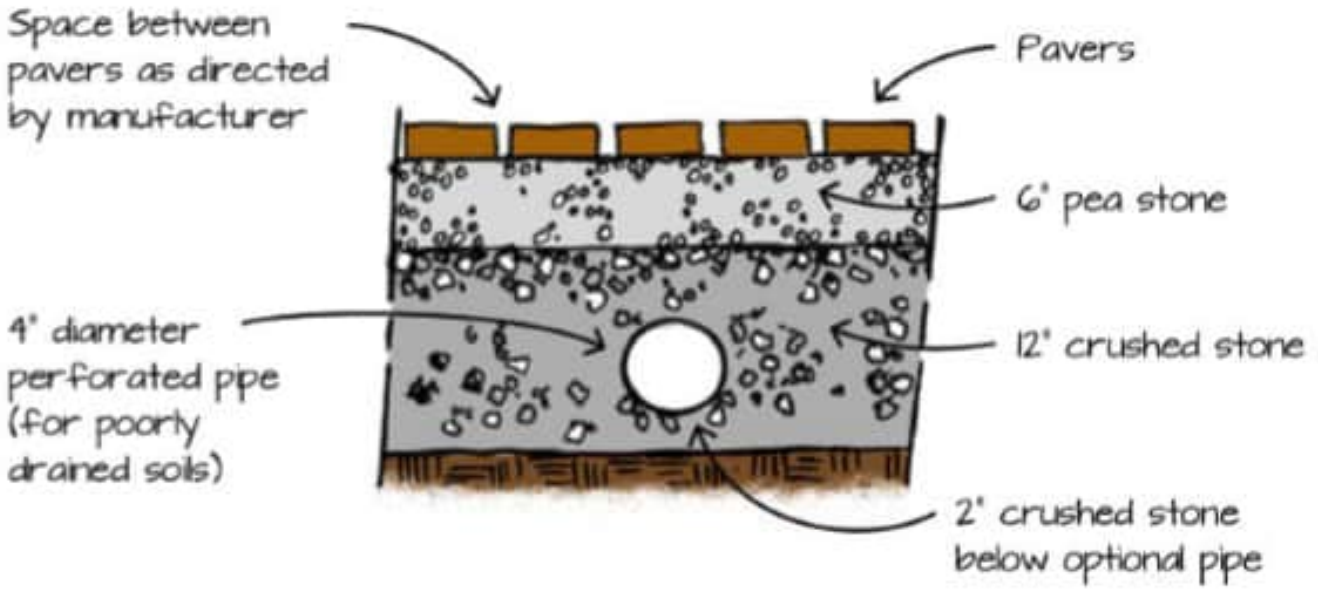


Dry Well

Dry wells are an effective way to infiltrate water from roofs or other concentrated areas so long as the soil is relatively well drained. The well is a hole dug out of the ground that is lined with geotextile fabric or holds a perforated container. Crushed stone slows and filters the water before it infiltrates into the ground water.

Permeable Pavers

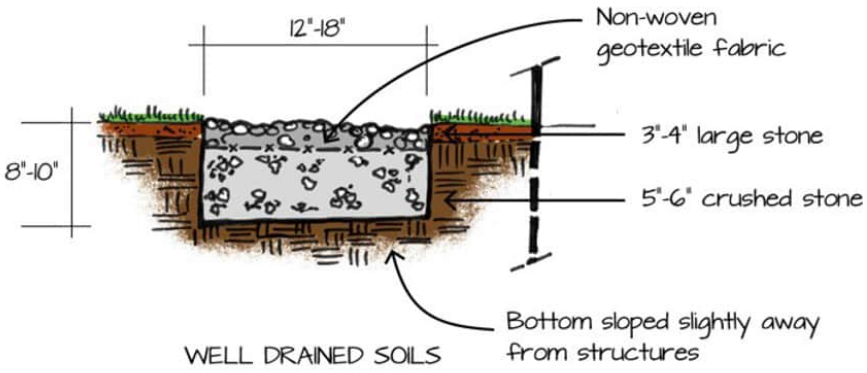
Permeable pavers allow stormwater to be infiltrated into the ground through gaps between the pavers. This water then flows through crushed stone into the groundwater below. If the soil is not particularly well drained a perforated pipe can be installed that will direct water to a stable outlet downhill from the driveway.

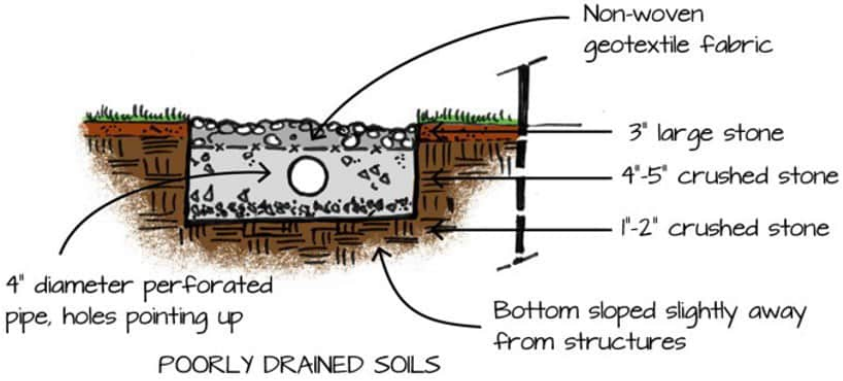


VT Guide to Storm Water Management for Homeowners and Small Businesses—page 34

Infiltration trench

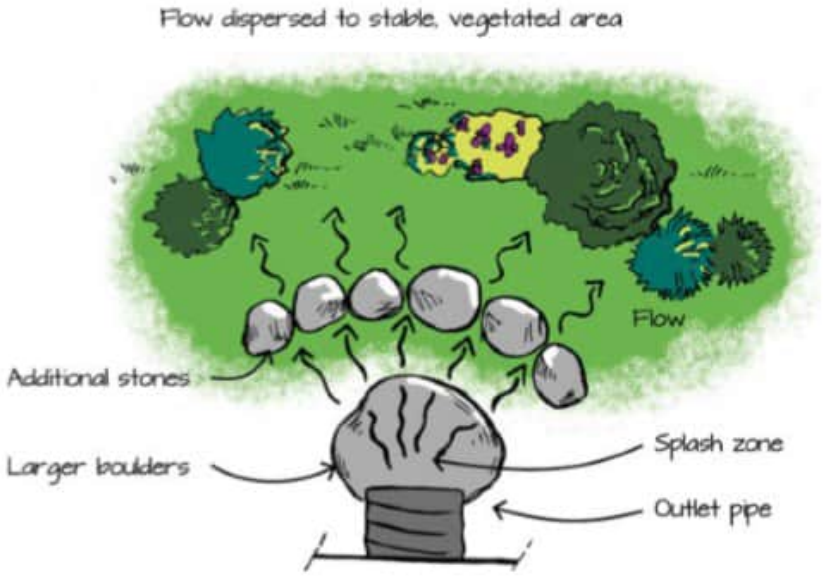
Infiltration trenches are shallow, stone lined channels that capture water from impervious surfaces (like roof tops) and infiltrate it into the ground. In less well drained soils an Infiltration Trench is outfitted with a pipe to convey water that risks pooling. More information on this can be found in the VT Guide to Storm Water Management for Homeowners and Small Businesses, listed in the Further Resources section on page 13.





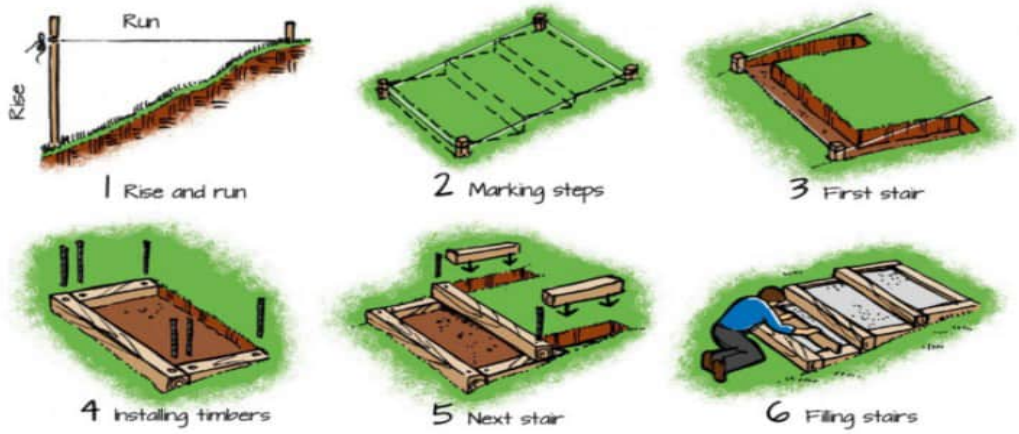
Energy Diffuser

Energy diffusers are made by placing a large rock or boulder under the outlet of a culvert or downspout. The rock provides a stable surface for flowing water to impact and lose energy before it continues down-hill. With less energy behind it the water is less likely to cause erosion that can destabilize the culvert.



Terraced Garden Beds or Infiltration Stairs

Terraced raised beds will provide space and adequate soil composition for gardening. In addition, there is an added benefit of reducing the surface area of the lawn which does not retain much surface water, due to grass having relatively short roots, and stabilizing the steep bank. For More information on infiltration stair see the VT Guide to Storm Water Management for Homeowners and Small Businesses on page 31.



5. Further Resources

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Household Septic Maintenance Factsheet — WNRCD

http://winooskinrcd.org/wp-content/uploads/managing-HH-septic-factsheet.pdf

Winooski Natural Resources Conservation District —Find other ways to get involved at our website

www.winooskinrcd.org

Rethink Runoff Stream Team

www.rethinkrunoff.org

6. Storm Smart Support

Thank you for being a good neighbor and working to make our watershed resilient. If you are interested in having a follow up assessment or would like some hands-on help installing or maintaining your Green Stormwater Infrastructure please get in touch. I am happy to schedule a time to help make your property Storm Smart.

If you want to spread the word please feel free to share my contact information with your neighbors or anyone else you think might be interested. If there are any questions I can be reached by email at Adelaide@winooskinrcd.org

Storm Smart Assessment

Laura and Joel Jackson

114 Hawk Lane, Hinesburg, Vermont

Thank you for your time and commitment to healthy land, clean water, and a vibrant community!

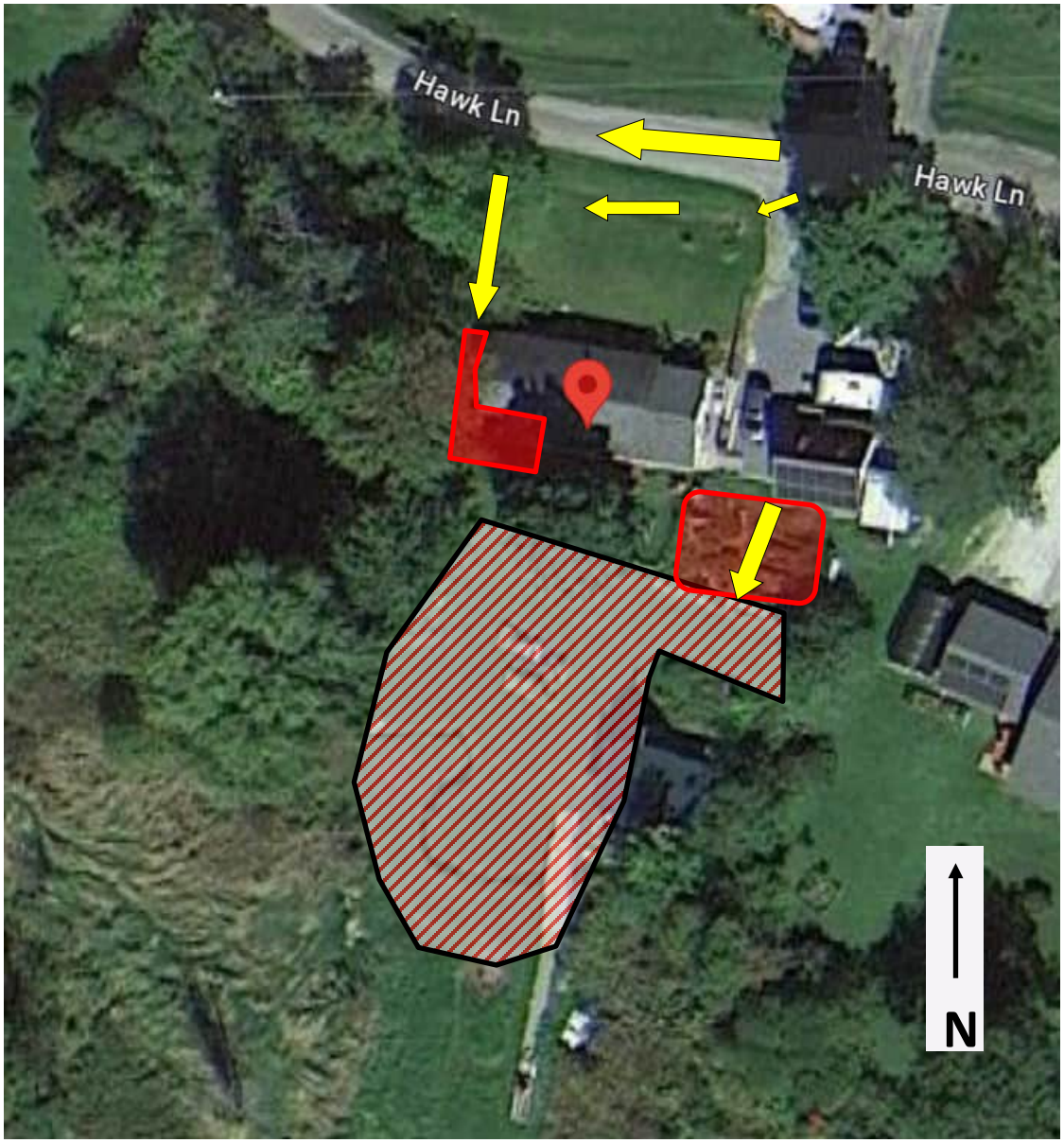
Contents

1. Summary of Visit

On May 10th, 2023 Adelaide Dumm, Winooski Natural Resources Conservation District (WNRCD) Conservation Specialist visited Laura and Joel Jackson's property at 114 Hawk Lane in Hinesburg, Vermont. The property is in the Lake Iroquois Patrick Brook Watershed. The Stormwater runoff from the Jackson's property flows into Patrick Brook, which flows to the LaPlatte River and eventually drains into Lake Champlain via the Shelburne Bay. The runoff occurring is of particular concern due to the close proximity to several smaller tributaries that connect to Patrick Brook, this assessment was conducted as part of the Lake Iroquois Watershed Action Plan. There were a few storm smart solutions identified that can be implemented on the property. The property owner expressed interest in improving storm water management to prevent future soil erosion and seasonal flooding on the property. The stewardship of the land will contribute to the greater well-being of plants, animals and people downstream.

Green Stormwater Infrastructure (GSI) solutions to the current runoff issues include maintaining the shoulder of the roadway with a vegetated swales and implementing BMPs in the yard and around the home to keep Stormwater on site. Maintaining the driveway an constructing a Rain Garden at the top of the culvert will help increase the water holding capacity on site by promoting the infiltration of storm water. Maintenance of the infiltration trench, the addition of a dry well and rain barrel, and potentially terraced garden beds would also assist with slowing down, spreading out and sinking Stormwater around the home. Installing terraced gardens on the hillside in the backyard, is a great strategy to minimize erosion on such a steep slope. Planting more perennials, like trees and shrubs, and establishing low mow zones around the stream in the backyard is a low maintenance solution and will aid in decreasing the volume of Stormwater making its way into Patrick Brook. The removal of the invasive Honeysuckle, and maintenance/ instillation of native plants along the sloped edges of the property will slow water down, allow for more soil infiltration, and increase water uptake by roots of perennial plants. Constructing filter berms would also help slow down runoff on the property. Increasing the presence of native plants on site in the rain garden and incorporating vegetated "speed bumps" will also promote pollinators and create wildlife habitat. Overall, there are improvements to be made but the landowner is motivated and has already started on some of the projects mentioned.

Site Map– Areas of Concern



Area prone to seasonal flooding

Flow of water on property

Area of erosion with bare soil exposed.

Opportunity Map

Remove invasive species, and establish a Vegetated swale with native perennial shrubs

Plant native vegetation along stream to create stable riparian buffer

Construct “speed bumps” or Filter Berms to slow down runoff from house and lawn

Add terraced raised beds/ infiltration stairs to reduce soil erosion

Extend gutters or add dry well under rain barrel

Install rain garden or catchment area

Maintain infiltration infrastructure around foundation

Establish “No Mow” zones

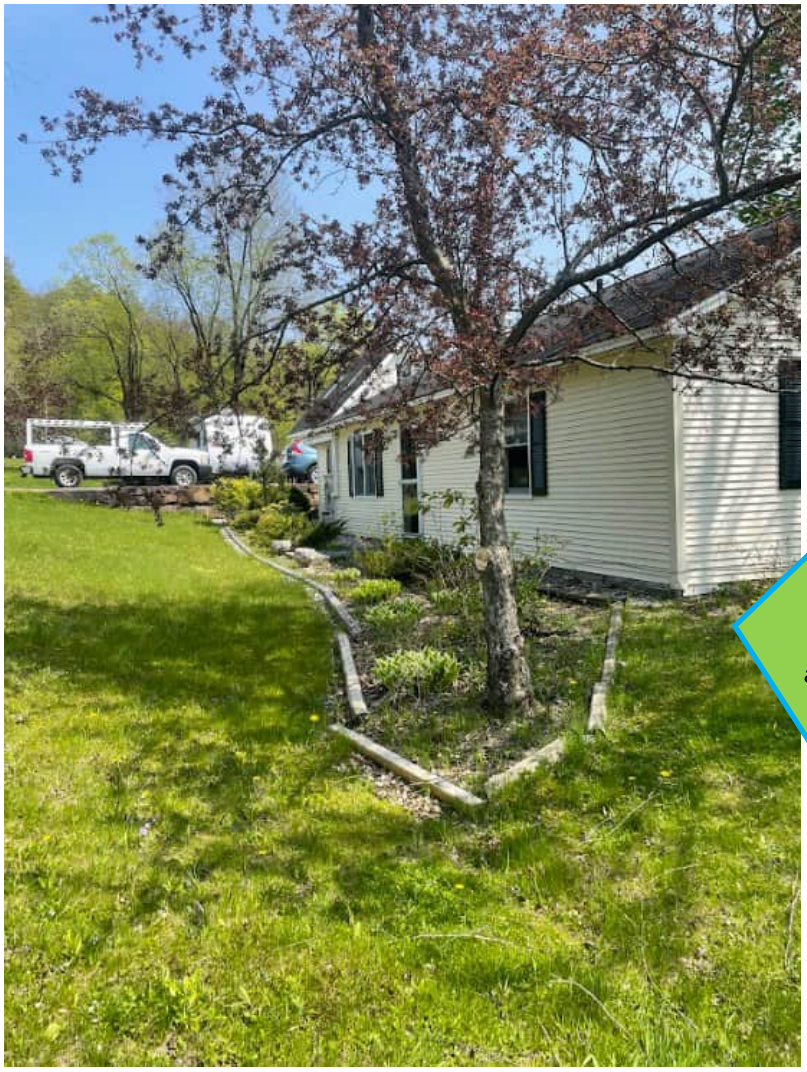
As shown in the map above, there is a wetland has been identified on your property. You can view this information at the VT DEC wetlands inventory map, and also with the VT DEC wetlands screening tool. A wetlands permitted project was identified in 2021, and Tina Heath at VT DEC Wetland Ecologist is the point of contact for this work. Wetlands provide many ecosystem services, including water quality improvements through infiltration and nutrient filtration, flood resiliency, carbon sequestration, critical wildlife habitat and are aesthetically pleasing!

To learn more about wetlands in Vermont and permits/ regulations please visit the Vermont Department of Environmental Conservation Wetlands website, https://dec.vermont.gov/watershed/wetlands.

3. Recommendations and Maintenance

Green Stormwater Infrastructure (GSI) and Best Management Practices (BMP) are management methods that help stormwater runoff sink in, spread out, and slow down on your property, stopping erosion and keeping our streams clear. These recommendations for one time fixes and regular maintenance are steps you can take on your property to make your home Storm Smart.

Yard Area



The amount and size of plants in a yard has a direct impact on the amount of surface runoff during storms. Generally, plants that absorb rainfall well are deep-rooted perennials and woody shrubs and trees. When selecting plants it is important to choose “the right plant for the right place” by paying attention to each species’ soil moisture and sun/shade requirements. Native plants are recommended since they are adapted to Vermont’s climate, provide the appropriate food sources for birds and butterflies, and fit well aesthetically into the landscape.

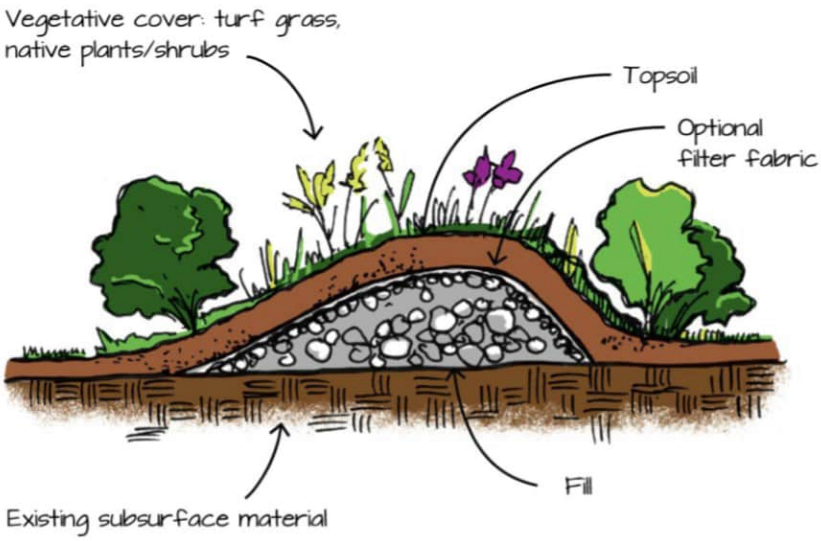
Yard Area continued

Create “road bumps” or terraces in the steepest areas with high erosion to slow the flow of water during rainstorms and help it infiltrate into the soil. These “road bumps” could be created by placing logs along contour lines to create a terraced effect or following design instructions for filter berms.

You could use the hügelkultur technique with all the invasives you’re irradicating on the property!

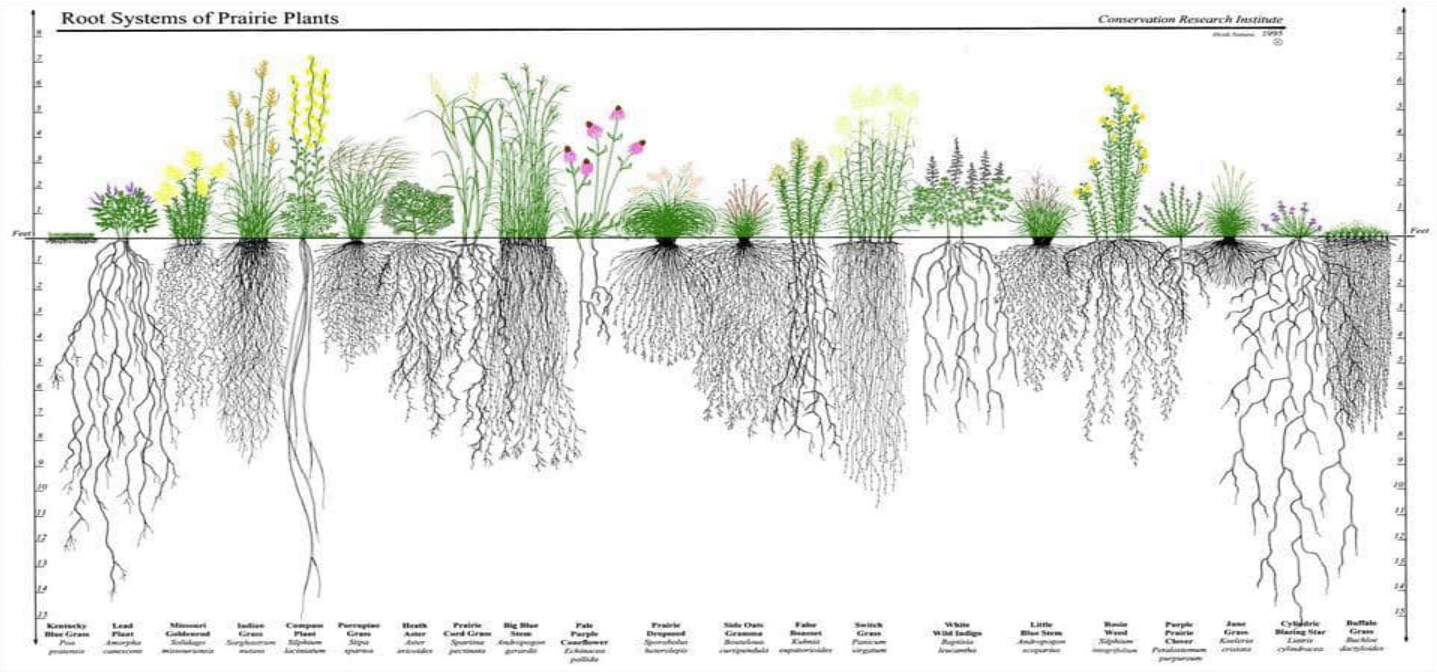
https://www.almanac.com/what-hugelkultur-ultimate-raised-bed

Filter berms capture and slow water that runs off parking lots, driveways, and walkways. Their interior is filled with stable, well drained material that absorbs and slows stormwater runoff. Vegetation on the outside of the berm provides more structure and helps further slow storm-water.



Low Mow Zones and Native Plants

- In comparison to Kentucky Blue Grass most native plants have deeper more complex root systems that do a better job stabilizing soil and absorbing water. These plants are slower growing than many of their foreign counterparts and by letting whole areas of your lawn grow tall they can have a chance to establish themselves.
- Native plants can be sourced from a variety of businesses and organizations. Below is a brief list. Check this website to be sure that the species you select are not invasive to the region https://www.vtinvasives.org/
- Winooski NRCD Annual Tree Sale http://winooskinrcd.org/trees-and-trout-sale/
- Intervale Conservation Nursery https://www.intervale.org/intervale-conservation-nursery



Alliance for the Chesapeake Bay

Raise the Blade

By simply raising the setting of your lawnmower blade to 3” you can encourage deeper root growth and therefore better infiltration in the frequently-used areas of your lawn that you decide to keep. Visit lawntolake.com for more information about the benefits of this practice.

Low Mow Zones and Creating a Riparian Buffer on the Stream

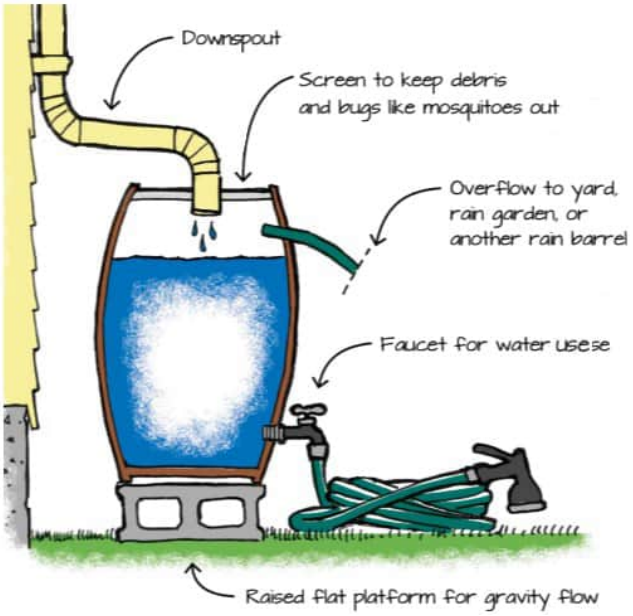
Establishing a low mow zone or no mow zone around the stream along with planting perennial plants will help to improve water quality and create wildlife habitat. Planting shrub willow, alders, dogwood trees and other native perennials that can withstand seasonal inundation will create a stable stream buffer and increase flood resiliency.

Rain Barrels

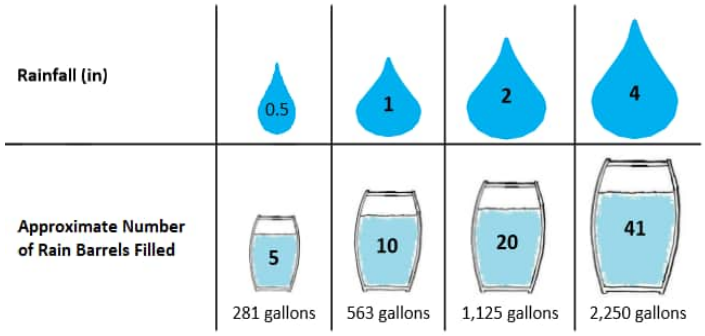
Rain Barrels are relatively easy to install, help retain water on your property, and give you a great resource for gardening. A barrel can come in many shapes and sizes and attach directly to the gutter downspout or be filled with a rain chain. Keeping your barrel covered stops mosquitos from reproducing in it. Check the barrel before a big storm comes to make sure it can handle the water coming its way.

Rain barrels can be purchased new from local hardware stores or online vendors, or you can build one yourself. Visit http://rethinkrunoff.org/educational-resources/install-a-rain-barrel/ to download detailed instructions for a DIY project or check out our instructional video at https://www.youtube.com/watch?v=5zWy5MGR724&t=30s

For more information see the VT Guide to Storm Water Management for Homeowners and Small Businesses—page 18.



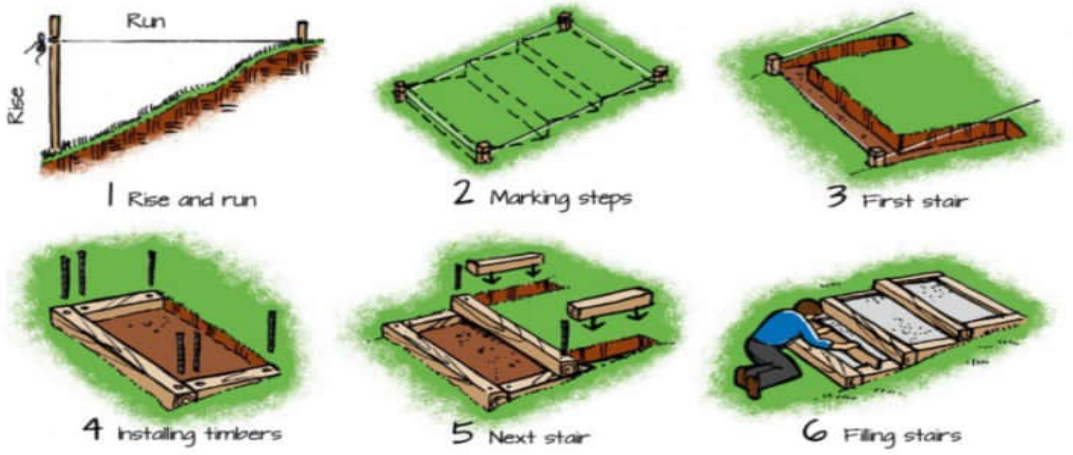
You could consider disconnecting your downspout and adding a rain barrel to prevent the soil erosion along foundation of the home. You already have a good infiltration trench system, maintaining it is key to preventing runoff!



Extend gutters or add dry well under rain barrel to catch the storm-water runoff sheeting off the solar panels.

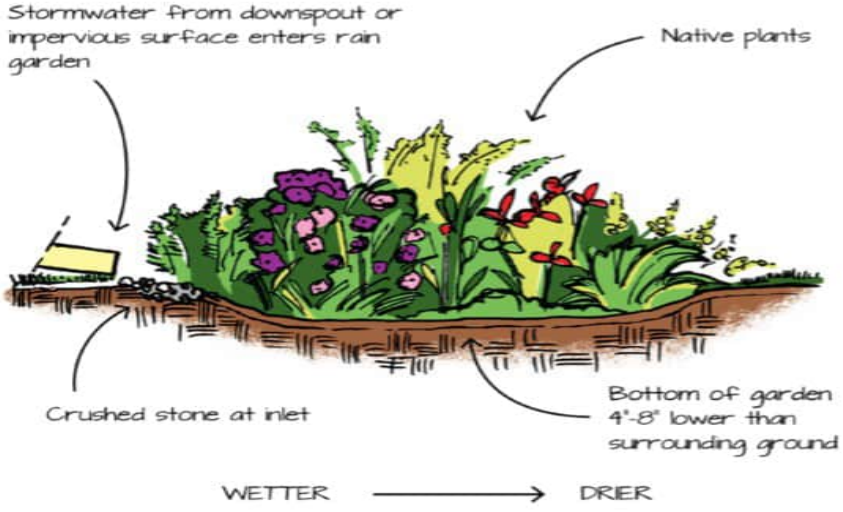
Yard Area Continued

Terraced raised beds will provide space and adequate soil composition for gardening. In addition, there is an added benefit of reducing the surface area of the lawn which does not retain much surface water, due to grass having relatively short roots, and stabilizing the steep bank. For More information on infiltration stair see the VT Guide to Storm Water Management for Homeowners and Small Businesses on page 31.



Rain Garden

Rain Gardens capture and slow water that runs off parking lots, driveways, and walkways. They use native plants to slow and filter water. Ultimately water is either infiltrated into the ground or is absorbed by the plants and release back into the atmosphere. Plants used in rain gardens should be both drought resistant and able to handle prolonged periods of submersion in water.



VT Guide to Storm Water Management for Homeowners and Small Businesses—page 30

Build a retention wall at the base of the vegetated area in your yard (uphill of the driveway) can stop water moving off the property and carrying debris into the culvert pipe. A significant amount of runoff flows through this point of your property before exiting, so capturing as much water as possible here could significantly impact the volume of water that ultimately moves down the watershed.

The wall could be constructed with wood, stone or brick. You could add a layer of crushed stone at the bottom for improved infiltration. Next, add some additional soil and plant water-loving native species like: Blue flag iris, Black Eyed Susan, New England Aster, Milkweed, Coneflower, Daylilies and Bee Balm (monarda).

Driveway

Clean out debris from culvert pipe so water can flow through as it moves off your property. Potentially build rain garden on the other end of culvert so minimize water moving through.

To prevent erosion, flowing water should be directed off driveway surfaces as quickly as possible. Properly graded driveways have a crown (high point) to do this. Crowns are generally located in the middle of the driveway, although a high point can be established on either side. See cross-sections below. Additionally, water bars can direct runoff away from driveways. See page 23 for water bar instructions. INSTRUCTIONS Grade your driveway based on one of the following cross-sections. Shaping is site-specific and any of these variations will direct flow off your driveway.

The drive way is an area on the property that can be improved to be more Storm Smart. It currently has some erosion from regular use. One way to improve this is to recrown the drive way so that water is diverted to the sides where it can be absorbed by vegetation. Regrading the driveway is a great option that would allow for more on site infiltration. Planting native perennials along the edge of the drive way or creating a vegetated swale will also increase the water retention potential on site, as the vegetation will absorb excess runoff. More information on regrading a driveway can be found in the VT Guide to Storm Water Management for Homeowners and Small Businesses—page 42.

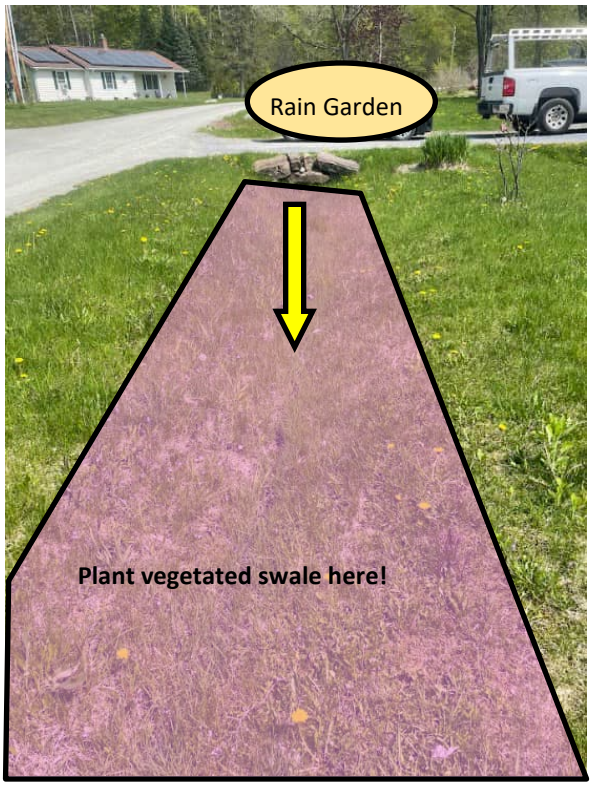
CROWNED DRIVEWAY
High point in the center

IN-SLOPED DRIVEWAY
High point on outside edge

OUT-SLOPED DRIVEWAY
High point on inside edge

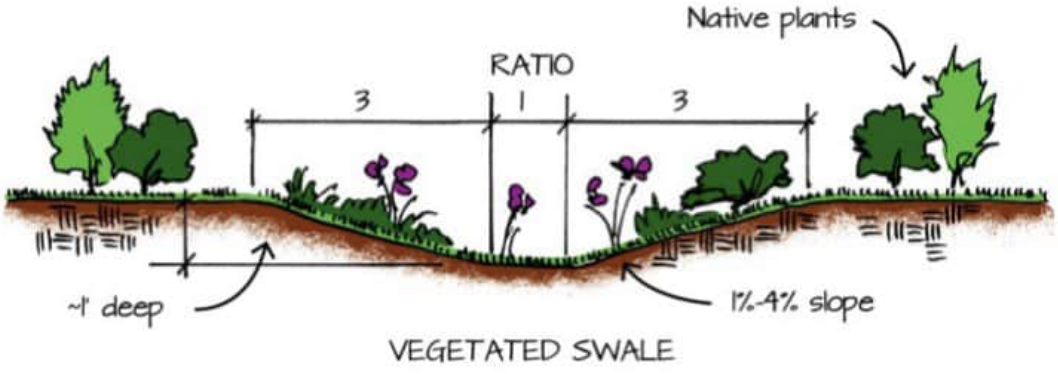
Vegetated Swale

Vegetated Swales are broad channels that slow, infiltrate, and direct water. They are often used in conjunction with check dams to improve their ability to slow water and capture sediment. Swales are a good choice for relatively flat parking areas or driveways and can be used to direct water towards more stable ground.



Good use of stone channel to divert stormwater to a more stable buffer!

VT Guide to Storm Water Management for Homeowners and Small Businesses—page 28



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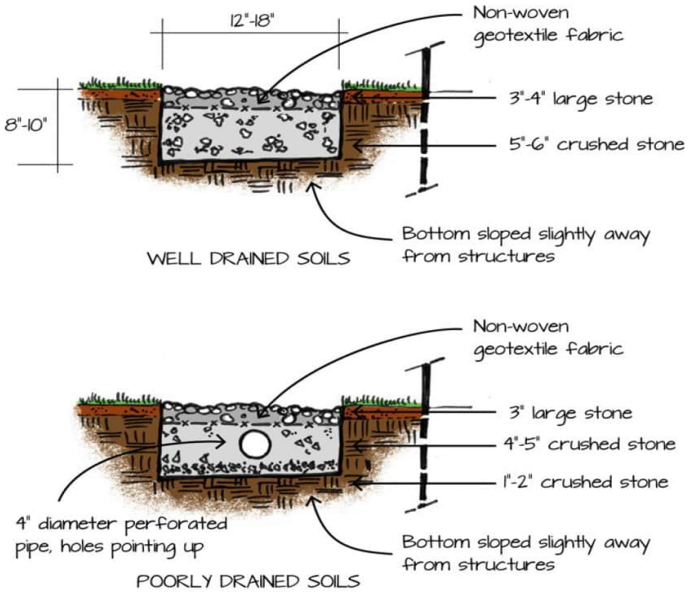
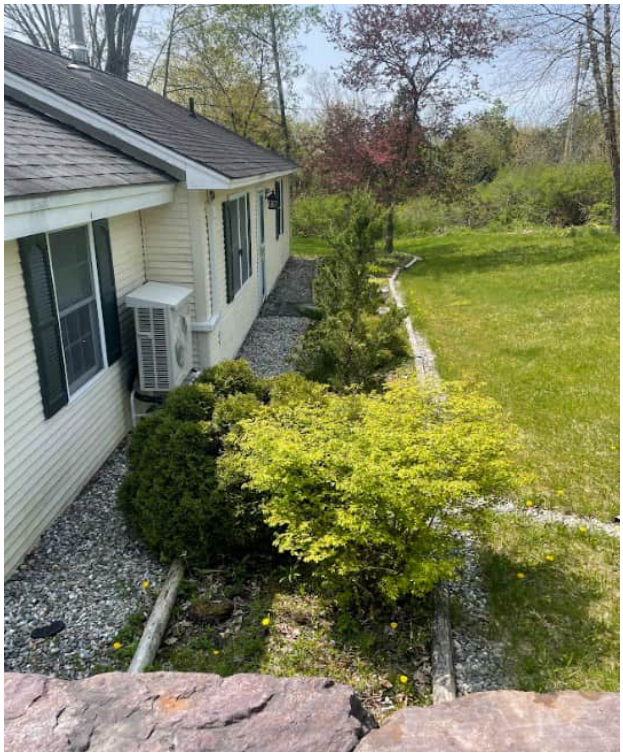


The infiltration trench system at the front of the house looks great, consider wrapping it around the side of the house too where soil is eroded from roof runoff.

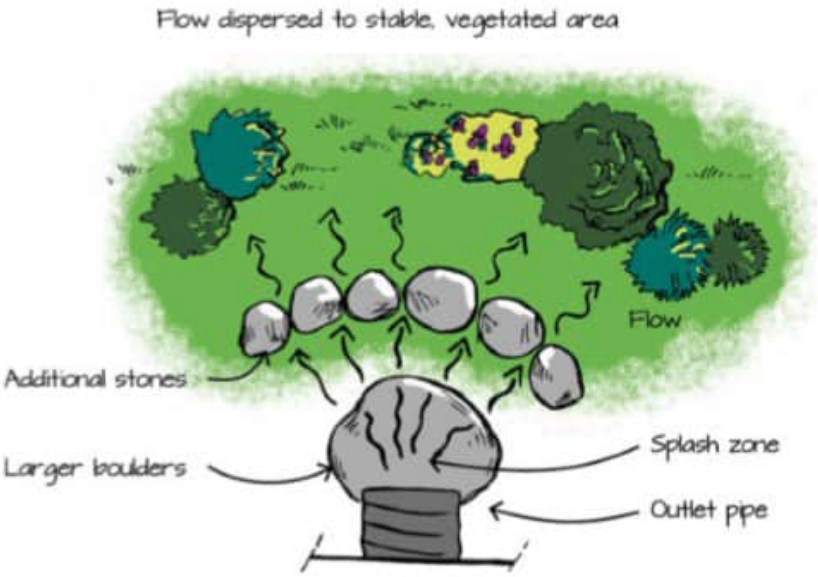


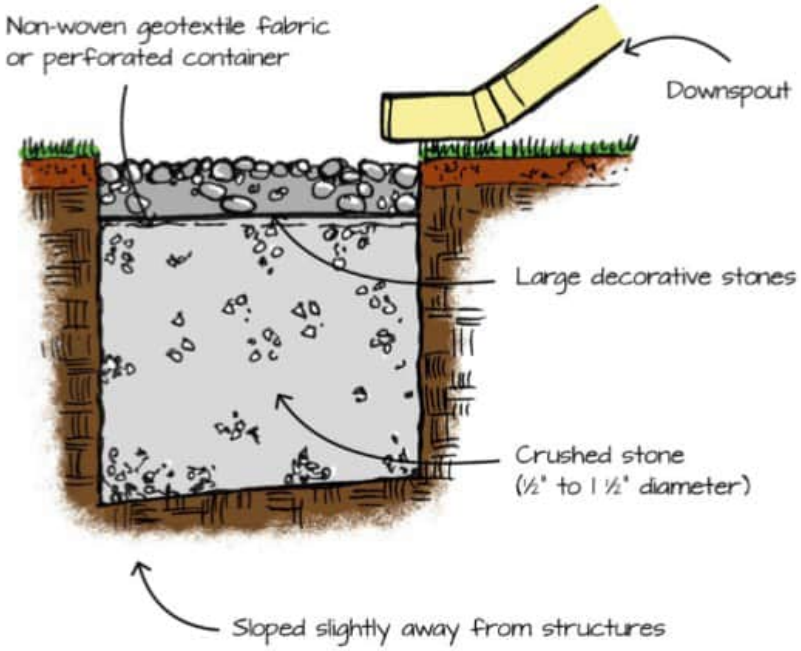
4. Construction Details

Being Storm Smart can save you time and money cleaning up after storms, help keep your downstream neighbors safe, protect fish and other aquatic life, and give us all more summer days of swimming in crystal clear water. These diagrams incorporated in the recommendation sections and more below can help you make being Storm Smart a reality.

Energy Diffuser

Energy diffusers are made by placing a large rock or boulder under the outlet of a culvert or downspout. The rock provides a stable surface for flowing water to impact and lose energy before it continues downhill. With less energy behind it the water is less likely to cause erosion that can destabilize the culvert.



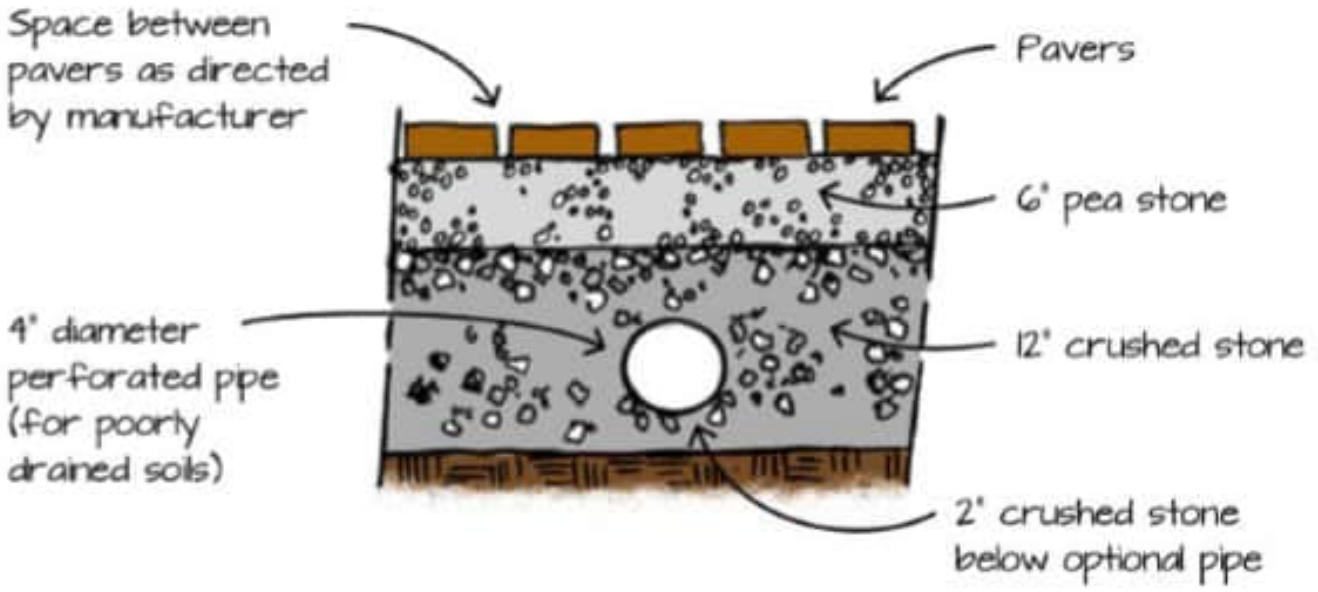


Dry Well

Dry wells are an effective way to infiltrate water from roofs or other concentrated areas so long as the soil is relatively well drained. The well is a hole dug out of the ground that is lined with geotextile fabric or holds a perforated container. Crushed stone slows and filters the water before it infiltrates into the ground water.

Permeable Pavers

Permeable pavers allow stormwater to be infiltrated into the ground through gaps between the pavers. This water then flows through crushed stone into the groundwater below. If the soil is not particularly well drained a perforated pipe can be installed that will direct water to a stable outlet downhill from the driveway.



VT Guide to Storm Water Management for Homeowners and Small Businesses—page 34

5. Further Resources

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www.winooskinrcd.org

Rethink Runoff Stream Team

www.rethinkrunoff.org

6. Storm Smart Support

Thank you for being a good neighbor and working to make our watershed resilient. If you are interested in having a follow up assessment or would like some hands-on help installing or maintaining your Green Stormwater Infrastructure please get in touch. I am happy to schedule a time to help make your property Storm Smart.

If you want to spread the word please feel free to share my contact information with your neighbors or anyone else you think might be interested. If there are any questions I can be reached by email at Adelaide@winooskinrcd.org

Storm Smart Assessment

Lisa Thompson

260 Pine Shore Drive Hinesburg VT 05461

Thank you for your time and commitment to healthy land, clean water, and a vibrant community!

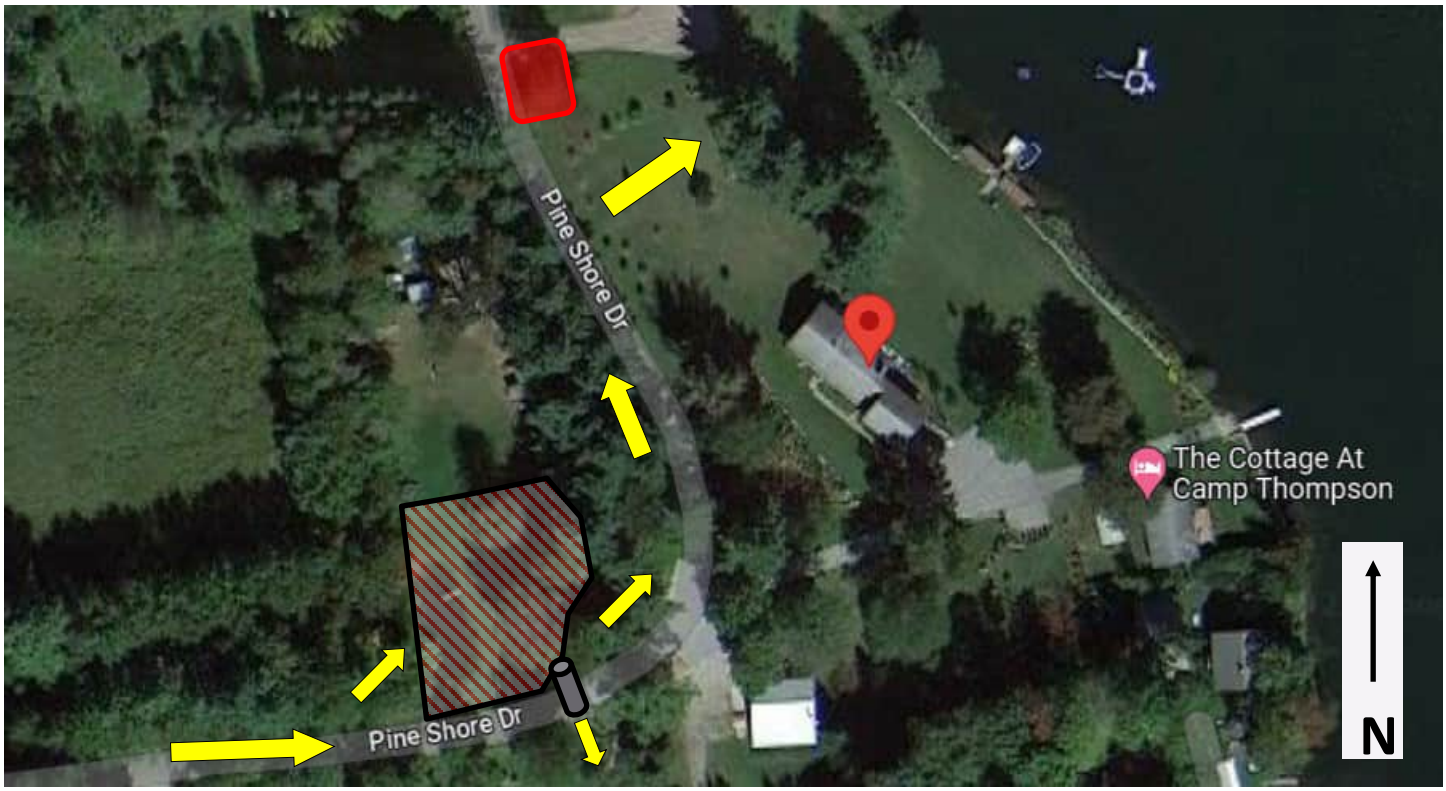
Contents

1. Summary of Visit

On May 18th 2023 Adelaide Dumm, Winooski Natural Resources Conservation District Conservation Specialist visited Lisa's property at 260 Pine Shore Drive in Hinesburg. The property is in the Lake Iroquois Patrick Brook Watershed, that drains to the LaPlatte River and eventually drains into Lake Champlain. The Stormwater runoff from the Pine Shore Drive flows onto Lisa's property and has deposited a substantial amount of sediment into the pond on her property and has caused erosion issues on its way into Lake Iroquois. The runoff occurring is of particular concern due to the close proximity to Lake Iroquois, this assessment was conducted as part of the Lake Iroquois Watershed Action Plan. There were a few storm smart solutions identified that can be implemented on the property. The property owner expressed interest in improving storm water management to prevent future soil erosion and seasonal flooding. The stewardship of the land will contribute to the greater well-being of plants, animals and people downstream.

Due to Lisa's existing Lake Wise Award we focused the Storm Smart Assessment on the upper portion of the property where she had concern about Stormwater runoff. Green Stormwater Infrastructure (GSI) solutions to the current runoff issues include maintaining the shoulders of the roadway with a vegetated swales and implementing BMPs on the field above her home to keep Stormwater on site. Planting a vegetation swale on her property along Pine Shore Drive will absorb and slow down runoff. Adding a series of check dams within the swale and constructing a rain garden in the field and before the water flows into the retention pond will help increase the water holding capacity on site by promoting the infiltration of storm water. Planting more perennials, like trees and shrubs, and establishing low mow zones is a low maintenance solution and will aid in decreasing the volume of Stormwater making its way down the road and into the lake. Working collaboratively with neighbors, Mark and Michelle Reid, to construct filter berms would also help direct runoff to a more stable vegetated area on her property. The maintenance and instillation of native plants along the sloped edges of the property will slow water down, allow for more soil infiltration, and increase water uptake by roots of perennial plants. Increasing the presence of native plants on site in the rain garden and incorporating vegetated "speed bumps" will also promote pollinators and create wildlife habitat. Overall, there are improvements to be made but the landowner is motivated and has already started on some of the projects mentioned.

Site Map– Areas of Concern



Area prone to seasonal flooding

Sloped lawn drains toward drive way

Area of erosion with bare soil exposed.

Opportunity Map

It was somewhat unclear who is responsible for road maintenance.

Coordinating with neighbors and or the town for maintenance may make it more feasible.

Establish a Vegetated swale with native perennial shrubs to stabilize slope by road side in vegetated swale

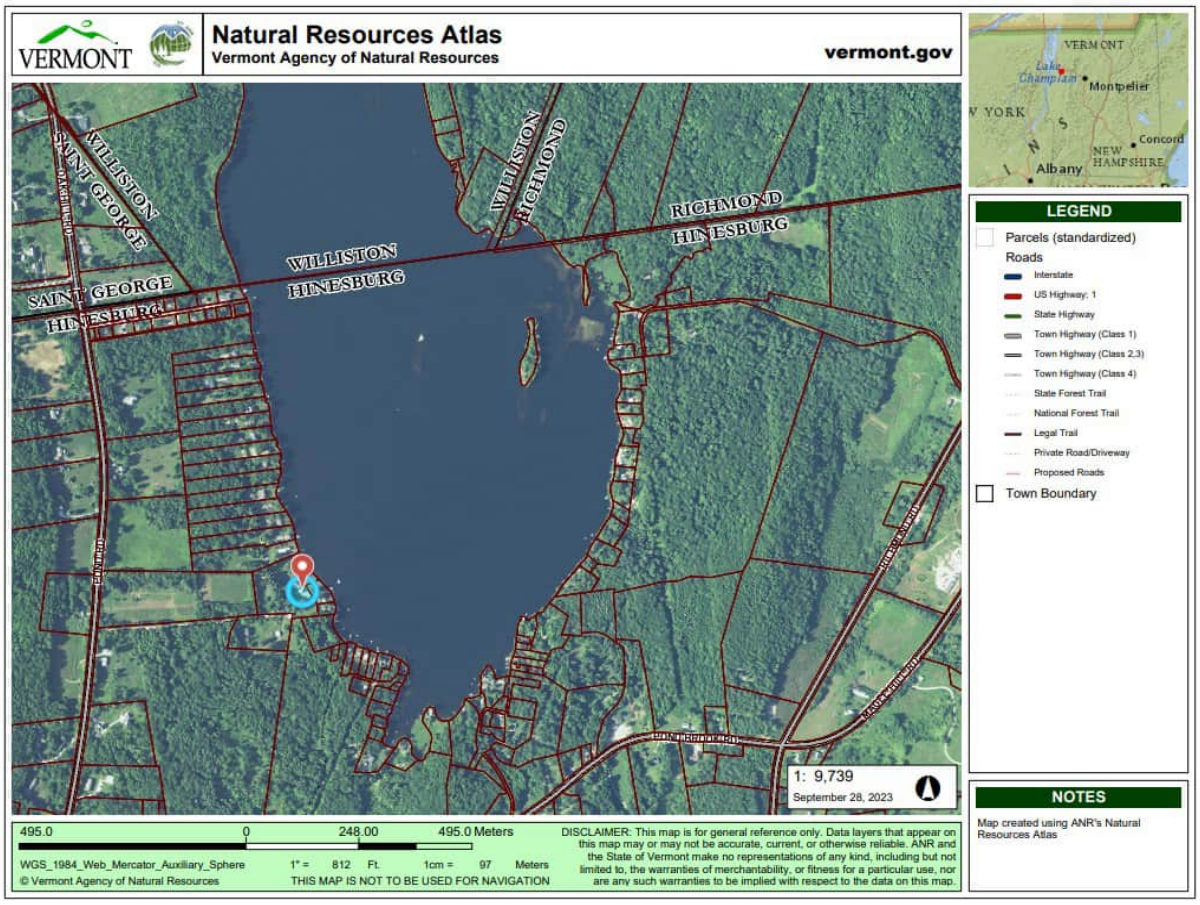
Plant native perennials around home to hold soil in place

Construct “speed bumps” or Filter Berms to slow down runoff

Check Dams along swale

Install rain garden or catch-ment area in the grass field from swale to infiltrate storm-water

Establish “No Mow” zones


VERMONT
Natural Resources Atlas
Vermont Agency of Natural Resources
vermont.gov
WILLISTON
HINESBURG
SAINT GEORGE
HINESBURG
RICHMOND
HINESBURG
WILLISTON
RICHMOND
VERMONT
Lake Champlain
Montpelier
NEW YORK
Concord
NEW HAMPSHIRE
Albany
LEGEND
Parcels (standardized)
Roads
Interstate
US Highway; 1
State Highway
Town Highway (Class 1)
Town Highway (Class 2,3)
Town Highway (Class 4)
State Forest Trail
National Forest Trail
Legal Trail
Private Road/Driveway
Proposed Roads
Town Boundary
NOTES
Map created using ANR's Natural Resources Atlas
1: 9,739
September 28, 2023
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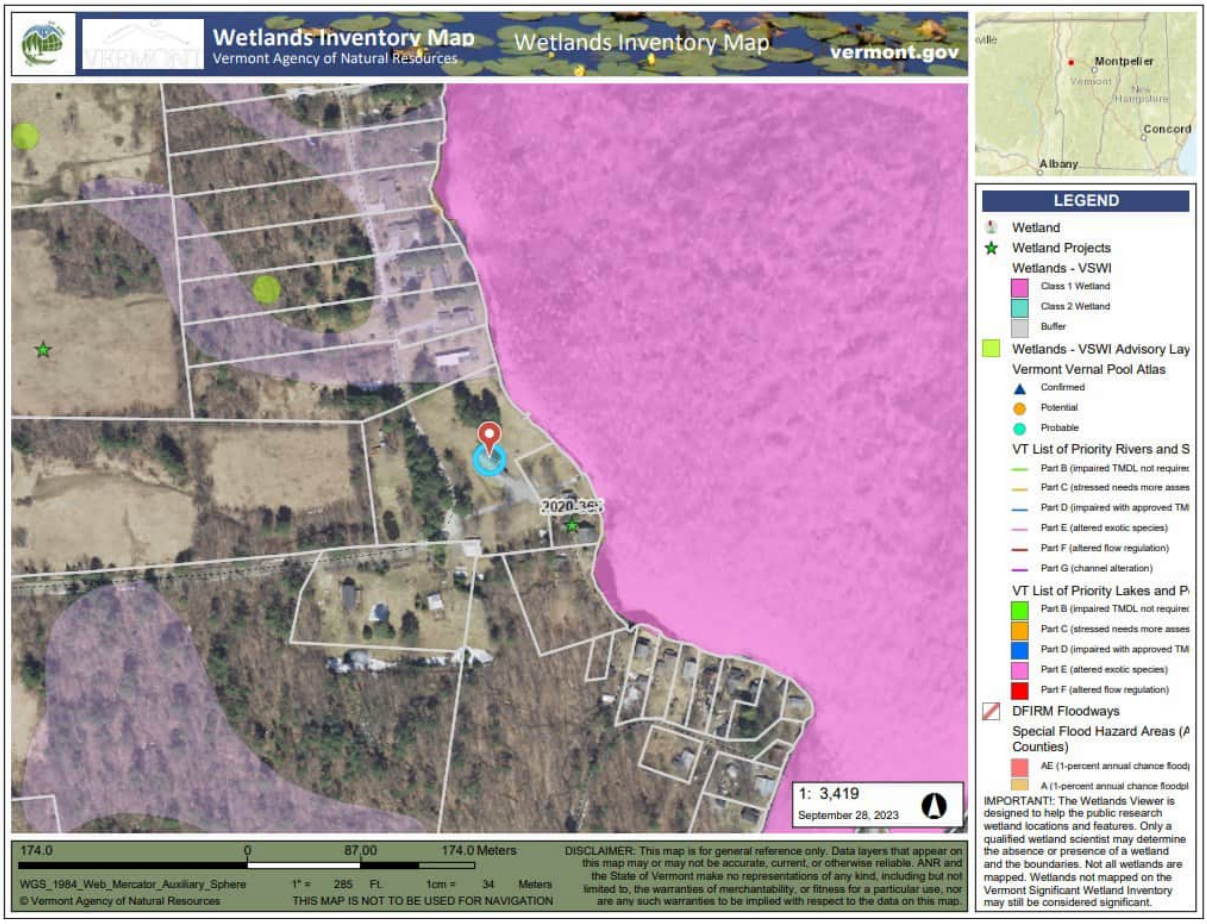
WGS_1984_Web_Mercator_Auxiliary_Sphere
1" = 812 Ft. 1cm = 97 Meters
© Vermont Agency of Natural Resources
THIS MAP IS NOT TO BE USED FOR NAVIGATION
DISCLAIMER: This map is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. ANR and the State of Vermont make no representations of any kind, including but not limited to, the warranties of merchantability, or fitness for a particular use, nor are any such warranties to be implied with respect to the data on this map.


Wetlands Inventory Map
Vermont Agency of Natural Resources
Wetlands Inventory Map
vermont.gov
Montpelier
Vermont
New Hampshire
Concord
Albany
LEGEND
Wetland
Wetland Projects
Wetlands - VSWI
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VT List of Priority Rivers and S
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DFIRM Floodways
Special Flood Hazard Areas (A
Counties)
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IMPORTANT! The Wetlands Viewer is designed to help the public research wetland locations and features. Only a qualified wetland scientist may determine the absence or presence of a wetland and the boundaries. Not all wetlands are mapped. Wetlands not mapped on the Vermont Significant Wetland Inventory may still be considered significant.
1: 3,419
September 28, 2023
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1" = 285 Ft. 1cm = 34 Meters
© Vermont Agency of Natural Resources
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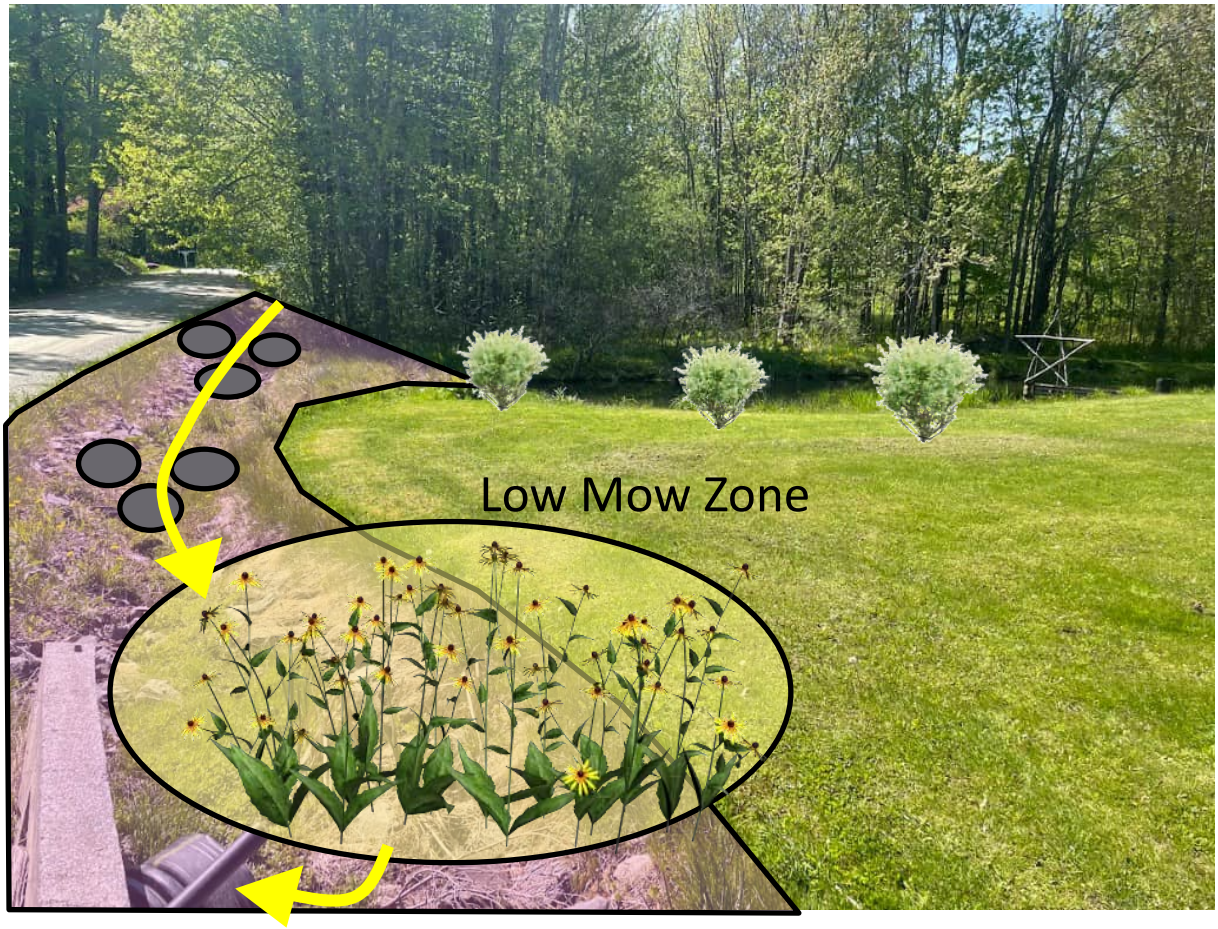
3. Recommendations and Maintenance

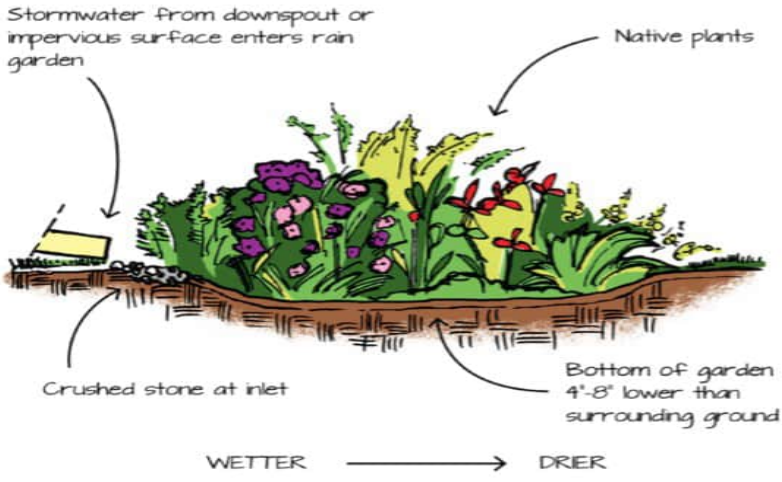
Green Stormwater Infrastructure (GSI) and Best Management Practices (BMP) are management methods that help stormwater runoff sink in, spread out, and slow down on your property, stopping erosion and keeping our streams clear. These recommendations for one time fixes and regular maintenance are steps you can take on your property to make your home Storm Smart.

Grass Field



Rain Gardens

Rain Gardens capture and slow water that runs off parking lots, driveways, and walkways. They use native plants to slow and filter water. Ultimately water is either infiltrated into the ground or is absorbed by the plants and release back into the atmosphere. Plants used in rain gardens should be both drought resistant and able to handle prolonged periods of submersion in water.



VT Guide to Storm Water Management for Homeowners and Small Businesses—page 30

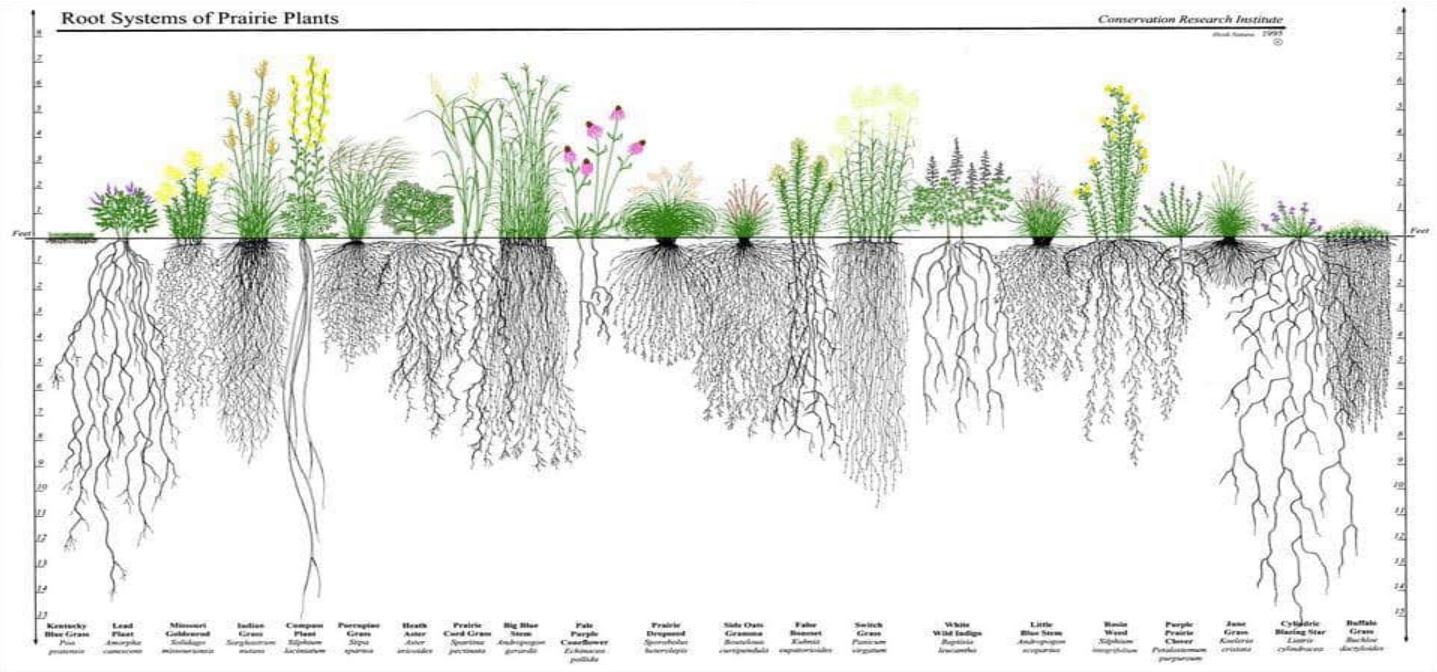
Ponds on the property

The ponds on the property have received sediment deposited from Stormwater runoff. Increasing the vegetation around the pond will work in collaboration with the other GSI techniques mentioned to slow down, spread out, and sink in sediment laden Stormwater runoff before it hits the pond.

Lisa received grant funding and assistance to construct the retention pond to the right in an effort to mitigate some of the Stormwater runoff. It has become well established with native vegetation and is a home for wildlife.

Low Mow Zones and Native Plants

- In comparison to Kentucky Blue Grass most native plants have deeper more complex root systems that do a better job stabilizing soil and absorbing water. These plants are slower growing than many of their foreign counterparts and by letting whole areas of your lawn grow tall they can have a chance to establish themselves.
- Native plants can be sourced from a variety of businesses and organizations. Below is a brief list. Check this website to be sure that the species you select are not invasive to the region https://www.vtinvasives.org/
- Winooski NRCD Annual Tree Sale http://winooskinrcd.org/trees-and-trout-sale/
- Intervale Conservation Nursery https://www.intervale.org/intervale-conservation-nursery



Alliance for the Chesapeake Bay

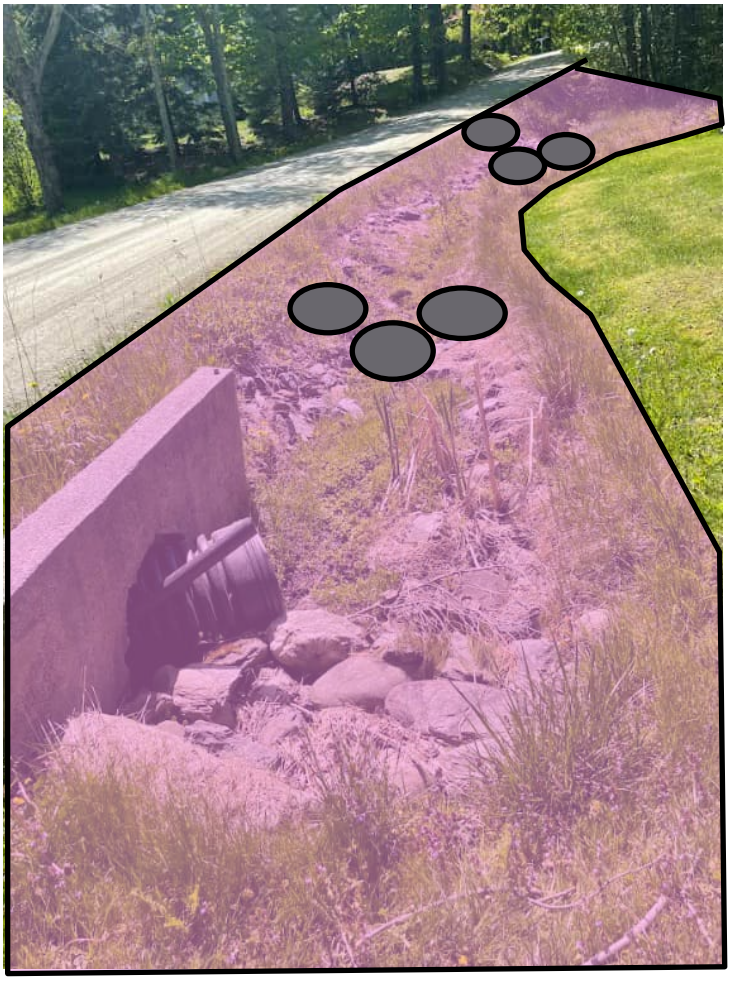
Raise the Blade

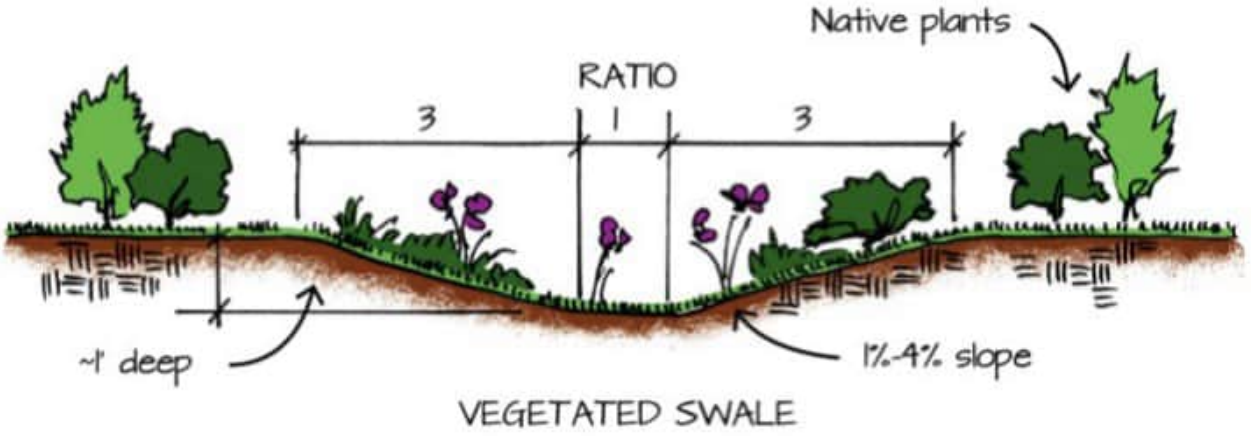
By simply raising the setting of your lawnmower blade to 3” you can encourage deeper root growth and therefore better infiltration in the frequently-used areas of your lawn that you decide to keep. Visit lawntolake.com for more information about the benefits of this practice.

Vegetated Swale

Vegetated Swales are broad channels that slow, infiltrate, and direct water. They are often used in conjunction with check dams to improve their ability to slow water and capture sediment. Swales are a good choice for relatively flat parking areas or driveways and can be used to direct water towards more stable ground.

The amount and size of plants has a direct impact on the amount of surface runoff during storms. Generally, plants that absorb rainfall well are deep-rooted perennials and woody shrubs and trees. When selecting plants it is important to choose "the right plant for the right place" by paying attention to each species' soil moisture and sun/shade requirements. Native plants are recommended since they are adapted to Vermont's climate, provide the appropriate food sources for birds and butterflies, and fit well aesthetically into the landscape.





VEGETATED SWALE

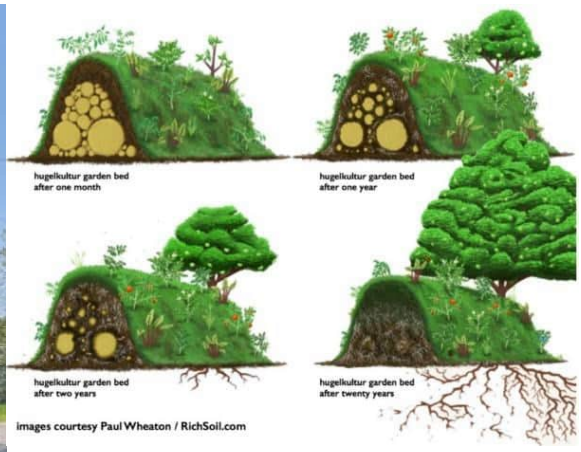
The road side along Pine Shore Drive received a lot of stormwater runoff but it properly crowned and effectively directs water to the drainage swales along the side. The privately owned property along Pine Shore Drive is an area that can be improved to be more Storm Smart as it currently has some erosion. Planting native perennials along the edge of the road or creating a vegetated swale will increase the water retention potential on site, as the vegetation will absorb excess runoff. More information can be found in the VT Guide to Storm Water Management for Homeowners and Small Businesses—page 42.

Work Collaboratively with neighbors to reduce Stormwater runoff

Create “road bumps” or terraces in the steepest areas with high erosion to slow the flow of water during rainstorms and help it infiltrate into the soil. These “road bumps” could be created by placing logs along contour lines to create a terraced effect or following design instructions for filter berms.

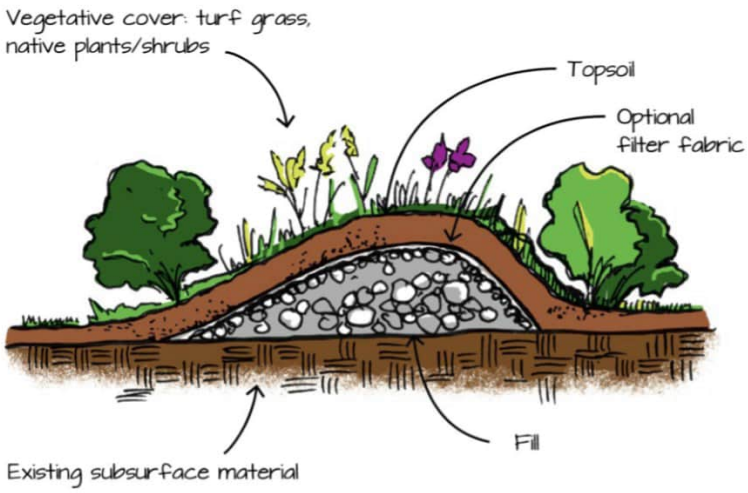
You could use the hügelkultur technique for creating filter berms on the property!

https://www.almanac.com/what-hugelkultur-ultimate-raised-bed



Filter Berms

Filter berms capture and slow water that runs off parking lots, driveways, and walkways. Their interior is filled with stable, well drained material that absorbs and slows stormwater runoff. Vegetation on the outside of the berm provides more structure and helps further slow stormwater.

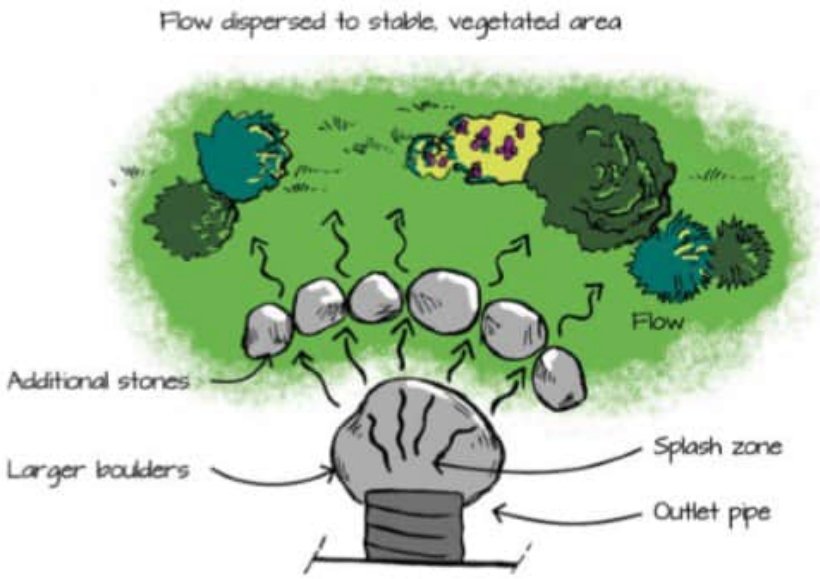


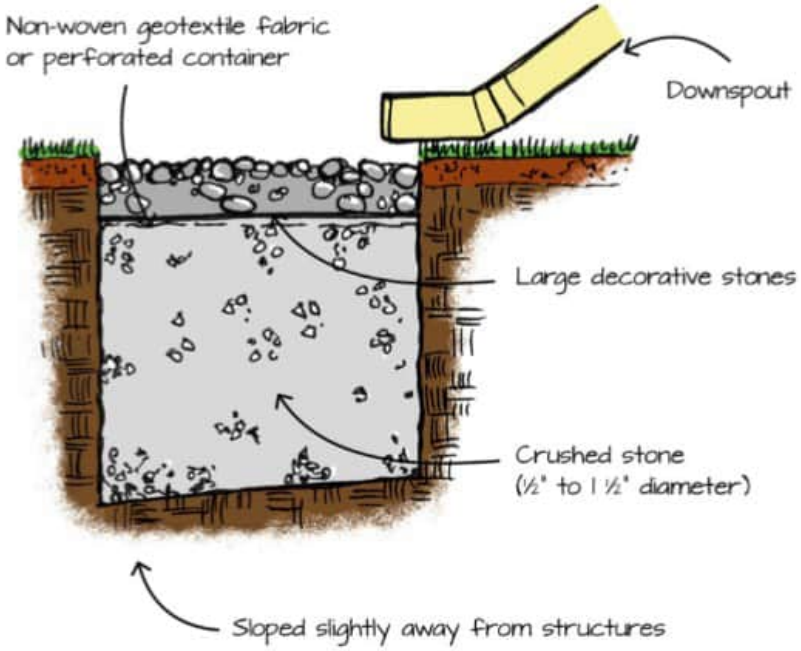
4. Construction Details

Being Storm Smart can save you time and money cleaning up after storms, help keep your downstream neighbors safe, protect fish and other aquatic life, and give us all more summer days of swimming in crystal clear water. These diagrams incorporated in the recommendation sections and more below can help you make being Storm Smart a reality.

Energy Diffuser

Energy diffusers are made by placing a large rock or boulder under the outlet of a culvert or downspout. The rock provides a stable surface for flowing water to impact and lose energy before it continues downhill. With less energy behind it the water is less likely to cause erosion that can destabilize the culvert.



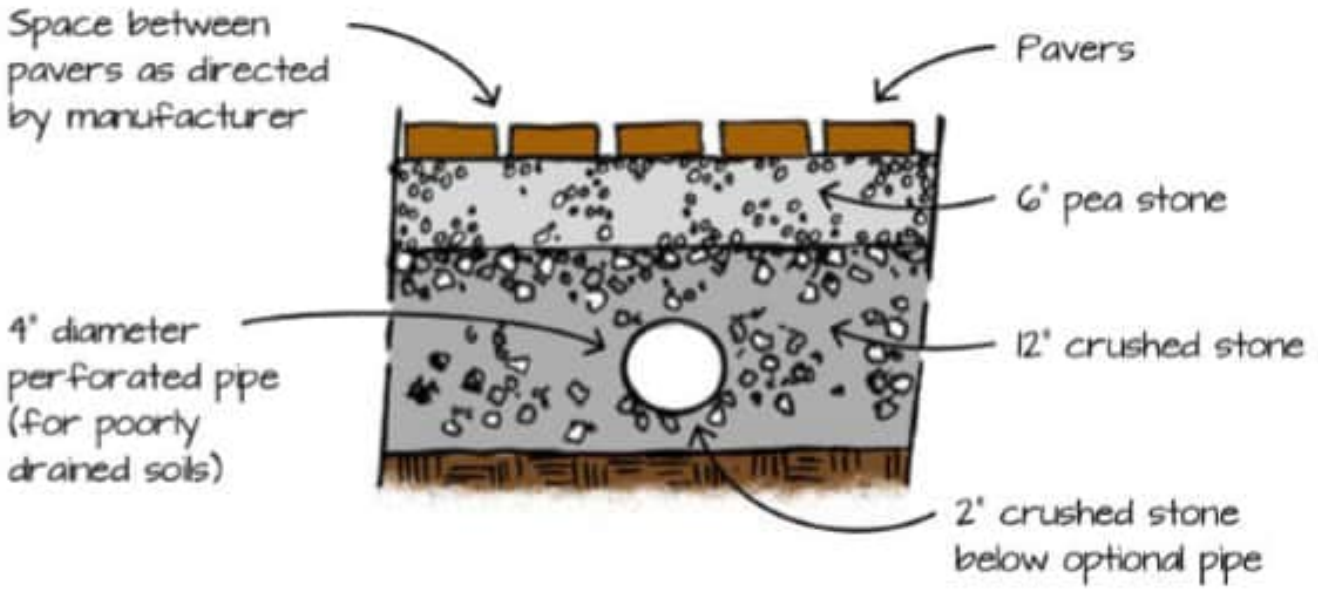


Dry Well

Dry wells are an effective way to infiltrate water from roofs or other concentrated areas so long as the soil is relatively well drained. The well is a hole dug out of the ground that is lined with geotextile fabric or holds a perforated container. Crushed stone slows and filters the water before it infiltrates into the ground water.

Permeable Pavers

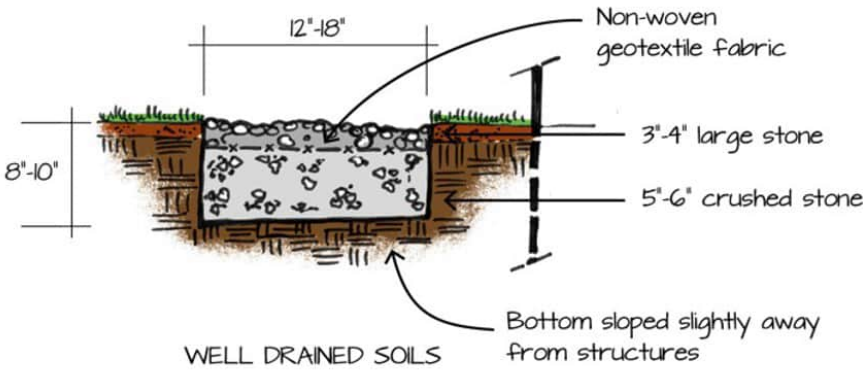
Permeable pavers allow stormwater to be infiltrated into the ground through gaps between the pavers. This water then flows through crushed stone into the groundwater below. If the soil is not particularly well drained a perforated pipe can be installed that will direct water to a stable outlet downhill from the driveway.

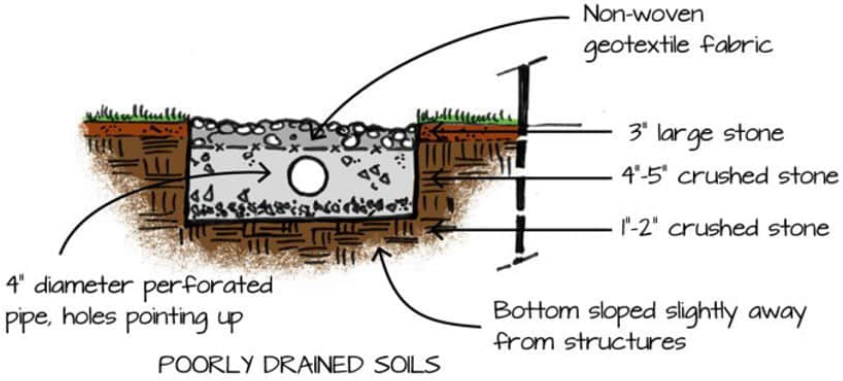


VT Guide to Storm Water Management for Homeowners and Small Businesses—page 34

Infiltration trench

Infiltration trenches are shallow, stone lined channels that capture water from impervious surfaces (like roof tops) and infiltrate it into the ground. In less well drained soils an Infiltration Trench is outfitted with a pipe to convey water that risks pooling. More information on this can be found in the VT Guide to Storm Water Management for Homeowners and Small Businesses, listed in the Further Resources section on page 13.





5. Further Resources

VT Guide to Stormwater Management— A document with great information about managing stormwater at home

http://dec.vermont.gov/sites/dec/files/wsm/erp/docs/2018-06-14%20VT_Guide_to_Stormwater_for_Homeowners.pdf

Agency of Natural Resources Atlas– Free online mapping software to explore the natural resources around your home

http://anrmaps.vermont.gov/websites/anra5/

Vermont Department of Environmental Conservation Stormwater—Information about green stormwater infrastructure

http://dec.vermont.gov/watershed/cwi/green-infrastructure

The Vermont Rain Garden Manual: Gardening to Absorb the Storm—A guide to building your own rain garden with emphasis on using plants that are native to Vermont

http://winooskinrcd.org/wp-content/uploads/VTRainGardenManual.pdf

Better Backroads Manual—A guide to managing dirt and gravel roads that can be useful if you have a long driveway
https://vtrans.vermont.gov/sites/aot/files/highway/2009%20Better%20Backroads%20Manual.pdf

Friends of the Winooski: Preventing Driveway Erosion—Strategies for managing dirt and gravel driveways
https://winooskiriver.org/uploads/files/Driveway_Road%20Maintenance.pdf

Household Septic Maintenance Factsheet — WNRCD

http://winooskinrcd.org/wp-content/uploads/managing-HH-septic-factsheet.pdf

Winooski Natural Resources Conservation District —Find other ways to get involved at our website

www.winooskinrcd.org

Rethink Runoff Stream Team

www.rethinkrunoff.org

6. Storm Smart Support

Thank you for being a good neighbor and working to make our watershed resilient. If you are interested in having a follow up assessment or would like some hands-on help installing or maintaining your Green Stormwater Infrastructure please get in touch. I am happy to schedule a time to help make your property Storm Smart.

If you want to spread the word please feel free to share my contact information with your neighbors or anyone else you think might be interested. If there are any questions I can be reached by email at Adelaide@winooskinrcd.org

Appendix C Project Prioritization Memo

Lake Iroquois-Patrick Brook Watershed Action Plan

Winooski Natural Resources Conservation District

SLR Project No.: 146.14439.00006

March 7, 2024

Memorandum

To:	Adelaide Dumm, District Manager	**From:**	Jessica Louisos, Alex Marcucci
Company:	Winooski NRCD		**SLR International Corporation**
cc:	Lewis Creek Association Lake Iroquois Association	**Date:**	November 13, 2023 Revised February 15, 2024
		Project No.	14439.00006

RE: Planning / Prioritization for Projects in the Lake Iroquois-Patrick Brook Watershed

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Project Identification and Prioritization Method

An initial project identification table and map were compiled based on existing reports, mapping, and project team meetings. Data sources were summarized in a watershed resource library (April 2023). Project team meetings guided the selection of priority assessment areas. SLR water resources engineers visited potential project sites and completed a windshield survey of the Lake Iroquois-Patrick Brook watershed to review possible projects during spring and summer 2023. Possible project areas were visited to review existing information, confirm project type, and determine feasibility. Observations and existing mapping were used to inform the project prioritization.

Unified Scoring Prioritization

The Vermont DEC has developed guidelines for stormwater master planning along with a Unified Scoring Prioritization for Stormwater Master Plans table to provide standardized scoring for projects (VTDEC, 2019, Appendix A). The projects identified for a GSI treatment volume are shown on a map (Appendix B) and described and prioritized in the Unified Scoring Prioritization Table (Appendix C). Project photos are included in Appendix D.

BMP Unit Costs and Adjustment factors were derived from stormwater master plans completed by Watershed Consulting Associates (2018) based on research and Vermont construction costs (Table 1). Costs were adjusted to include an 8% total inflation adjustment based on the Consumer Price Indicator Inflation Calculator. Multipliers for site type and permitting and engineering required are also applied (Tables 2 & 3, Watershed Consulting Associates (2018)).

Table 1: BMP Unit Costs

BMP Type	Cost/ft3 Treatment Volume
Constructed Wetland	9.49
Dry Pond	4.87
Grass Conveyance Swale	4.32
Rain Garden (no underdrain)	16.72
Rain Garden (with underdrain)	16.72
Sand Filter	19.37

Subsurface Infiltration	6.76
Surface Infiltration	6.75
Underground Chamber	7.34
Wet Pond	7.35

Table 2: Site Type Cost Adjustment

Site Type	**Cost Multiplier**
Existing BMP retrofit	0.25
New BMP in undeveloped area	1.00
New BMP in partially developed area	1.50
New BMP in developed area	2.00

Table 3: Permitting and Engineer (P&E) Cost Adjustment

Level of P&E Required	**Cost Multiplier**
None	1.00
Low	1.20
Moderate	1.25
High	1.35

Non-Unified Scoring Prioritization

Not all projects identified fit within the structure of the Unified Scoring Matrix when the primary recommendation is not stormwater treatment with a GSI method. A Non-Unified Scoring method was used that was developed by Fitzgerald Environmental Associates and SLR (2021). Projects were assigned several numerical scoring metrics that are weighted to assist in prioritizing each project based on water quality benefits, project feasibility, maintenance requirements, costs, and any additional benefits. The maximum possible score is 30. Each category is described and includes a description of the scoring for each criterion (Appendix A). Potential projects are shown on a map (Appendix B). Final evaluation criteria summarized in the Non-Unified Prioritization Project Table (Appendix C) and photos are included in Appendix D.

References

Fitzgerald Environmental Associates, LLC and SLR, 2021. Cambridge / Jeffersonville Stormwater Project Prioritization, dated March 1, 2021, produced for Lamoille County Planning Commission & Villages of Cambridge and Jeffersonville.

Watershed Consulting Associates, LLC., 2018. Stormwater Master Plan for the Town of Berlin, Vermont. Final Report, January 17, 2018. Prepared for the Central Vermont Regional Planning Commission.

VTDEC, 2019. Vermont Stormwater Master Planning Guidelines, Agency of Natural Resources, Department of Environmental Conservation, Clean Water Initiative Program, revised December 12, 2019.

APPENDIX A – SCORING CRITERIA

Lake Iroquois-Patrick Brook Watershed Action Plan

Project Prioritization

Winooski Natural Resources Conservation District

14439.00006

November 13, 2023

Revised March 7, 2024

Unified Scoring Prioritization for Stormwater Master Plans

The following table is to assist in the standardized prioritization of projects identified in a Stormwater Master Plan (SWMP).

Criteria	Proposed Weight	Max points
Water Quality/Environmental impact		
Sediment reduction (using STP calculator for sediment) (not yet developed)	0-4 (natural groupings within the range of sediment reductions for proposed projects for a specific plan. 0=very low reduction, 4= very high sediment reduction)	4
Phosphorus/nutrient reduction (using STP Calculator)	0-4 (natural groupings within the range of phosphorus reductions for proposed projects for a specific plan. 0=very low p reduction, 4= very high P reduction)	4
Impervious area managed	1-4 (natural groupings within the range of impervious surface managed for proposed projects for a specific plan. More impervious treated gets more points)	4
Percent of Water Quality & Channel Protection Volume treated*	0-3 (0= no WQ treated, 1= ½ WQV treated, 2=meeting WQV, 3=meets WQV and CPV). Do not apply to road projects.	3
Percent of Recharge criteria met *	0-3 (0 = no infiltration, 1 =infiltrates less than recharge volume, 2= meets full recharge, 3= exceeds recharge 1.5 times or more) Do not apply to road projects.	3
Streambank or other gully erosion mitigation	0-2 (calculate volume= Length x avg. width x avg. depth, use natural groupings to divide volume into 3 categories)	2
Green infrastructure opportunity	0-1 (0=no, 1=yes)	1
* WQV, CPV and Recharge criteria as outlined in 2017 Vermont Stormwater Management Manual		
Total Water Quality Score (out of 21, or 15 if road project)		
Feasibility Criteria		
Public land or Private Landowner support	0-3 (3=public land, 2=willing private land owner, 0=unwilling or unknown willingness of private landowner)	3
Project and Permitting complexity (number of permits required)	0-2 (2= simple permitting, 0= complex permitting-potential denial)	2
Infrastructure conflicts	1 (Y= 0, N=1)	1
Total Estimated Project Cost)	Enter engineering estimate+ construction estimate (no points)	
Project efficiency ($/lbs. of P removed)	1-12 (Use natural grouping of $/lbs. removed)	12
Ease of O&M and ease of access for O&M	0-2 (based on municipal input on what is easiest to maintain, 0=high maintenance, 2=easy maintenance)	2
Total Feasibility Score (out of 20)		
Other considerations/Co-benefits (0=doesn't address concern, 1=addresses concern)		
Educational benefits and or Recreational benefits	1	1
Natural habitat creation/protection	1	1
Infrastructure improvement (culvert replacement)	1	1
Outfall erosion control	1	1
Connected to receiving water	3=all runoff infiltrates on site, 2= runoff receives some treatment before reaching receiving water. 1=runoff drains via infrastructure directly to receiving water with no erosion or additional pollutant loading, 0 =runoff drains directly to receiving water	3
Flood mitigation (known problem)	1	1
Existing local concerns	1	1
Total Co-benefits Score (out of 9)		
Overall Score (out of 50 or 44)		

NON-UNIFIED SCORING PRIORITIZATION SCORING

A Non-Unified Scoring method was used that was developed by Fitzgerald Environmental Associates and SLR (2021). Projects were assigned several numerical scoring metrics that are weighted to assist in prioritizing each project based on water quality benefits, project feasibility, maintenance requirements, costs, and any additional benefits. The maximum possible score is 30. Each category is described below and includes a description of the scoring for each criterion. Final evaluation criteria summarized in the Non-Unified Prioritization Project Table are described below:

Nutrient Reduction Effectiveness (4 points) – Degree of nutrient removal potential with project implementation, this accounts for both the existing nutrient loads and the removal efficiency and capacity of the proposed treatment. Nutrient loading was quantified based on the watershed size, the land cover types, and percent impervious surfaces, and the effectiveness was based on the treatment efficacy of the potential mitigation options appropriate for the space and location of the treatment area.

- 0 points – No nutrient source and/or no increased treatment
- 1 point – Minor nutrient source and/or minor increase in treatment
- 2 points – Moderate nutrient source with some increase in treatment
- 3 points – Moderate nutrient source with significant increase in treatment
- 4 points – Major nutrient source with significant increase in treatment

Sediment Reduction Effectiveness (4 points) – Degree of sediment removal potential with project implementation, this accounts for both the existing sediment loads and the removal efficiency and capacity of the proposed treatment. Sediment loading was quantified based on the watershed size, the land cover types, and percent impervious surfaces, and the effectiveness was based on the treatment efficacy of the potential mitigation options appropriate for the space and location of the treatment area.

- 0 points - No sediment source and/or no increased treatment
- 1 point – Minor sediment source and/or minor increase in treatment
- 2 points – Moderate sediment source with some increase in treatment
- 3 points – Moderate sediment source with significant increase in treatment
- 4 points – Major sediment source with significant increase in treatment

Drainage Area (1 point) – Approximate drainage area to site is greater than 2 acres

Impervious Drainage (3 points)– Approximate area of impervious surfaces draining to the site.

- 0 points – Area of impervious surfaces is less than 0.25 acres
- 1 point – Area of impervious surfaces is 0.25-0.5 acres
- 2 points – Area of impervious surfaces is 0.5-1.0 acres
- 3 points – Area of impervious surfaces is >1.0 acres

Connectivity to Surface Waters (3 points)

- 0 points – All stormwater infiltrates on site
- 1 point – Stormwater receives some treatment before reaching receiving waters
- 2 points – Stormwater drains into drainage infrastructure that directly outlets to receiving waters (assumes no erosion or additional pollutant loading to discharge point)

- 3 points – Stormwater drains directly into receiving waters (typically stormwater draining directly into a large wetland is assigned 2 points)

Landowner Support (2 points)

- 0 points – Project is located on private property, no contact with landowner
- 1 point – Project is on Town or State property with no contact
- 2 points – Project has been discussed and is supported by landowner

Operation and Maintenance Requirements (2 points)

- 0 points – Project will require significant increased maintenance effort
- 1 point – Project will require some increased maintenance effort
- 2 points – Project will require no additional maintenance effort

Cost and Constructability (6 points) – This score is based on the overall project cost (low score for high cost) and accounts for additional design, permitting requirements, and implementation considerations, such as site constraints and utilities, prior to project implementation.

Additional Benefits (5 points total) – Description of other project benefits, total score is roughly a count of the number of additional benefits. Additional benefits considered in the prioritization are as follows:

1. **Chronic Problem Area** – The site requires frequent maintenance and/or is an ongoing problem affecting water quality
2. **Seasonal Flooding** – The site is affected by or contributes to seasonal flooding
3. **Educational** – The site provides an opportunity to educate the public about stormwater treatment practices
4. **High Visibility** – The site is highly visible and will benefit from aesthetically designed treatment practices
5. **Infrastructure Conflicts** – The stormwater problem area is increasing erosion or inundation vulnerability of adjacent infrastructure (i.e. roads, buildings, etc.)
6. **Drains to Connected Stormwater Infrastructure** – The site drains into a larger stormwater conveyance system that is less likely to receive downstream treatment
7. **Reduces Thermal Pollution** – Project implementation will reduce the risk of thermal loading from runoff to receiving surface waters
8. **Improves BMP Performance** – Project implementation will improve the performance of existing stormwater treatment practices that receive runoff from the site
9. **Peak Flow Reduction** – Project implementation will significantly reduce stormwater peak flows leaving the site
10. **Enhances Natural Communities** – Project implementation will promote a native vegetated lakeshore buffer and/or provide wildlife habitat along the lakeshore or river.

APPENDIX B – PROJECT MAP

Lake Iroquois-Patrick Brook Watershed Action Plan

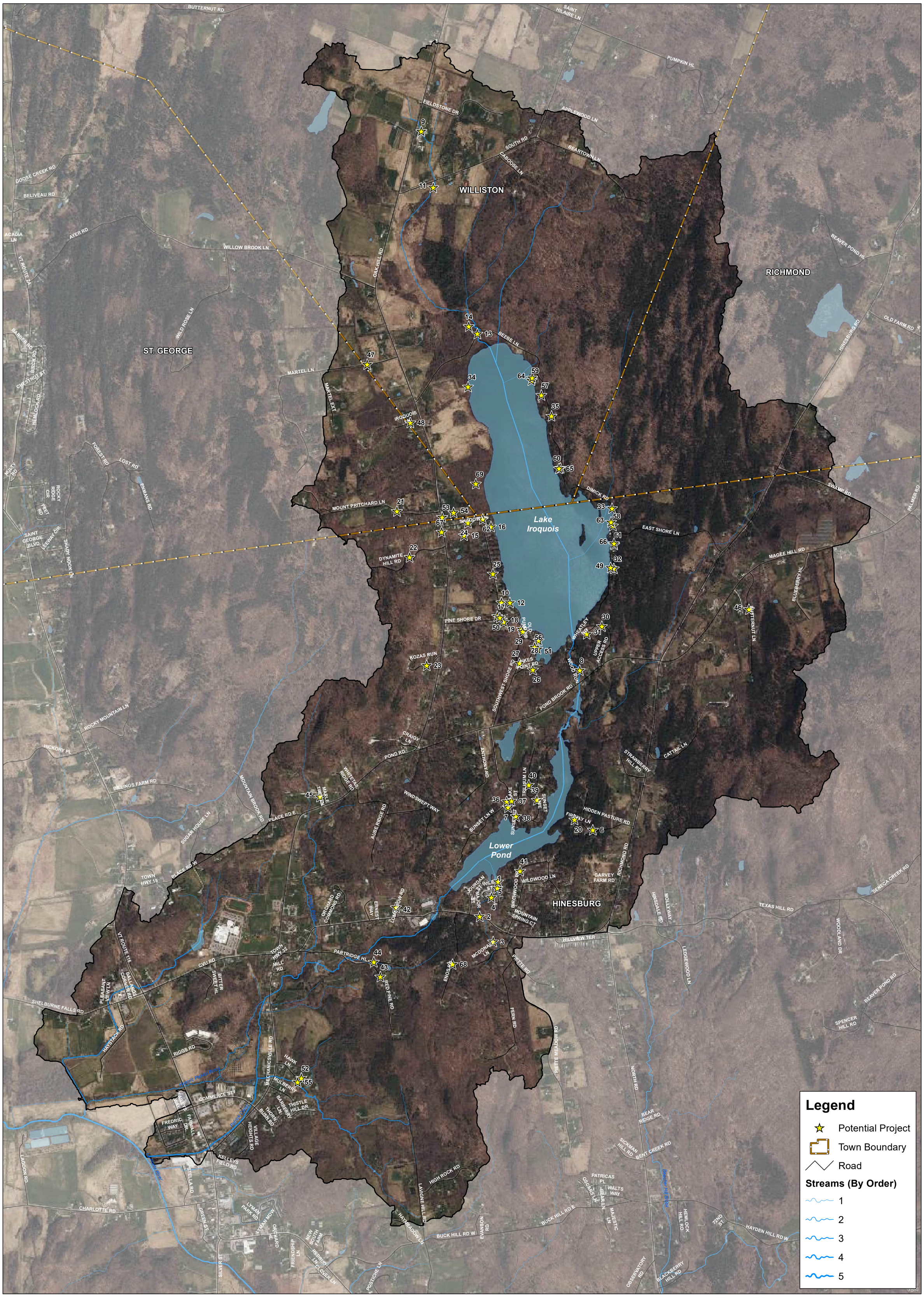
Project Prioritization

Winooski Natural Resources Conservation District

14439.00006

November 13, 2023

Revised March 7, 2024



LAKE IROQUOIS & PATRICK BROOK WATERSHED PROJECT IDENTIFICATION

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 1,800 3,600

Feet

1 in = 900 feet

N

SLR

1 SOUTH MAIN ST
WATERBURY, VT 05676
802.882.8335

APPENDIX C – PROJECT TABLES

Lake Iroquois-Patrick Brook Watershed Action Plan

Project Prioritization

Winooski Natural Resources Conservation District

14439.00006

November 13, 2023

Revised March 7, 2024

Lake Iroquois-Patrick Brook Watershed Action Plan - Projects
Unified Scoring Prioritization Matrix
March 7, 2024

Project Number	Town	Name	Project Description	Total Drainage Acreage	Impervious Acreage in Drainage Area	BMP Type	Phosphorus/Nutrient Reduction - Calculated (kg/yr)	WQv (cu ft)	Treatment Volume (cu ft)	Percent of WQv Treated	Percent of WQv & CPv Treated	Total Water Quality Score	Total Feasibility Score	Total Co-benefits Score	Overall Score
34	Hinesburg	Lake Iroquois Boat Launch Rain Garden	Install swale, stone forebay, and rain garden to capture untreated runoff flowing from boat launch into lake	0.11	0.11	Rain Garden	0.05	372	384	103%	2	5	7	4	16
49	Hinesburg	East Shore Lane Rain Garden	Construct rain garden to capture road runoff before it reaches lake	0.52	0.07	Rain Garden	0.13	323	250	77%	1	5	11	4	20
50	Hinesburg	Pine Shore Drive Rain Gardens	Construct rain garden to treat runoff from roadside swale and pond, Construct filter berms in the roadside swale with depressions upgradient planted with rain garden vegetation	8.15	0.69	Rain Garden, Filter Berms	0.95	3733	724	19%	1	6	17	4	27
51	Hinesburg	Southwest Shore Road Rain Garden	Construct rain garden to treat runoff from 452 Southwest Shore Road	0.34	0.08	Rain Garden	0.12	323	250	77%	1	5	13	4	22
52	Hinesburg	Hawk Lane Rain Garden	Construct rain garden to treat runoff from 114 Hawk Lane	0.28	0.1	Rain Garden	0.11	378	250	66%	1	5	13	4	22
53	St. George	Oak Hill Road Rain Garden	Construct rain garden to treat runoff from Oak Hill Road and 5327 Oak Hill Road property	0.29	0.18	Rain Garden	0.19	641	250	39%	1	5	17	5	27
62	Hinesburg	Shadow Lane Rain Garden	Construct rain garden to treat runoff from 163 Shadow Lane	0.16	0.05	Rain Garden	0.04	192	230	120%	2	5	7	5	17
63	Hinesburg	Dimick Road Rain Garden	Construct rain garden to treat runoff from 56 Dimick Road	0.29	0.07	Rain Garden	0.1	281	350	125%	2	7	9	4	20
64	Williston	746 Beebe Lane Rain Garden	Construct rain garden to treat runoff from 746 Beebe Lane	0.15	0.06	Rain Garden	0.04	223	500	225%	2	5	7	4	16
65	Williston	1140 Beebe Lane Rain Garden	Construct rain garden to treat runoff from 1140 Beebe Lane	0.15	0.02	Rain Garden	0.02	93	500	537%	2	5	7	4	16
66	Hinesburg	563 East Shore Lane Rain Garden	Construct rain garden to treat runoff from 563 East Shore Lane	0.88	0.05	Rain Garden	0.18	324	400	124%	2	6	13	4	23

Lake Iroquois-Patrick Brook Watershed Action Plan - Projects
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Project Number	Town	Name	Project Description	Total Drainage Acreage	Impervious Acreage in Drainage Area	BMP Type	Phosphorus/Nutrient Reduction - Calculated (kg/yr)	Phosphorus/Nutrient Reduction - Score	Impervious Area Managed (acres, uses % treated)	Impervious Area Managed	WQv (acre-feet)	WQv (cu ft)	Treatment Volume (cu ft)	Percent of WQv Treated	Percent of WQv & CPv Treated	Hydrologic Soil Group	Hydric	Percent of Recharge Criteria Met - Score	Streambank/gully erosion mitigation-Volume	Streambank/gully erosion mitigation	Green Infrastructure Opportunity	Total Water Quality Score
34	Hinesburg	Lake Iroquois Boat Launch Rain Garden	Install swale, stone forebay, and rain garden to capture untreated runoff flowing from boat launch into lake	0.11	0.11	Rain Garden	0.05	1	0.1	1	0.01	372	384	103%	2	D	No	0	0	0	1	5
49	Hinesburg	East Shore Lane Rain Garden	Construct rain garden to capture road runoff before it reaches lake	0.52	0.07	Rain Garden	0.13	1	0.1	1	0.01	323	250	77%	1	A	No	1	0	0	1	5
50	Hinesburg	Pine Shore Drive Rain Gardens	Construct rain garden to treat runoff from roadside swale and pond, Construct filter berms in the roadside swale with depressions upgradient planted with rain garden vegetation	8.15	0.69	Rain Garden, Filter Berms	0.95	2	0.1	1	0.09	3733	724	19%	1	C	No	1	0	0	1	6
51	Hinesburg	Southwest Shore Road Rain Garden	Construct rain garden to treat runoff from 452 Southwest Shore Road	0.34	0.08	Rain Garden	0.12	1	0.1	1	0.01	323	250	77%	1	A	No	1	0	0	1	5
52	Hinesburg	Hawk Lane Rain Garden	Construct rain garden to treat runoff from 114 Hawk Lane	0.28	0.1	Rain Garden	0.11	1	0.1	1	0.01	378	250	66%	1	C/D	Yes	1	0	0	1	5
53	St. George	Oak Hill Road Rain Garden	Construct rain garden to treat runoff from Oak Hill Road and 5327 Oak Hill Road property	0.29	0.18	Rain Garden	0.19	1	0.1	1	0.01	641	250	39%	1	C/D	No	1	0	0	1	5
62	Hinesburg	Shadow Lane Rain Garden	Construct rain garden to treat runoff from 163 Shadow Lane	0.16	0.05	Rain Garden	0.04	1	0.1	1	0.00	192	230	120%	2	D	Yes	0	0	0	1	5
63	Hinesburg	Dimick Road Rain Garden	Construct rain garden to treat runoff from 56 Dimick Road	0.29	0.07	Rain Garden	0.1	1	0.1	1	0.01	281	350	125%	2	A	No	2	0	0	1	7
64	Williston	746 Beebe Lane Rain Garden	Construct rain garden to treat runoff from 746 Beebe Lane	0.15	0.06	Rain Garden	0.04	1	0.1	1	0.01	223	500	225%	2	D	No	0	0	0	1	5
65	Williston	1140 Beebe Lane Rain Garden	Construct rain garden to treat runoff from 1140 Beebe Lane	0.15	0.02	Rain Garden	0.02	1	0.1	1	0.00	93	500	537%	2	D	No	0	0	0	1	5
66	Hinesburg	563 East Shore Lane Rain Garden	Construct rain garden to treat runoff from 563 East Shore Lane	0.88	0.05	Rain Garden	0.18	1	0.1	1	0.01	324	400	124%	2	A	No	1	0	0	1	6

Lake Iroquois-Patrick Brook Watershed Action Plan - Projects
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Project Number	Town	Name	Project Description	Public or Private Landowner Support	Project and Permitting Complexity	Infrastructure Conflicts	BMP Unit Cost	Site Type Cost Adjustment	Permitting & Engineer Cost Adjustment	Total Estimated Project Cost	Project efficiency ($/kgs P removed)	Project efficiency-Score	Ease of O&M and ease of access for O&M	Total Feasibility Score	Education and/or recreational benefits	Natural Habitat Creation/Protection	Infrastructure Improvement (Culvert Replacement)	Outfall Erosion Control	Connected to Receiving Water	Flood Mitigation (Known Problem)	Existing Local Concerns	Total Co-benefits Score	Overall Score
34	Hinesburg	Lake Iroquois Boat Launch Rain Garden	Install swale, stone forebay, and rain garden to capture untreated runoff flowing from boat launch into lake	2	2	1	16.72	1.5	1.2	$ 11,557	$ 231,137	1	1	7	1	0	0	0	3	0	0	4	16
49	Hinesburg	East Shore Lane Rain Garden	Construct rain garden to capture road runoff before it reaches lake	0	2	1	16.72	1.5	1.2	$ 7,524	$ 57,877	7	1	11	1	0	0	0	3	0	0	4	20
50	Hinesburg	Pine Shore Drive Rain Gardens	Construct rain garden to treat runoff from roadside swale and pond, Construct filter berms in the roadside swale with depressions upgradient planted with rain garden vegetation	2	2	1	16.72	1.5	1.2	$ 21,790	$ 22,936	11	1	17	1	0	0	0	3	0	0	4	27
51	Hinesburg	Southwest Shore Road Rain Garden	Construct rain garden to treat runoff from 452 Southwest Shore Road	2	2	1	16.72	1.5	1.2	$ 7,524	$ 62,700	7	1	13	1	0	0	0	3	0	0	4	22
52	Hinesburg	Hawk Lane Rain Garden	Construct rain garden to treat runoff from 114 Hawk Lane	2	2	1	16.72	1.5	1.2	$ 7,524	$ 68,400	7	1	13	1	0	0	0	3	0	0	4	22
53	St. George	Oak Hill Road Rain Garden	Construct rain garden to treat runoff from Oak Hill Road and 5327 Oak Hill Road property	2	2	1	16.72	1.5	1.2	$ 7,524	$ 39,600	11	1	17	1	0	0	0	3	0	1	5	27
62	Hinesburg	Shadow Lane Rain Garden	Construct rain garden to treat runoff from 163 Shadow Lane	2	2	1	16.72	1.5	1.2	$ 6,922	$ 173,052	1	1	7	1	0	0	0	3	0	1	5	17
63	Hinesburg	Dimick Road Rain Garden	Construct rain garden to treat runoff from 56 Dimick Road	2	2	1	16.72	1.5	1.2	$ 10,534	$ 105,336	3	1	9	1	0	0	0	3	0	0	4	20
64	Williston	746 Beebe Lane Rain Garden	Construct rain garden to treat runoff from 746 Beebe Lane	2	2	1	16.72	1.5	1.2	$ 15,048	$ 376,200	1	1	7	1	0	0	0	3	0	0	4	16
65	Williston	1140 Beebe Lane Rain Garden	Construct rain garden to treat runoff from 1140 Beebe Lane	2	2	1	16.72	1.5	1.2	$ 15,048	$ 752,400	1	1	7	1	0	0	0	3	0	0	4	16
66	Hinesburg	563 East Shore Lane Rain Garden	Construct rain garden to treat runoff from 563 East Shore Lane	2	2	1	16.72	1.5	1.2	$ 12,038	$ 66,880	7	1	13	1	0	0	0	3	0	0	4	23

Lake Iroquois-Patrick Brook Watershed Action Plan - Projects
Non-Unified Scoring Prioritization Matrix
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Project Number	Town	Stream Segment	Name	Project Description	Project Type	Nutrient Reduction Effectiveness	Sediment Reduction Effectiveness	Drainage Area	Impervious Drainage	Connectivity to Surface Waters	Landowner Support	O&M Requirements	Cost and Constructability	Additional Benefits, Score	Additional Benefits, See List	Total Score
1	Hinesburg	Sunset Lake south trib	Culvert replacement at Sunset Lake Cooperative	Replace significantly undersized culvert under Wile Street. Major aggradation upstream of structure. Stream overtopped road at culvert and flooded Wile Street, Jourdan Street, and a nearby mobile home	Culvert Replacement	1	2	1	3	3	0	1	1	2	1,5	14
2	Hinesburg	Sunset Lake south trib	Culvert replacement at Richmond Road	Replace undersized culvert under Richmond Road. Perched outlet and streambed scour at outlet of structure	Culvert Replacement	1	2	1	3	3	1	1	1	2	1,5	15
3	Hinesburg	Sunset Lake south trib	Remove berm and restore gully	Stream between McDonald Lane and Richmond has been extensively manipulated. Channel appears to have been excavated and large berm built on right bank. Stream is more of a gully presently and bank erosion abundant	Stream restoration	3	3	1	2	3	0	1	3	1	10	17
4	Hinesburg	Sunset Lake south trib	Improve flood resiliency at Sunset Lake Cooperative	Consider buyouts, floodplain restoration, buffer restoration	Flood Resiliency	2	2	1	3	3	0	1	3	4	1,4,5,10	19
5	Hinesburg	Sunset Lake	Move snow pile location at Sunset Lake Cooperative	Move snow pile location away from wetland, stream, and lake		3	3	1	3	3	0	2	6	2	4,10	23
6	Hinesburg	Sunset Lake eastern trib	Culvert replacement at Hidden Pasture Lane	Replace rusted out culvert	Culvert Replacement	1	1	1	1	3	0	1	1	1	5	10
7	Hinesburg	Sunset Lake western trib	Restoration of Sunset Lake western trib	Remove destroyed bridge and renaturalize channel	Stream Restoration	1	1	1	2	3	0	1	3	1	10	13
8	Hinesburg	Patrick Brook	Remove masonry dam between two lakes	Remove small stone dam between Lake Iroquois and Pond Brook Road	Dam Removal	1	1	1	3	3	0	1	2	1	10	13
9	Williston	Patrick Brook	Stream and buffer restoration at Isham Family Farm	Widen and naturalize riparian buffer; straightened channel with hay field on both sides lacking woody vegetation, sinuosuty, LWD, etc.; plant woody vegetation around pond to increase shading	Buffer Planting, Stream Restoration	3	3	1	3	3	0	2	5	3	4,7,10	23
10	Hinesburg		Filter berms at 260 and 310 Pine Shore Drive	Construct filter berms to treat runoff from 260 and 310 Pine Shore Drive	Filter Berm	1	1	0	0	3	2	1	5	1	3	14
11	Williston	Patrick Brook	Buffer restoration downstream of South road	Widen riparian buffer into adjacent mowed field; plant	Buffer Planting	3	3	1	3	3	0	2	6	2	7,10	23
12	Hinesburg		Sea wall removal and bank restoration along Pine Shore Drive	Remove existing sea walls on three properties and restore bank	Lakeshore Restoration	1	1	1	2	3	2	1	4	2	2,10	17
13	Williston	Patrick Brook	Culvert replacement on Beebe Lane	Replace undersized culvert on Beebe Lane	Culvert Replacement	1	2	1	3	3	0	1	1	1	5	13
14	Williston	Patrick Brook	River corridor easement/land conservation upstream of Beebe Lane	Protect land through easement or conservation; large wetland complex with connected floodplain	Easement/ Conservation	1	1	1	1	3	0	2	6	1	10	16
15	Hinesburg	Lake Iroquois Shadow Ln Trib - Lower	Stabilize gully in lower Shadow Lane tributary	Numerous headcuts and actively eroding gully between Pond Road and lake. Stabilize gully to reduce sediment input to lake	Stream Restoration	3	4	1	3	3	2	1	3	1	10	21

	Additional Benefits List
1	Chronic Problem Area
2	Seasonal Flooding
3	Educational
4	High Visibility
5	Infrastructure Conflicts
6	Drains to Connected Stormwater Infrastructure
7	Reduces Thermal Pollution
8	Improves BMP Performance
10	Enhances Natural Communities

Lake Iroquois-Patrick Brook Watershed Action Plan - Projects
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Project Number	Town	Stream Segment	Name	Project Description	Project Type	Nutrient Reduction Effectiveness	Sediment Reduction Effectiveness	Drainage Area	Impervious Drainage	Connectivity to Surface Waters	Landowner Support	O&M Requirements	Cost and Constructability	Additional Benefits, Score	Additional Benefits, See List	Total Score
16	Hinesburg	Lake Iroquois Shadow Ln Trib	Riparian buffer planting along Shadow Lane tributary	Buffer lacking vegetation along southern bank near lake shore. Conduct plantings	Buffer Planting	3	3	1	3	3	2	2	6	2	7,10	25
17	Hinesburg	Lake Iroquois Pine Shore Drive tributary	Buffer planting around onstream pond on Pine Shore Drive tributary	Plant woody vegetation around pond to increase shading	Buffer Planting	3	3	1	3	3	0	2	6	2	7,10	23
18	Hinesburg	Lake Iroquois Pine Shore Drive tributary	Expand no-mow zone/buffer planting around driveway on Pine Shore Drive Tributary	Expand riparian buffer zone in vicinity of driveway	Buffer Planting	3	3	1	3	3	0	2	6	2	7,10	23
19	Hinesburg	Lake Iroquois Old Pump Road tributary	Culvert replacement on Old Pump Road	Replace undersized, clogged culvert with poor placement with larger structure set at appropriate elevation	Culvert Replacement	1	2	1	3	3	0	1	1	1	5	13
20	Hinesburg		New swale along Firefly Lane	Create new swale and turnout along Firefly Lane	Road Improvement	1	1	0	0	1	0	1	3	0		7
21	St. George		Mount Pritchard Lane Improvements	Improve existing swales - stone line with larger rock due to slope and erosion; regrade to remove berm; create new sediment trap at the bottom of swale; cleanout existing turnouts	Road Improvement	3	3	1	3	2	0	1	3	3	1,4,8	19
22	Hinesburg		Dynamite Hill Road Improvements	Regrade road to establish crown and remove berms; improve existing swales - stone line due to slope and erosion; create new turnouts; stabilize/replace existing culverts; install new sediment traps; install new settling basin at bottom of road	Road Improvement	4	4	1	3	3	0	1	2	3	1,4,8	21
23	Hinesburg		Kozas Run Improvements	Improve existing swales - stone line due to slope and erosion; create new sediment traps	Road Improvement	3	4	1	2	2	0	1	3	2	1,8	18
24	Hinesburg		Shadow Lane Improvements	Major gully erosion of roadside swales and roadway	Road Improvement	4	4	1	3	3	2	1	2	3	1,4,8	23
25	Hinesburg		Pine Shore Drive Improvements	Reshape existing swale; install new settling basin	Road Improvement	1	1	0	0	1	0	1	3	1	8	8
26	Hinesburg		Pikes Point Road Improvements	Install new swale and settling basin; regrade to remove berm; improve vegetated buffer at lake	Road Improvement	1	1	0	0	1	0	1	3	1	10	8
27	Hinesburg		Cove Road Improvements	Install new swale, settling basin, and culvert	Road Improvement	1	1	0	0	1	0	1	3	0		7
28	Hinesburg		Southwest Shore Road Improvements	Install new swale with check dams and culvert	Road Improvement	1	1	0	0	3	0	1	3	1	8	10
29	Hinesburg		Old Pump Road Improvements	Crown to raise road grade; grade to remove berm	Road Improvement	1	1	0	0	3	0	1	5	0		11
30	Hinesburg		Upper Access Road Improvements	Install new swales, culvert, and turnouts; regrade to establish crown and remove berm; improve existing turnouts	Road Improvement	1	1	1	2	3	0	1	2	1	8	12
31	Hinesburg		Wheatley Road Improvements	Grade to establish crown	Road Improvement	1	1	0	0	3	0	1	5	0		11

Lake Iroquois-Patrick Brook Watershed Action Plan - Projects
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Project Number	Town	Stream Segment	Name	Project Description	Project Type	Nutrient Reduction Effectiveness	Sediment Reduction Effectiveness	Drainage Area	Impervious Drainage	Connectivity to Surface Waters	Landowner Support	O&M Requirements	Cost and Constructability	Additional Benefits, Score	Additional Benefits, See List	Total Score
32	Hinesburg		East Shore Lane Improvements	Improve existing swales; improve existing turnouts; create new settling area; create new swales, turnout and settling basin; grade to establish crown	Road Improvement	2	3	1	2	3	0	1	2	2	4,8	16
33	Hinesburg		Dimick Road Improvements	Regrade to remove berm; create new turnout; install new culvert	Road Improvement	1	1	1	0	3	0	1	3	0		10
35	Williston		Beebe Lane Improvements	Grade to establish crown and remove berms; clean out existing turnouts; install new turnouts and sediment traps	Road Improvement	2	2	1	3	3	0	1	3	2	4,8	17
36	Hinesburg		Sunset Lane West Improvements	Improve existing swales - stone line due to slope; create new swale and sediment traps	Road Improvement	1	1	1	2	3	0	1	2	1	8	12
37	Hinesburg		Lake Street/Sunset Lane East Improvements	Improve existing swale - stone line due to slope	Road Improvement	1	1	0	1	1	0	1	3	1	8	9
38	Hinesburg		Sunset Court Improvements	Replace culvert; install new culvert and sediment traps	Road Improvement	1	1	0	0	1	0	1	2	1	8	7
39	Hinesburg		Sunset Lane East Improvements	Improve existing swale; replace culvert; install new sediment trap	Road Improvement	1	1	0	0	1	0	1	2	1	8	7
40	Hinesburg		Trillium Lane Improvements	Improve existing swales - stone line due to slope; install new sediment trap; create settling basin; replace culvert	Road Improvement	2	2	1	1	1	0	1	2	1	8	11
41	Hinesburg		Birchwood Drive Improvements	Improve existing swale - stone line due to slope and erosion; replace culverts; install new sediment trap; grade to remove berm	Road Improvement	3	4	1	2	3	0	1	2	2	8,10	18
42	Hinesburg		Longmeadow Road Improvements	Grade to establish crown	Road Improvement	1	1	0	1	1	0	1	5	0		10
43	Hinesburg		Red Pine Road Improvements	Improve existing swales; replace culvert; install new culvert; clean out culvert; stabilize culvert; divert flow out of swale	Road Improvement	1	2	1	2	3	2	1	2	1	8	15
44	Hinesburg		Partridge Hill Improvements	Improve existing swales - stone line and add check dams due to slope; clean out existing culverts; install new sediment traps; create new turnouts; install new culverts; grade to raise road and remove berm	Road Improvement	4	4	1	3	3	2	1	2	3	1,8,10	23
45	Hinesburg		Maple Tree Lane Improvements	Create new swale and sediment traps	Road Improvement	1	1	0	1	1	0	1	3	0		8
46	Hinesburg		Butternut Lane Improvements	Improve existing swale - stone line due to slope; install new culvert	Road Improvement	1	1	0	0	1	0	1	2	1	8	7
47	Williston & St. George		Martel Lane Improvements	Improve existing swales - stone line due to slope and erosion; create new settling basin	Road Improvement	1	2	1	2	1	0	1	3	1	8	12
48	Williston & St. George		Iroquois Lane Improvements	Improve existing swale; install new sediment trap; grade to establish crown	Road Improvement	1	1	0	1	1	0	1	3	1	8	9
54	St. George		Filter berms at 5327 Oak Hill Road	Construct filter berms to treat runoff from 5327 Oak Hill Road	Filter Berm	1	1	0	1	3	2	1	5	1	3	15
55	Hinesburg		Filter berms at 114 Hawk Lane	Construct filter berms to treat runoff from 114 Hawk Lane	Filter Berm	1	1	0	0	3	2	1	5	1	3	14

Lake Iroquois-Patrick Brook Watershed Action Plan - Projects
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Project Number	Town	Stream Segment	Name	Project Description	Project Type	Nutrient Reduction Effectiveness	Sediment Reduction Effectiveness	Drainage Area	Impervious Drainage	Connectivity to Surface Waters	Landowner Support	O&M Requirements	Cost and Constructability	Additional Benefits, Score	Additional Benefits, See List	Total Score
56	Hinesburg		Filter berms at 452 Southwest Shore Road	Construct filter berms to treat runoff from 452 Southwest Shore Road	Filter Berm	1	1	0	0	3	2	1	5	1	3	14
57	Williston		Driveway improvement at 840 Beebe Lane	Install water bars on driveway	Driveway Improvement	1	1	0	0	3	2	1	5	1	3	14
58	Hinesburg		Driveway improvement at 56 Dimick Road	Install water bars on driveway	Driveway Improvement	1	1	0	0	3	2	1	5	1	3	14
59	Williston		Sea wall removal and bank restoration at 746 Beebe Lane	Remove existing sea walls and restore bank	Lakeshore Restoration	1	1	1	2	3	2	1	4	2	2,10	17
60	Williston		Driveway improvement at 1140 Beebe Lane	Install water bars on driveway	Driveway Improvement	1	1	0	0	3	2	1	5	1	3	14
61	Hinesburg		Filter berms at 563 East Shore Lane	Construct filter berms to treat runoff from 563 East Shore Lane	Filter Berm	1	1	0	0	3	2	1	5	1	3	14
67	Hinesburg	Lake Iroquois Shadow Ln Trib - Upper	Arrest incision and create settling area in upper Shadow Lane Trib	Stabilize headcut and eroding channel; install settling area upstream of Pond Road to capture sediment and stormwater	Stream Restoration	3	4	1	2	3	0	1	3	1	10	18
68	Hinesburg		Enos Road Improvements	Create new swale, stone line swale, and add cross culverts	Road Improvement	1	1	1	1	1	2	1	3	0		11
69	Williston		Land conservation along Lake Iroquois western shore	Protect large undeveloped lakeshore parcel through easement or conservation	Easement/ Conservation	1	1	1	3	3	0	2	6	1	10	18
70	Hinesburg		Explore dam removal and naturalization of system	Investigate removal of dams within watershed that are not in active use to promote more natural hydrology and improved aquatic organism passage	Dam Removal	1	1	1	3	3	0	1	2	1	10	13

APPENDIX D – PROJECT PHOTOS

Lake Iroquois-Patrick Brook Watershed Action Plan

Project Prioritization

Winooski Natural Resources Conservation District

14439.00006

November 13, 2023

Revised March 7, 2024

Project Photos

Figure 1: Project 1 – culvert replacement at Sunset Lake Cooperative

Figure 2: Project 2 – culvert replacement at Richmond Road

Figure 3: Project 3 – remove berm and restore gully

Figure 4: Project 4 – improve flood resiliency at Sunset Lake Cooperative

Figure 5: Project 5 – move snow pile location at Sunset Lake Cooperative

Figure 6: Project 6 – culvert replacement at Hidden Pasture Lane

Figure 7: Project 7 – restoration of Sunset Lake western tributary

Figure 8: Project 8 – remove dam between Lake Iroquois and Sunset Lake

Figure 9: Project 9 – buffer planting at Isham Family Farm

Figure 10: Project 9 – stream and buffer restoration at Isham Family Farm

Figure 11: Project 9 – buffer restoration at Isham Family Farm pond

Figure 12: Project 10 – Filter berms at 260 and 310 Pine Shore Drive (photo from WNRCD)

Figure 13: Project 11 – buffer restoration downstream of South Road

Figure 14: Project 12 – Sea wall removal and bank restoration along Pine Shore Drive (photo from WNRCD)

Figure 15: Project 13 – culvert replacement at Beebe Lane

Figure 16: Project 14 – river corridor easement upstream of Beebe Lane

Figure 17: Project 15 – stabilize gully in Shadow Lane tributary

Figure 18: Project 16 – buffer planting along Shadow Lane tributary

Figure 19: Project 17 – buffer planting around onstream pond on Pine Shore Drive tributary

Figure 20: Project 19 – culvert replacement on Old Pump Road

Figure 21: Project 20 – new swale along Firefly Lane

Figure 22: Project 21 – Mount Pritchard Lane improvements

Figure 23: Project 21 – Mount Pritchard Lane improvements

Figure 24: Project 22 – Dynamite Hill Road improvements

Figure 25: Project 22 – Dynamite Hill Road improvements

Figure 26: Project 23 – Kozas Run improvements

Figure 27: Project 24 – Shadow Lane improvements

Figure 28: Project 24 – Shadow Lane improvements

Figure 29: Project 24 – Shadow Lane improvements

Figure 30: Project 25 – Pine Shore Drive improvements

Figure 31: Project 26 – Pikes Point Road improvements

Figure 32: Project 26 – Pikes Point Road improvements

Figure 33: Project 27 – Cove Road improvements

Figure 34: Project 28 – Southwest Shore Road improvements

Figure 35: Project 29 – Old Pump Road improvements

Figure 36: Project 30 – Upper Access Road improvements

Figure 37: Project 31 – Wheatley Road improvements

Figure 38: Project 32 – East Shore Lane improvements

Figure 39: Project 33 – Dimick Road improvements

Figure 40: Project 34 – Lake Iroquois boat launch rain garden

Figure 41: Project 35 – Beebe Lane improvements

Figure 42: Project 35 – Beebe Lane improvements

Figure 43: Project 36 – Sunset Lane West improvements

Figure 44: Project 38 – Sunset Court improvements

Figure 45: Project 40 – Trillium Lane improvements

Figure 46: Project 41 – Birchwood Drive improvements

Figure 47: Project 42 – Longmeadow Road improvements

Figure 48: Project 43 – Red Pine Lane improvements

Figure 49: Project 44 – Partridge Hill improvements

Figure 50: Project 44 – Partridge Hill improvements

Figure 51: Project 44 – Partridge Hill improvements

Figure 52: Project 45 – Maple Tree Lane improvements

Figure 53: Project 46 – Butternut Lane improvements

Figure 54: Project 47 – Martel Lane improvements

Figure 55: Project 48 – Iroquois Lane improvements

Figure 56: Project 49 – East Shore Lane rain garden

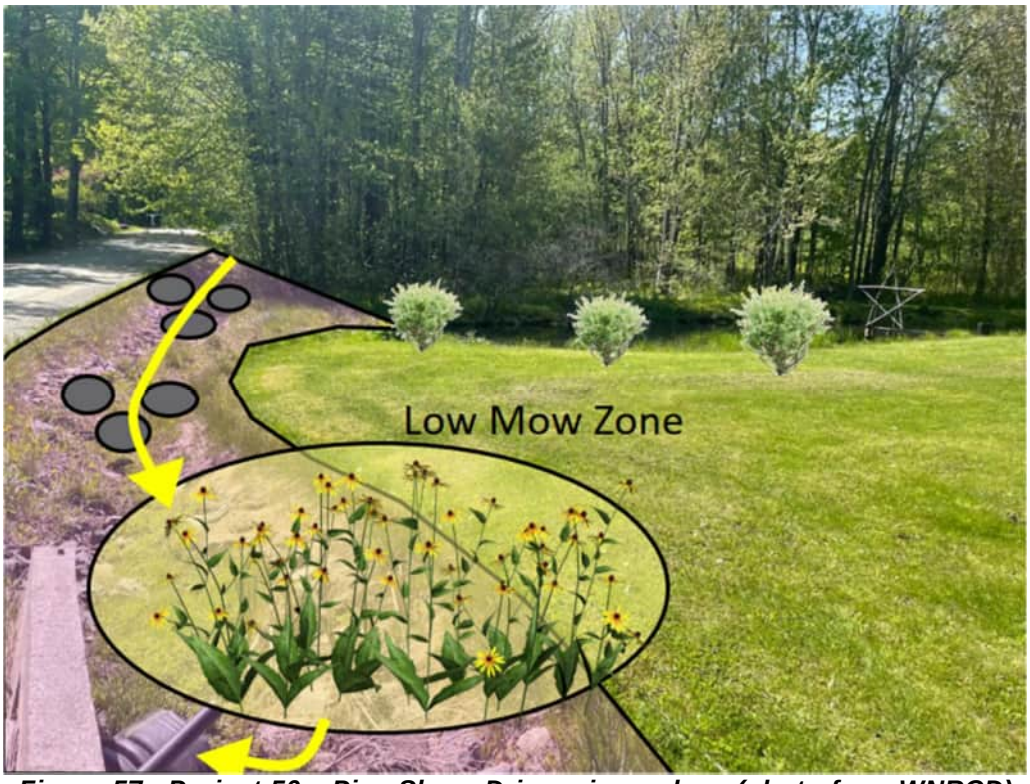


Figure 57: Project 50 – Pine Shore Drive rain gardens (photo from WNRCD)

Figure 58: Project 51 –Southwest Shore Road rain garden (photo from WNRCD)

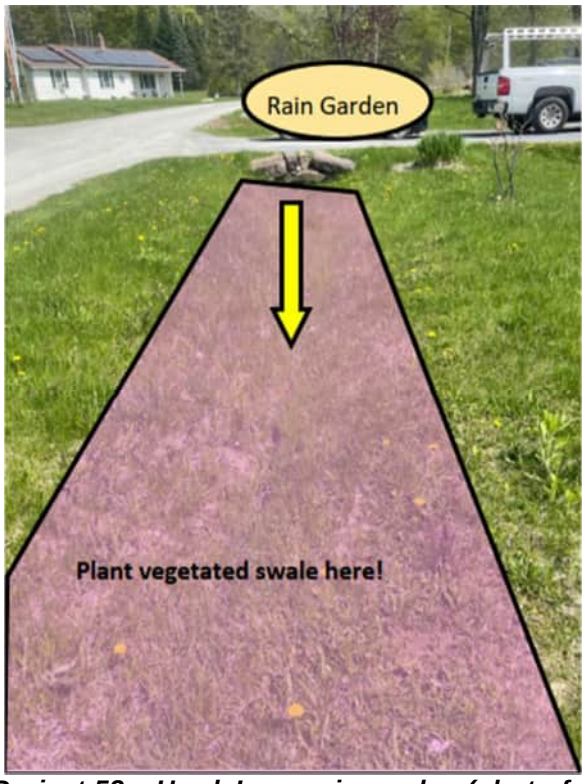


Figure 59: Project 52 – Hawk Lane rain garden (photo from WNRCD)

Figure 60: Project 53 –Oak Hill Road rain garden (photo from WNRCD)

Figure 61: Project 54 – Filter berms at 5327 Oak Hill Road (photo from WNRCD)

Figure 62: Project 55 – Filter berms at 114 Hawk Lane (photo from WNRCD)

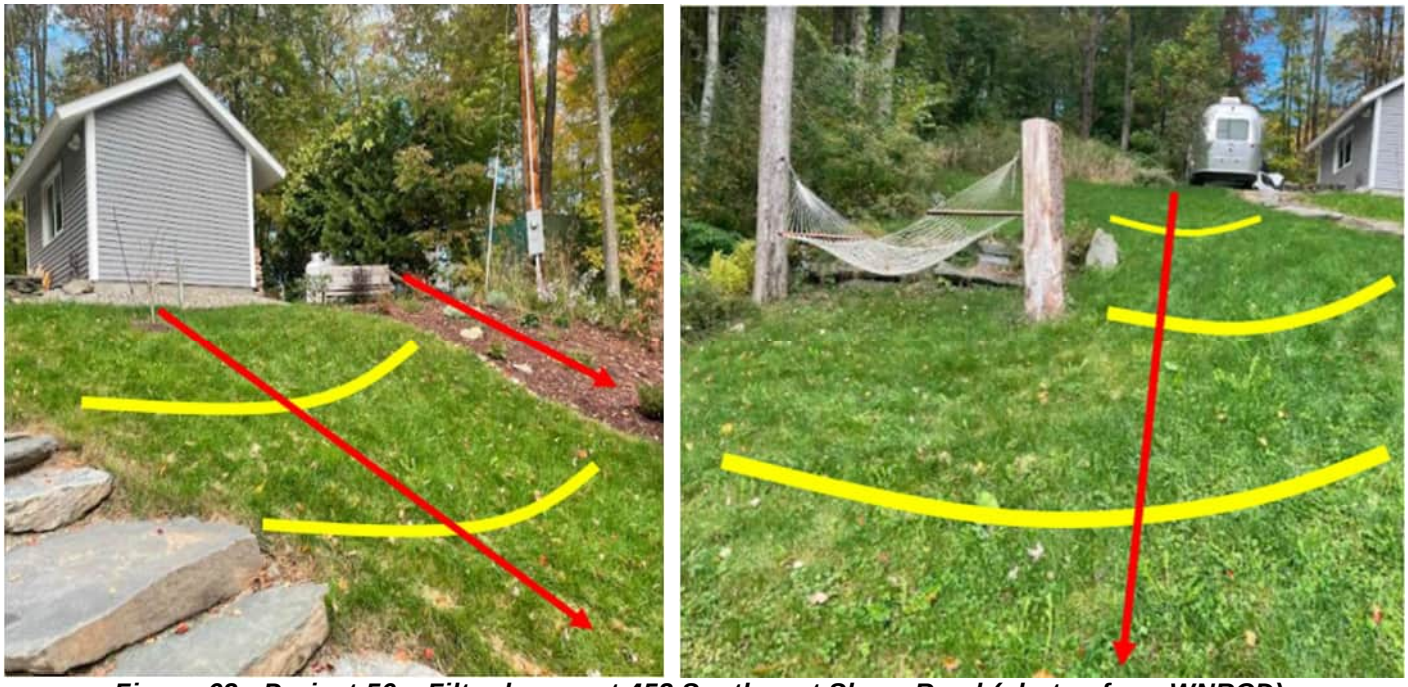


Figure 63: Project 56 – Filter berms at 452 Southwest Shore Road (photos from WNRCD)

Figure 64: Project 57 – Driveway improvement at 840 Beebe Lane (photos from WNRCD)

Figure 65: Project 58 – Driveway improvements at 56 Dimick Road (photos from WNRCD)

Figure 66: Project 59 – Sea wall removal and bank restoration at 746 Beebe Lane (photo from WNRCD)

Figure 67: Project 60 – Driveway improvements at 1140 Beebe Lane (photo from WNRCD)

Figure 68: Project 61 – Filter berms at 563 East Shore Lane (photo from WNRCD)

Figure 69: Project 62 – Shadow Lane rain garden

Figure 70: Project 63 – Dimick Road rain garden (photos from WNRCD)

Figure 71: Project 66 – 653 East Shore Lane rain garden (photos from WNRCD)

Figure 72: Project 67 – Upper Shadow Lane Tributary restoration

Figure 73: Project 68 – Enos Road improvements

Appendix D Concept Designs

Lake Iroquois-Patrick Brook Watershed Action Plan

Winooski Natural Resources Conservation District

SLR Project No.: 146.14439.00006

March 7, 2024

Date Saved: 1/25/2024

Document Path: Y:\144390006\Maps\PartridgeHill_Concept.mxd

PARTRIDGE HL

PARTRIDGE HL

Patrick Brook

RED PINE RD

RED PINE RD

GRADE TO REMOVE BERM

RESHAPE SWALE AND INSTALL SEDIMENT TRAP

STONE LINE SWALE AND INSTALL TURNOUT

REMOVE TWO CEDARS INSTALL SEDIMENT TRAP ADD HEADWALL RIPRAP

STONE LINE SWALE

STONE LINE SWALE

STONE LINE SWALE AND ADD CHECK DAMS

RESHAPE SWALE AND INSTALL TURNOUT

INSTALL THREE NEW CULVERTS AND STONE LINE SWALES

INSTALL SEDIMENT TRAP

STONE LINE SWALE AND ADD CHECK DAMS INSTALL SEDIMENT TRAP CLEAN OUT CULVERT

STONE LINE SWALE CLEAN OUT OR CONSIDER REMOVING CULVERT

STONE LINE SWALE

INSTALL NEW CULVERT

STONE LINE SWALES AND ADD CHECK DAMS CLEAN OUT SEDIMENT TRAP

INSTALL STONE LINED SWALE AND TURNOUT

CLEAN OUT CULVERT BLOCK SWALE CULVERT DIVERT FLOW ACROSS ROAD

INSTALL NEW CULVERT

UPSIZE CULVERT

CONSIDER ADDING NEW CULVERT

CLEAN OUT AND RESHAPE SWALE

CLEAN OUT CULVERT CONSIDER REPLACEMENT

VCGI

Legend

Road Feature - Existing & Proposed

- Turnout
- Sediment Trap
- Berm
- Swale
- Culvert
- Road

Streams (By Order)

- 1
- 2
- 3
- 4
- 5

PARTRIDGE HILL - PROPOSED CONDITIONS

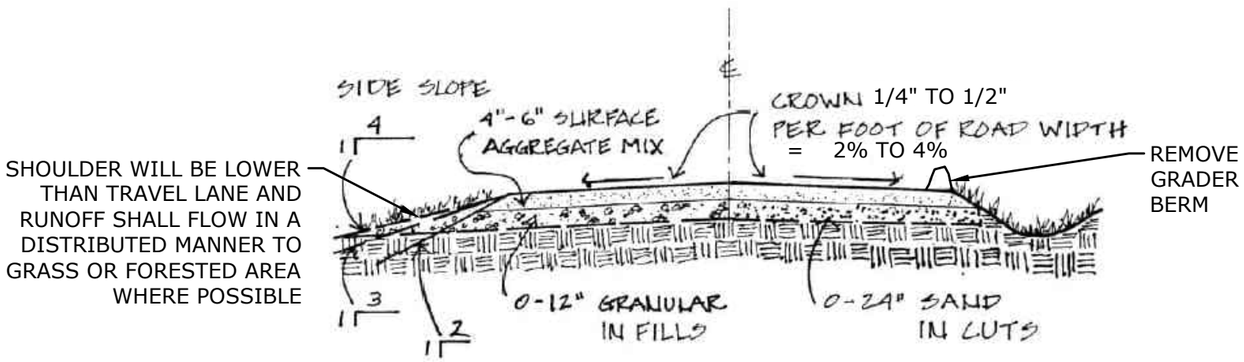
LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN
WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 75 150 300
Feet

1 in = 150 feet

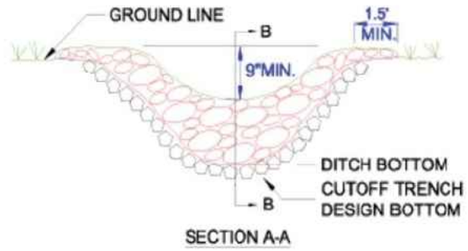
N

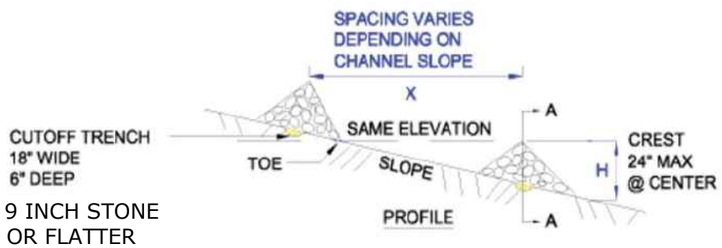
SLR
1 SOUTH MAIN ST
SECOND FLOOR
WATERBURY, VT 05676
802.882.8335

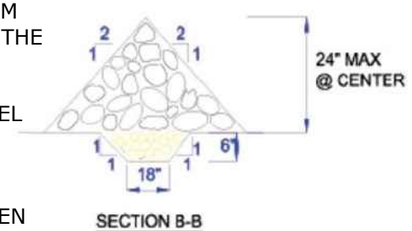


ROAD CROWN & PROFILE

- REGRADE ROAD SURFACE TO REMOVE RUTS, EROSION, AND GRADER/PLOW BERMS
- CROWN SHOULD BE MAINTAINED





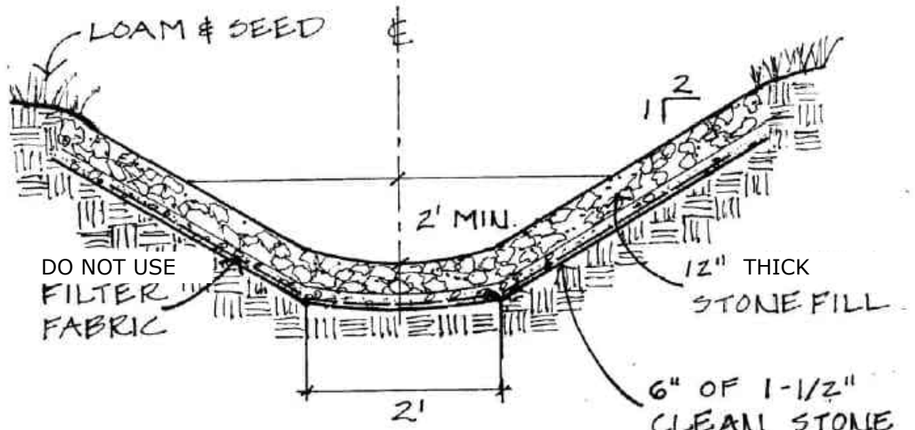


- USE MIX OF 2 TO 9 INCH STONE
- SIDE SLOPES 2:1 OR FLATTER
- SPAN WIDTH OF CHANNEL AND UP SIDES OF BANKS
- SPACE SO THAT THE TOE OF THE UPSTREAM DAM IS THE ELEVATION OF THE CREST OF THE DOWNSTREAM DAM
- PERIODICALLY REMOVE ACCUMULATED SEDIMENT AND DEBRIS TO ALLOW CHANNEL TO DRAIN THROUGH THE STONE AND PREVENT LARGE FLOWS FROM CARRYING SEDIMENT OVER THE DAM
- IF SIGNIFICANT EROSION OCCURS BETWEEN DAMS, A LINER OF STONE SHOULD BE INSTALLED

STONE CHECK DAM

OPERATION & MAINTENANCE NOTES:

ANNUALLY IN SPRING AFTER THAW AND AFTER LARGE RAINSTORMS, INSPECT ALL ROAD FEATURES.
NOTE WHERE EROSION IS AFFECTING FEATURE DESIGN.
SPECIFIC OPERATION & MAINTENANCE NOTES LISTED FOR EACH FEATURE.

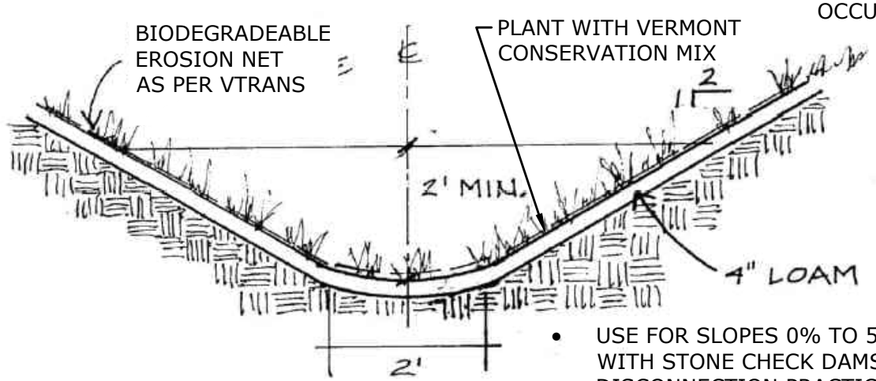


STONE FILL SIZE:

- SLOPES 5% TO 10% USE 6-8 INCH MINUS
- SLOPES MORE THAN 10% USE 12 INCH MINUS

STONE LINED DITCH

- RESHAPE SWALE AND REAPPLY SURFACE TREATMENT WHERE GULLY EROSION (>1 FT DEEP) IS OCCURRING



- USE FOR SLOPES 0% TO 5% OR 5% TO 8% WITH STONE CHECK DAMS OR DISCONNECTION PRACTICES EVERY 164 FEET
- NO BARE SOILS ALLOWED
- USE TRAPEZOIDAL OR PARABOLIC CROSS SECTION

GRASS LINED DITCH

REFERENCE NOTE: ADAPTED FROM "VERMONT BETTER BACKROADS MANUAL, CLEAN WATER YOU CAN AFFORD" A PULICATION OF THE NORTHERN VERMONT & GEORGE D. AIKEN RESOURCE CONSERVATION DEVELOPMENT (R C& D) COUNCILS, NOVEMBER 1995, UPDATED 2002, 2009.

STONE CHECK DAM DETAIL FROM STATE OF VERMONT AGENCY OF NATURAL RESOURCES DEPARTMENT OF ENVIRONMENTAL CONSERVATION VERMONT POLLUTION DISCHARGE ELIMINATION SYSTEM (VPDES) GENERAL PERMIT 3-9040 FOR STORMWATER DISCHARGES FROM MUNICIPAL ROADS, FINAL DRAFT.

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REVISIONS

DETAILS - ROAD SECTION

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG VERMONT

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 8, 2024 (DATE)

14439.00006 (PROJECT NO.)

DET-1 (SHEET NO.)

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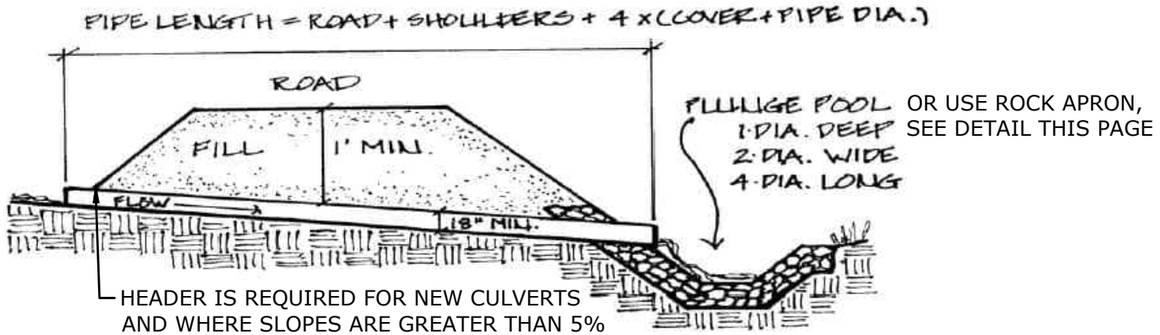
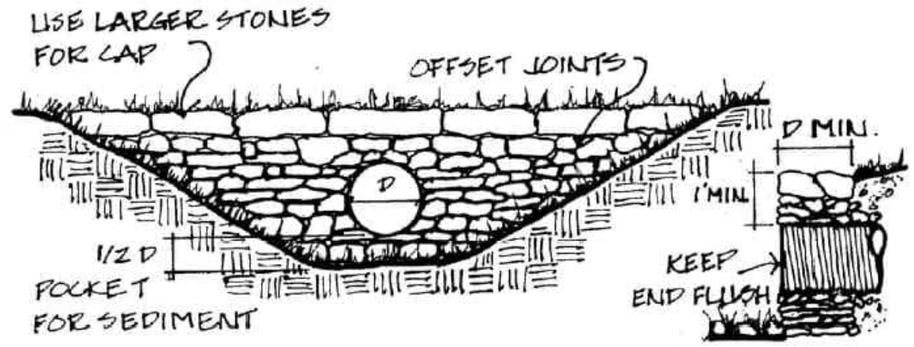


OR USE ROCK APRON, SEE DETAIL THIS PAGE

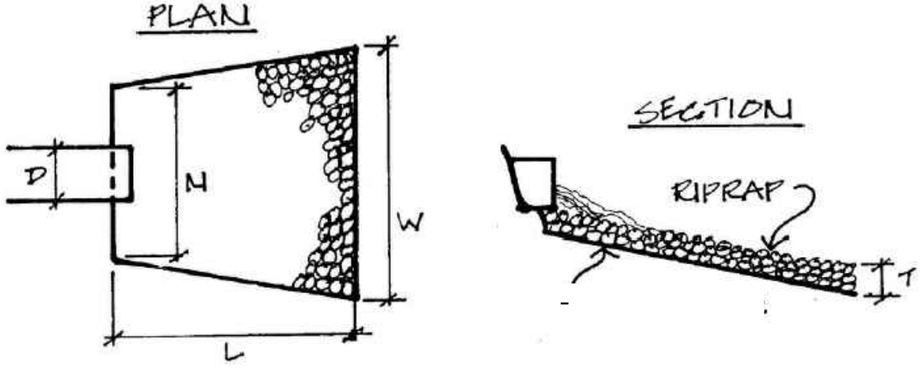
CULVERT PROFILE & CROSS SECTION



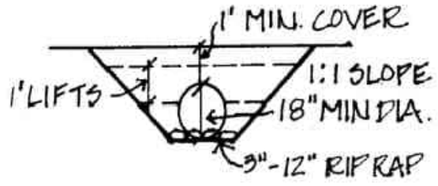
HEADER

Rock Apron Specifications					
Culvert Diameter (D)	Riprap Size	T (in.)	N (ft.)	W (ft.)	L (ft.)
18 inches	(3-12 inch)	18	4.5	14.5	10.0
24 inches	(3-12 inch)	18	6.0	20.0	14.0

D= diameter of culvert
T= depth of stone in apron
N= width of apron near culvert
W= width at downhill end of apron
L= length of apron



ROCK APRON



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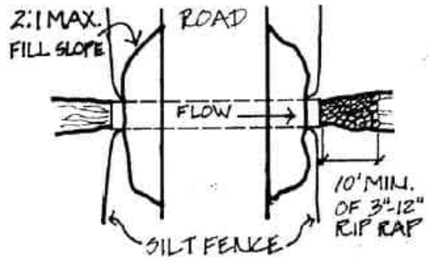
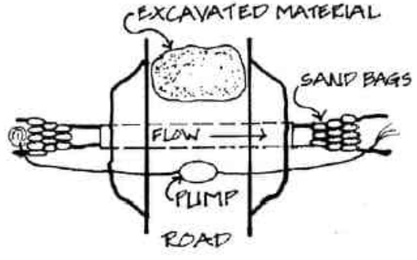


CULVERT PLAN VIEW



CULVERT INSTALLATION
FLOW BYPASS

- CHECK INLET AND OUTLETS TO REMOVE ACCUMULATED DEBRIS BLOCKING OPENING
- REPLACE DISLODGED HEADER OR APRON STONES

REFERENCE NOTE: ADAPTED FROM "VERMONT BETTER BACKROADS MANUAL, CLEAN WATER YOU CAN AFFORD" A PULICATION OF THE NORTHERN VERMONT & GEORGE D. AIKEN RESOURCE CONSERVATION DEVELOPMENT (R C& D) COUNCILS, NOVEMBER 1995, UPDATED 2002, 2009.

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REVISIONS

DETAILS - CULVERT

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

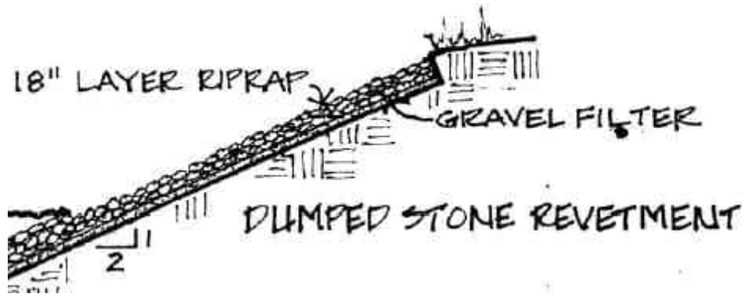
JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 8, 2024 (DATE)

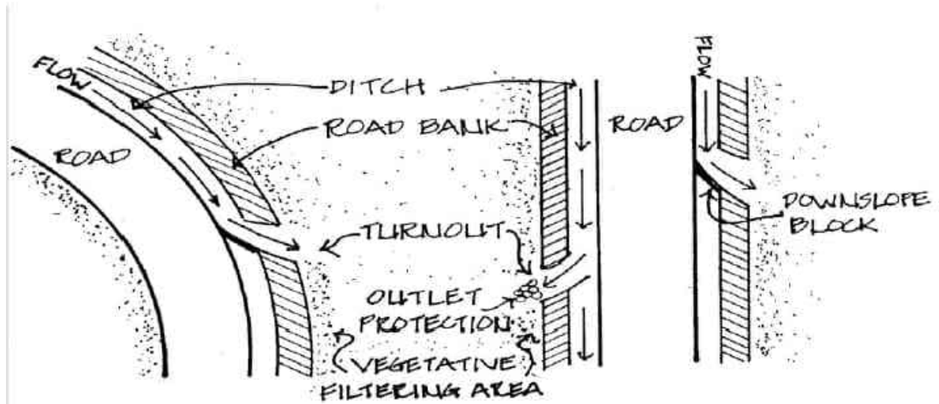
14439.00006 (PROJECT NO.)

DET-2 (SHEET NO.)



STONE ARMOR OR ROAD EDGE STABILIZATION

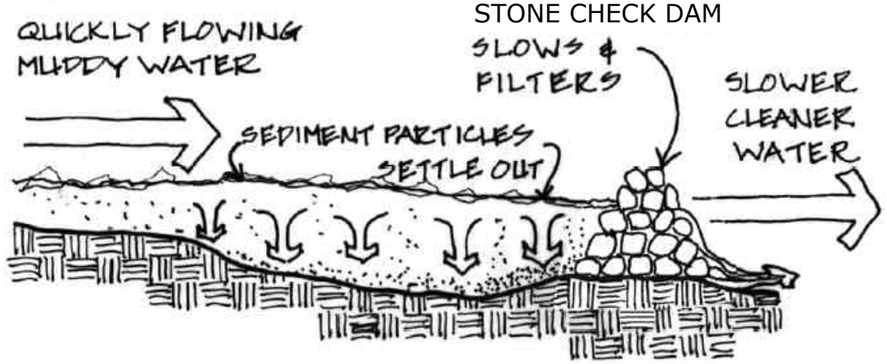
- RIRPAP SIZE IS BASED ON QUANTITY AND VELOCITY OF WATER
- ALWAYS CONTACT A STREAM ALTERNATION ENGINEER BEFORE INSTALLING RIPRAP AT A STREAM BANK
- USE ANGULAR STONE
- COVER WITH GRUBBINGS OR TOPSOIL AND SEED. IF ON A STREAM BANK, ONLY APPLY ABOVE ORDINARY HIGH WATER.
- CONSIDER PLANTING WITH ADDITIONAL VEGETATION



TURN-OUT

- AVOID DIRECT OUTLET TO SURFACE WATERS
- STABILIZE OUTLET BASED ON SLOPE:
  - 0% TO 5% STABILIZE WITH GRASS
  - 5% TO 10% STABILIZE WITH 6-8 INCH MINUS STONE
  - GREATER THAN 10% STABILIZE WITH 12 INCH MINUS STONE
- REMOVE ACCUMULATED SEDIMENT WHEN HALF FULL

STONE CHECK DAM



SEDIMENT TRAP

- INSPECT ANNUALLY AND AFTER LARGE STORMS
- REMOVE ACCUMULATED SEDIMENT WHEN HALF FULL.

REFERENCE NOTE: ADAPTED FROM "VERMONT BETTER BACKROADS MANUAL, CLEAN WATER YOU CAN AFFORD" A PULICATION OF THE NORTHERN VERMONT & GEORGE D. AIKEN RESOURCE CONSERVATION DEVELOPMENT (R C& D) COUNCILS, NOVEMBER 1995, UPDATED 2002, 2009.

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REVISIONS

DETAILS - OTHER

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 8, 2024 (DATE)

14439.00006 (PROJECT NO.)

DET-3 (SHEET NO.)

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BALLPARK OPINION OF PROBABLE CONSTRUCTION COST
LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN
PARTRIDGE HILL AND RED PINE - ROAD IMPROVEMENTS
Hinesburg, Vermont
14439.00006
February 16, 2024

SLR

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION SETUP / CLOSEOUT				
Mobilization	LS	1	$5,000	$5,000
Site preparation and remove minor vegetation	LS	1	$2,000	$2,000
ROAD IMPROVEMENTS				
Install stone turnout	EA	3	$300	$900
Install stone sediment trap	EA	3	$350	$1,050
Grade to remove berm	LF	50	$0.3	$13
Reshape grass swale	LF	250	$5	$1,250
Line swale with stone	LF	1,600	$35	$56,000
Add check dams to swale	LF	500	$8	$4,000
Install driveway culvert	EA	3	$2,000	$6,000
Install drainage culvert	EA	5	$3,000	$15,000
Install stone at culvert	EA	1	$500	$500
Remove sediment and debris from culvert	EA	3	$500	$1,500
CONSTRUCTION SUBTOTAL (ROUNDED)				**$93,000**
FINAL DESIGN - check ex conditions, adjust plans				$3,500
GRANT ASSISTANCE (NGO) - no bid process, minor meetings and reporting				$5,000
CONSTRUCTION ASSISTANCE - answer questions, check progress, document completion				$5,000
CONSTRUCTION CONTINGENCY (15%)				$13,950
TOTAL (ROUNDED)				**$120,000**

Date Saved: 2/8/2024

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CONSIDER STONE LINING SWALE AND/OR INSTALLING NEW CROSS CULVERT

ENOS RD

INSTALL NEW CROSS CULVERT

INSTALL NEW CROSS CULVERT

FORMALIZE SWALE ALONG DRIVEWAY

Legend

Road Feature - Existing & Proposed

- Swale
- Culvert
- Road
- VHD Stream
- white line — Parcel Boundary

ENOS ROAD - PROPOSED CONDITIONS

LAKE IROQUOIS - PATRICK BROOK WATERSHED ACTION PLAN

WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

Background imagery from Nearmap.

0 50 100

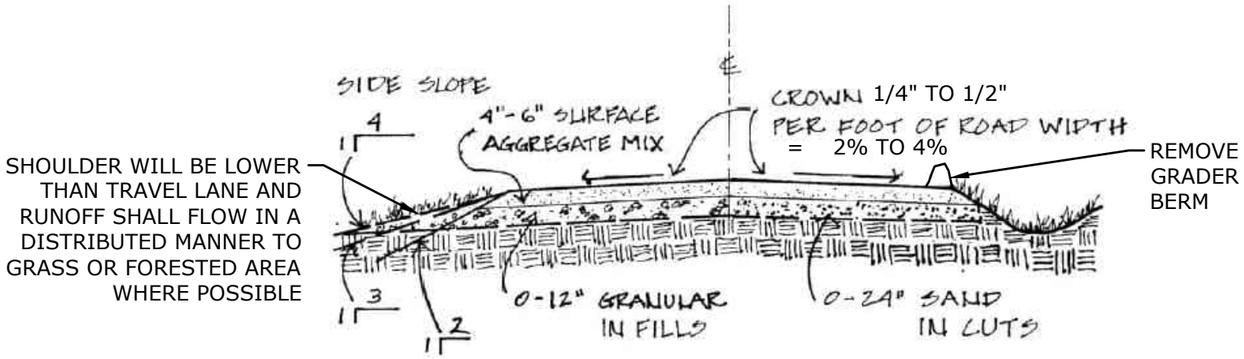
Feet

1 in = 100 feet

N

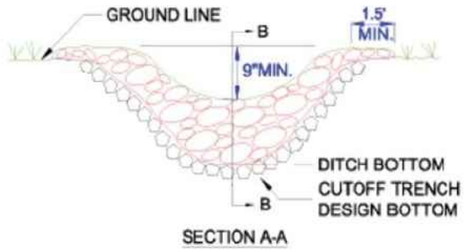
SLR

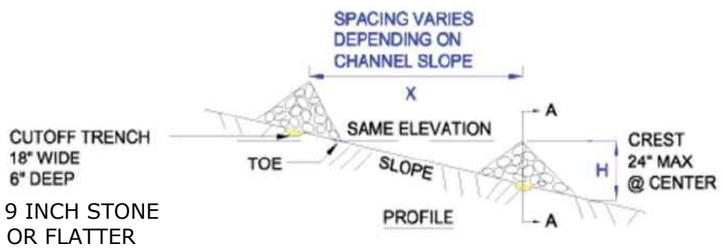
1 SOUTH MAIN STREET
SECOND FLOOR
WATERBURY, VT 05676
802.882.8335



ROAD CROWN & PROFILE

- REGRADE ROAD SURFACE TO REMOVE RUTS, EROSION, AND GRADER/PLOW BERMS
- CROWN SHOULD BE MAINTAINED





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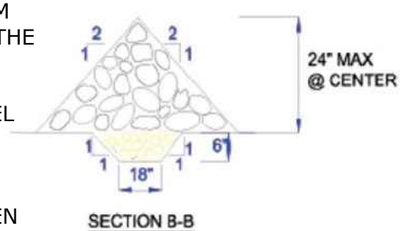

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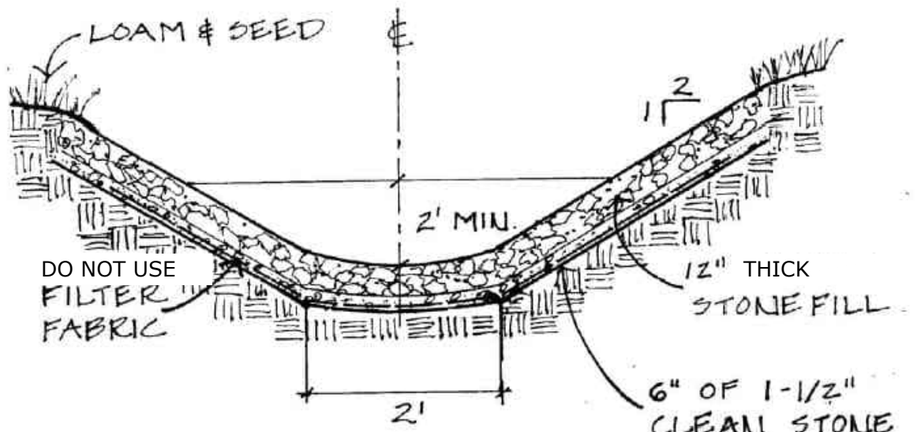

STONE FILL SIZE:

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STONE LINED DITCH

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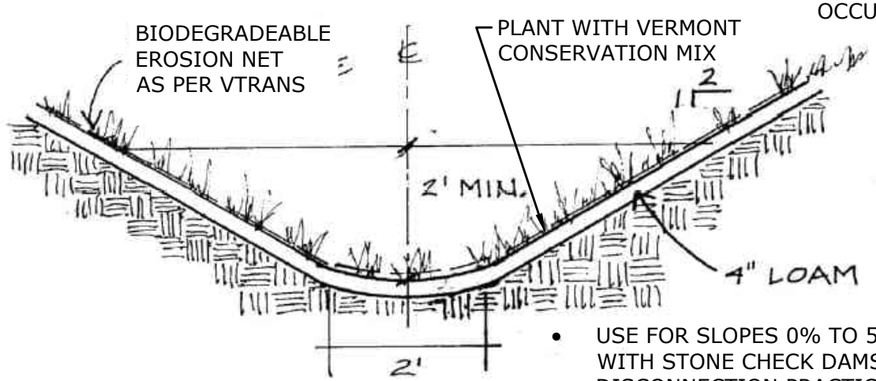

- USE FOR SLOPES 0% TO 5% OR 5% TO 8% WITH STONE CHECK DAMS OR DISCONNECTION PRACTICES EVERY 164 FEET
- NO BARE SOILS ALLOWED
- USE TRAPEZOIDAL OR PARABOLIC CROSS SECTION

GRASS LINED DITCH

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REVISIONS

DETAILS - ROAD SECTION

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG VERMONT

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 8, 2024 (DATE)

14439.00006 (PROJECT NO.)

DET-1 (SHEET NO.)

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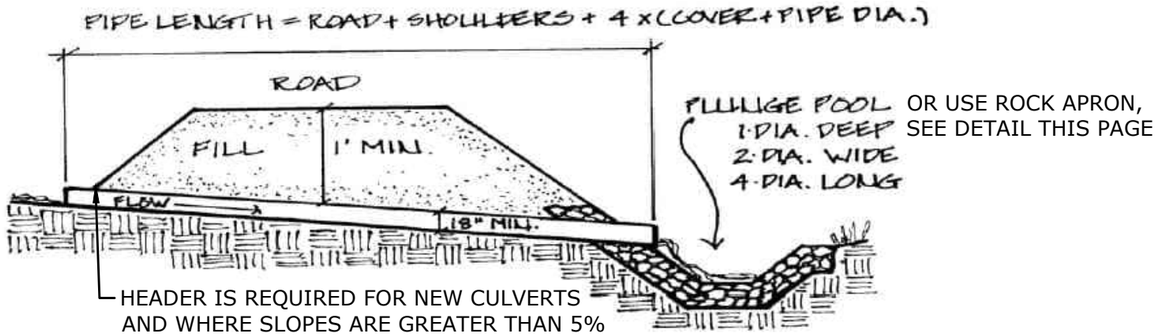
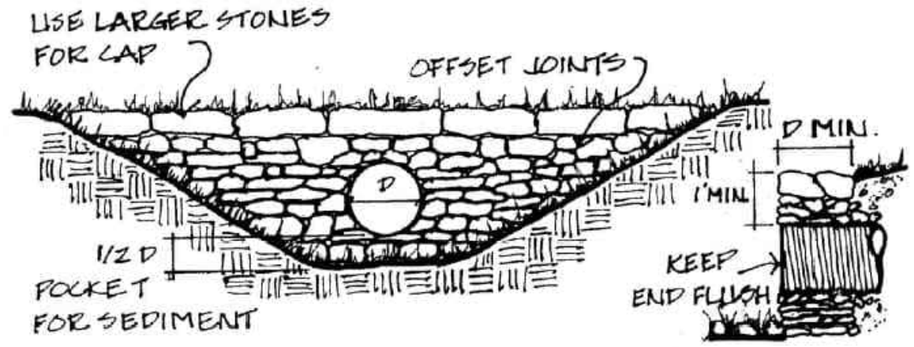


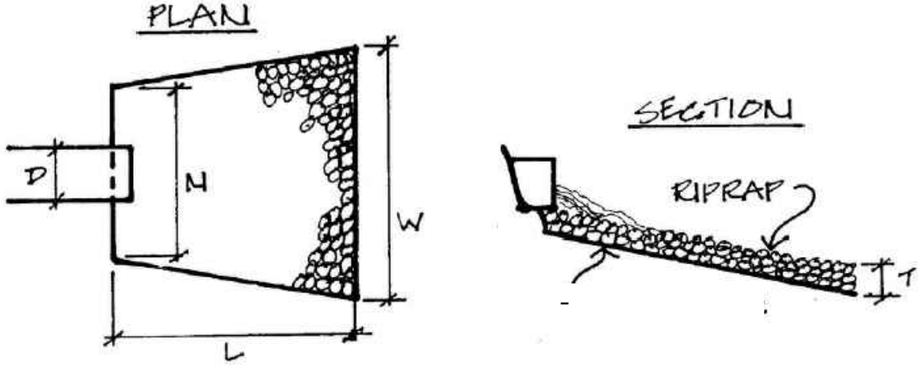
CULVERT PROFILE & CROSS SECTION



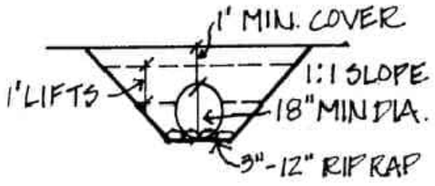
HEADER

Rock Apron Specifications					
Culvert Diameter (D)	Riprap Size	T (in.)	N (ft.)	W (ft.)	L (ft.)
18 inches	(3-12 inch)	18	4.5	14.5	10.0
24 inches	(3-12 inch)	18	6.0	20.0	14.0

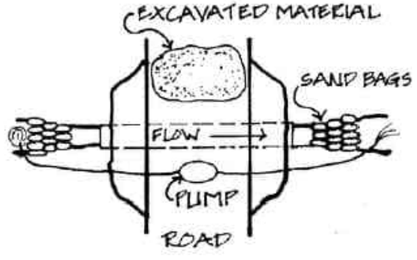
D= diameter of culvert
T= depth of stone in apron
N= width of apron near culvert
W= width at downhill end of apron
L= length of apron



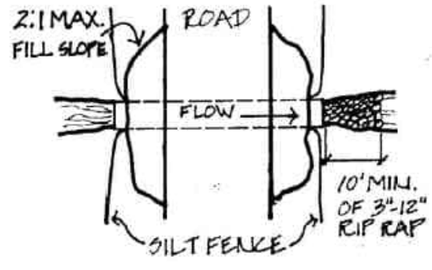
ROCK APRON



CULVERT CROSS SECTION



CULVERT INSTALLATION
FLOW BYPASS



CULVERT PLAN VIEW

- CHECK INLET AND OUTLETS TO REMOVE ACCUMULATED DEBRIS BLOCKING OPENING
- REPLACE DISLODGED HEADER OR APRON STONES

REFERENCE NOTE: ADAPTED FROM "VERMONT BETTER BACKROADS MANUAL, CLEAN WATER YOU CAN AFFORD" A PULICATION OF THE NORTHERN VERMONT & GEORGE D. AIKEN RESOURCE CONSERVATION DEVELOPMENT (R C& D) COUNCILS, NOVEMBER 1995, UPDATED 2002, 2009.

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REVISIONS

DETAILS - CULVERT

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

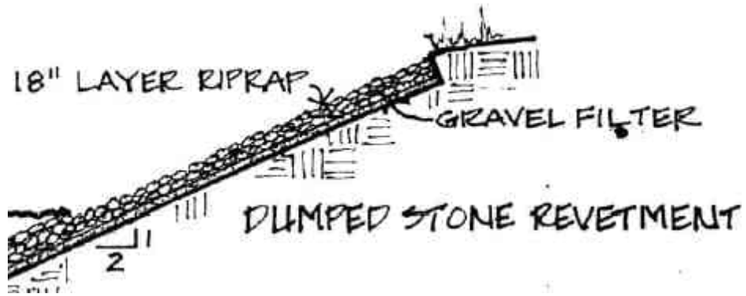
JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 8, 2024 (DATE)

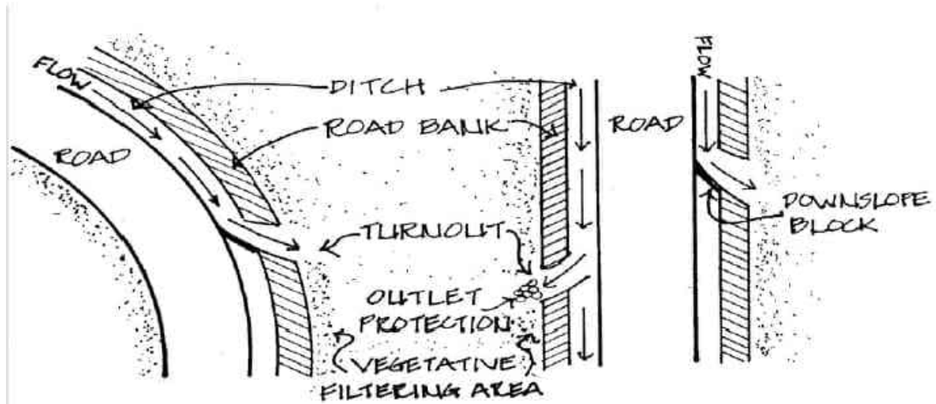
14439.00006 (PROJECT NO.)

DET-2 (SHEET NO.)



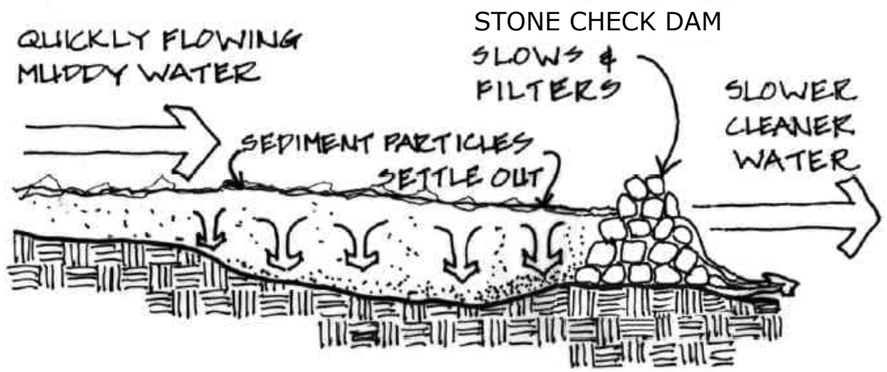
STONE ARMOR OR ROAD EDGE STABILIZATION

- RIRPAP SIZE IS BASED ON QUANTITY AND VELOCITY OF WATER
- ALWAYS CONTACT A STREAM ALTERNATION ENGINEER BEFORE INSTALLING RIPRAP AT A STREAM BANK
- USE ANGULAR STONE
- COVER WITH GRUBBINGS OR TOPSOIL AND SEED. IF ON A STREAM BANK, ONLY APPLY ABOVE ORDINARY HIGH WATER.
- CONSIDER PLANTING WITH ADDITIONAL VEGETATION



TURN-OUT

- AVOID DIRECT OUTLET TO SURFACE WATERS
- STABILIZE OUTLET BASED ON SLOPE:
  - 0% TO 5% STABILIZE WITH GRASS
  - 5% TO 10% STABILIZE WITH 6-8 INCH MINUS STONE
  - GREATER THAN 10% STABILIZE WITH 12 INCH MINUS STONE
- REMOVE ACCUMULATED SEDIMENT WHEN HALF FULL



SEDIMENT TRAP

- INSPECT ANNUALLY AND AFTER LARGE STORMS
- REMOVE ACCUMULATED SEDIMENT WHEN HALF FULL.

REFERENCE NOTE: ADAPTED FROM "VERMONT BETTER BACKROADS MANUAL, CLEAN WATER YOU CAN AFFORD" A PULICATION OF THE NORTHERN VERMONT & GEORGE D. AIKEN RESOURCE CONSERVATION DEVELOPMENT (R C& D) COUNCILS, NOVEMBER 1995, UPDATED 2002, 2009.

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REVISIONS

DETAILS - OTHER

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE
SCALE

FEBRUARY 8, 2024
DATE

14439.00006
PROJECT NO.

DET-3
SHEET NO.

Drawing: W:\CADDESIGN\14439.00006-DE\CAD\MR-DETAILS.DWG Layout: Tab:OTHER
Plotted by: AMARCUCCI On this date: Thu, 2024 February 8 - 2:56pm

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

ENOS ROAD - ROAD IMPROVEMENTS

Hinesburg, Vermont

14439.00006

February 16, 2024

SLR

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION SETUP / CLOSEOUT				
Mobilization	LS	1	$5,000	$5,000
Site preparation and remove minor vegetation	LS	1	$2,000	$2,000
ROAD IMPROVEMENTS				
New grass swale	LF	40	$9	$360
Line swale with stone	LF	370	$35	$12,950
Install drainage culvert	EA	3	$3,000	$9,000
CONSTRUCTION SUBTOTAL (ROUNDED)				**$29,000**
FINAL DESIGN - check ex conditions, adjust plans				$1,500
GRANT ASSISTANCE (NGO) - no bid process, minor meetings and reporting				$2,000
CONSTRUCTION ASSISTANCE - answer questions, check progress, document completion				$2,000
CONSTRUCTION CONTINGENCY (15%)				$4,350
TOTAL (ROUNDED)				**$39,000**

Date Saved: 2/8/2024

Document Path: Y:\14439.000006\Maps\ShadowLane_Concept.mxd

INSTALL SEDIMENT TRAP

INSTALL SWALE TO DIVERT ROAD RUNOFF TO VEGETATED AREA

RESHAPE SWALE AND INSTALL SEDIMENT TRAPS

INSTALL SWALE AND CULVERT TO DIVERT ROAD RUNOFF TO VEGETATED AREA

INSTALL SEDIMENT TRAP

STONE LINE ALL SWALES AND ADD CHECK DAMS

INSTALL SEDIMENT TRAP

POTENTIAL GRAVEL WETLAND TO TREAT ROAD RUNOFF

GRADE ROAD TO ESTABLISH CROWN CONSIDER PAVING ROAD

CLEAN ALL CULVERTS OF SEDIMENT AND DEBRIS

POTENTIAL GRAVEL WETLAND TO TREAT ROAD RUNOFF

RESHAPE EXISTING SWALE TO DIVERT ROAD RUNOFF TO VEGETATED AREA

ST. GEORGE

WILLISTON

HINESBURG

OAK HILL RD

OAK HILL RD

Lake Iroquois

Legend

Road Feature - Existing & Proposed

- Sediment Trap
- Catch Basin
- Crown
- Swale
- Culvert
- Road
- Town Boundary
- Parcel Boundary (white line)

Background imagery from Nearmap.

SHADOW LANE - PROPOSED CONDITIONS

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN
WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 40 80 160
Feet

1 in = 80 feet

N

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WATERBURY, VT 05676
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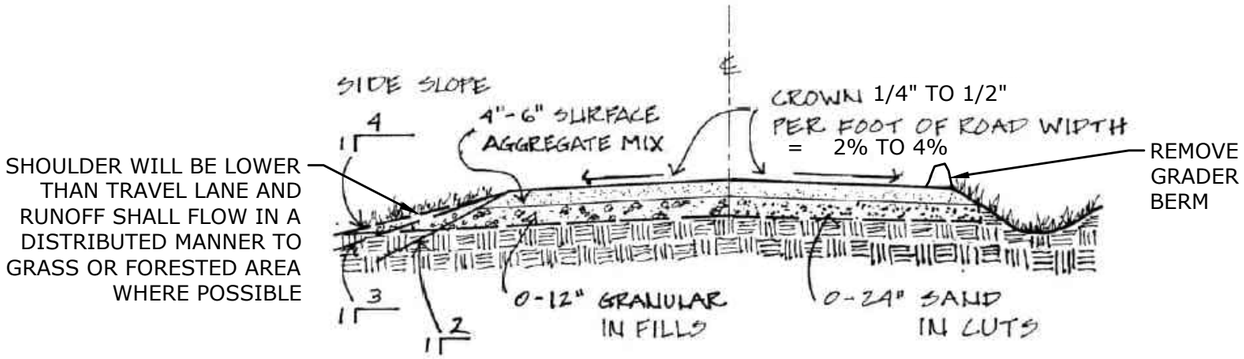
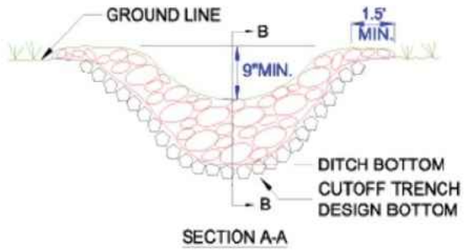
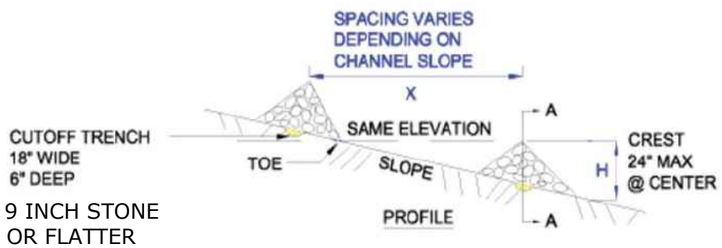


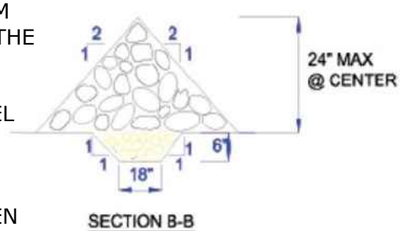
ROAD CROWN & PROFILE

- REGRADE ROAD SURFACE TO REMOVE RUTS, EROSION, AND GRADER/PLOW BERMS
- CROWN SHOULD BE MAINTAINED





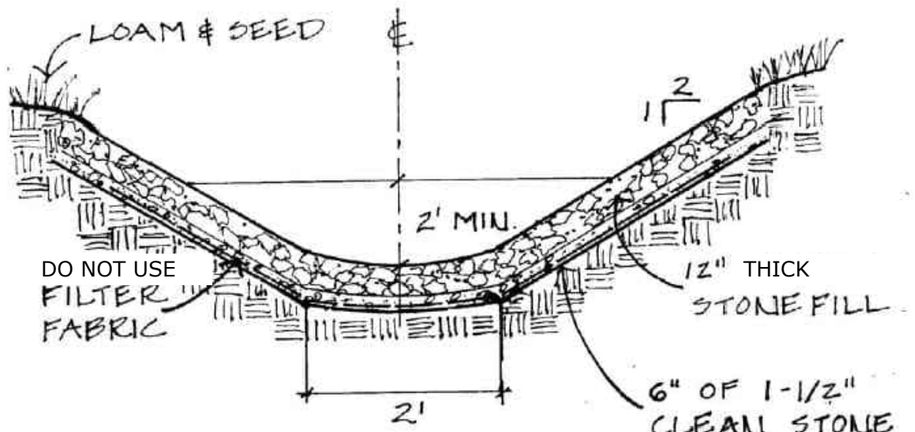
- USE MIX OF 2 TO 9 INCH STONE
- SIDE SLOPES 2:1 OR FLATTER
- SPAN WIDTH OF CHANNEL AND UP SIDES OF BANKS
- SPACE SO THAT THE TOE OF THE UPSTREAM DAM IS THE ELEVATION OF THE CREST OF THE DOWNSTREAM DAM
- PERIODICALLY REMOVE ACCUMULATED SEDIMENT AND DEBRIS TO ALLOW CHANNEL TO DRAIN THROUGH THE STONE AND PREVENT LARGE FLOWS FROM CARRYING SEDIMENT OVER THE DAM
- IF SIGNIFICANT EROSION OCCURS BETWEEN DAMS, A LINER OF STONE SHOULD BE INSTALLED



STONE CHECK DAM

OPERATION & MAINTENANCE NOTES:

ANNUALLY IN SPRING AFTER THAW AND AFTER LARGE RAINSTORMS, INSPECT ALL ROAD FEATURES.
NOTE WHERE EROSION IS AFFECTING FEATURE DESIGN.
SPECIFIC OPERATION & MAINTENANCE NOTES LISTED FOR EACH FEATURE.

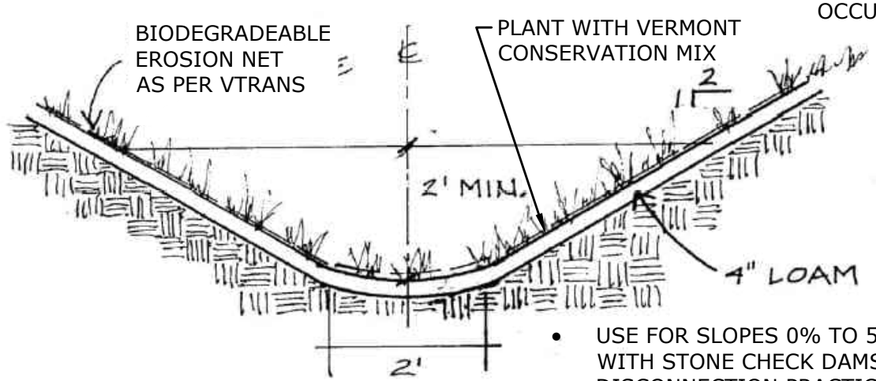


STONE FILL SIZE:

- SLOPES 5% TO 10% USE 6-8 INCH MINUS
- SLOPES MORE THAN 10% USE 12 INCH MINUS

STONE LINED DITCH

- RESHAPE SWALE AND REAPPLY SURFACE TREATMENT WHERE GULLY EROSION (>1 FT DEEP) IS OCCURRING



- USE FOR SLOPES 0% TO 5% OR 5% TO 8% WITH STONE CHECK DAMS OR DISCONNECTION PRACTICES EVERY 164 FEET
- NO BARE SOILS ALLOWED
- USE TRAPEZOIDAL OR PARABOLIC CROSS SECTION

GRASS LINED DITCH

REFERENCE NOTE: ADAPTED FROM "VERMONT BETTER BACKROADS MANUAL, CLEAN WATER YOU CAN AFFORD" A PULICATION OF THE NORTHERN VERMONT & GEORGE D. AIKEN RESOURCE CONSERVATION DEVELOPMENT (R C& D) COUNCILS, NOVEMBER 1995, UPDATED 2002, 2009.

STONE CHECK DAM DETAIL FROM STATE OF VERMONT AGENCY OF NATURAL RESOURCES DEPARTMENT OF ENVIRONMENTAL CONSERVATION VERMONT POLLUTION DISCHARGE ELIMINATION SYSTEM (VPDES) GENERAL PERMIT 3-9040 FOR STORMWATER DISCHARGES FROM MUNICIPAL ROADS, FINAL DRAFT.

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REVISIONS

DETAILS - ROAD SECTION

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG VERMONT

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 8, 2024 (DATE)

14439.00006 (PROJECT NO.)

DET-1 (SHEET NO.)

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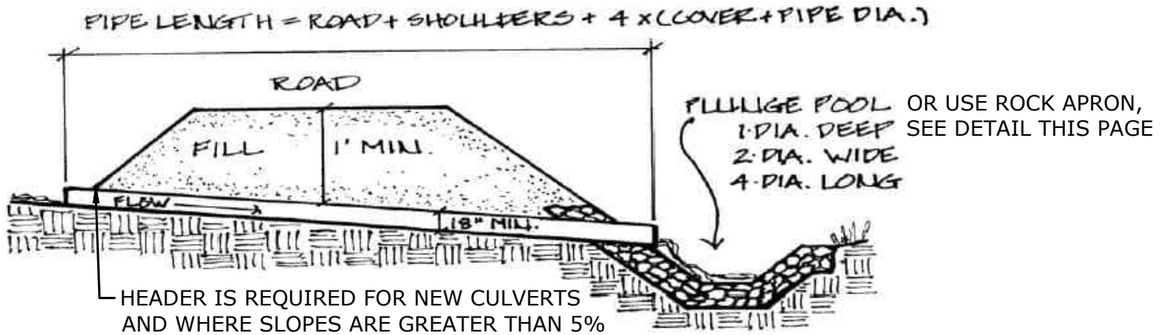
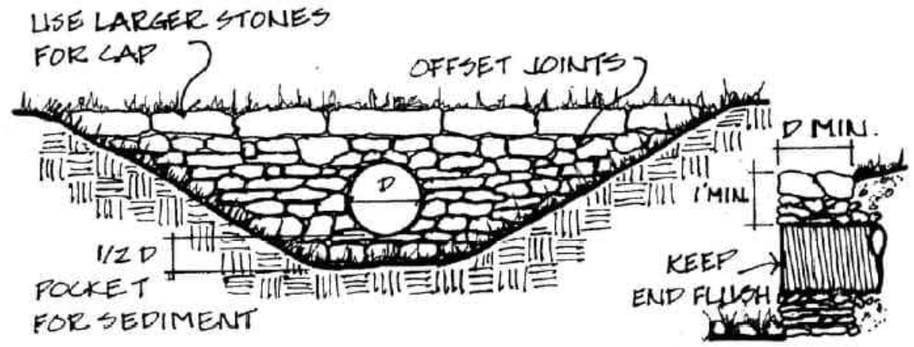


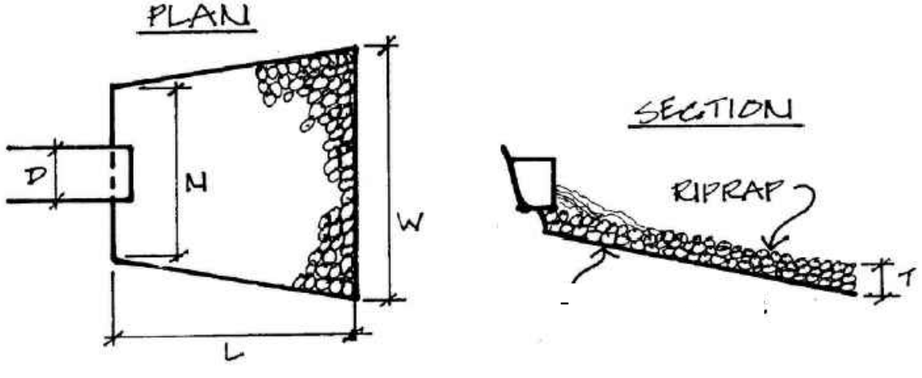
CULVERT PROFILE & CROSS SECTION



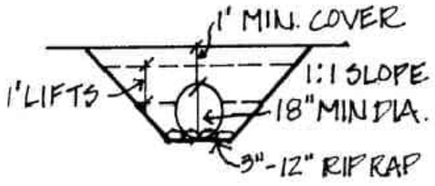
HEADER

Rock Apron Specifications					
Culvert Diameter (D)	Riprap Size	T (in.)	N (ft.)	W (ft.)	L (ft.)
18 inches	(3-12 inch)	18	4.5	14.5	10.0
24 inches	(3-12 inch)	18	6.0	20.0	14.0

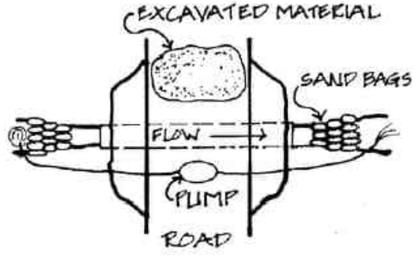
D= diameter of culvert
T= depth of stone in apron
N= width of apron near culvert
W= width at downhill end of apron
L= length of apron



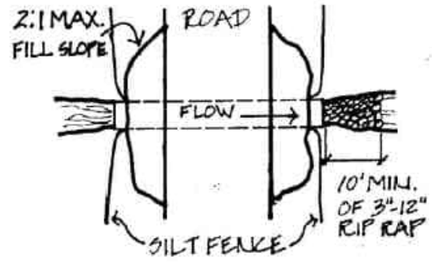
ROCK APRON



CULVERT CROSS SECTION



CULVERT INSTALLATION
FLOW BYPASS



CULVERT PLAN VIEW

- CHECK INLET AND OUTLETS TO REMOVE ACCUMULATED DEBRIS BLOCKING OPENING
- REPLACE DISLODGED HEADER OR APRON STONES

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REVISIONS

DETAILS - CULVERT

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

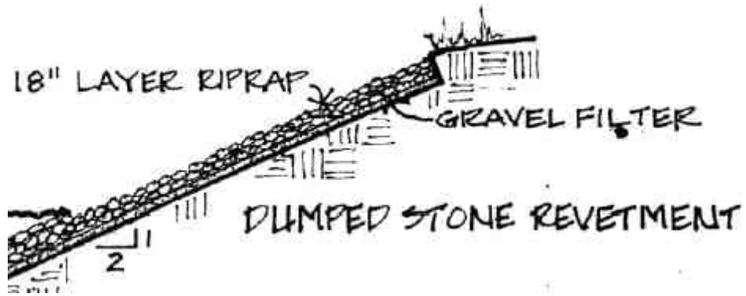
JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 8, 2024 (DATE)

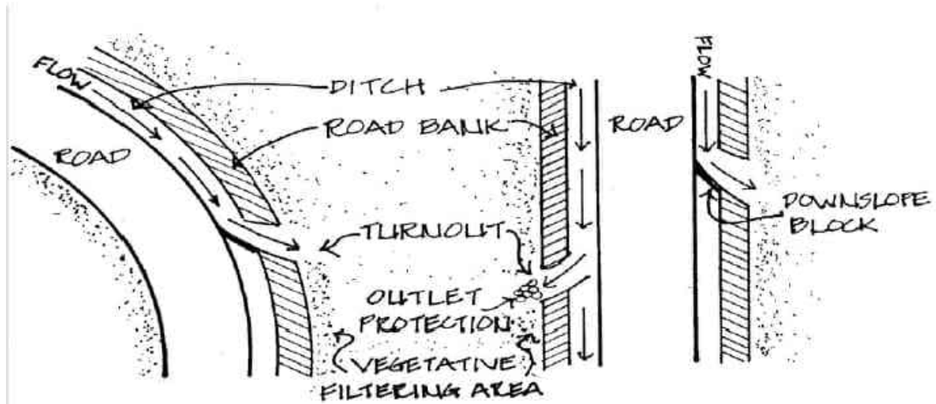
14439.00006 (PROJECT NO.)

DET-2 (SHEET NO.)



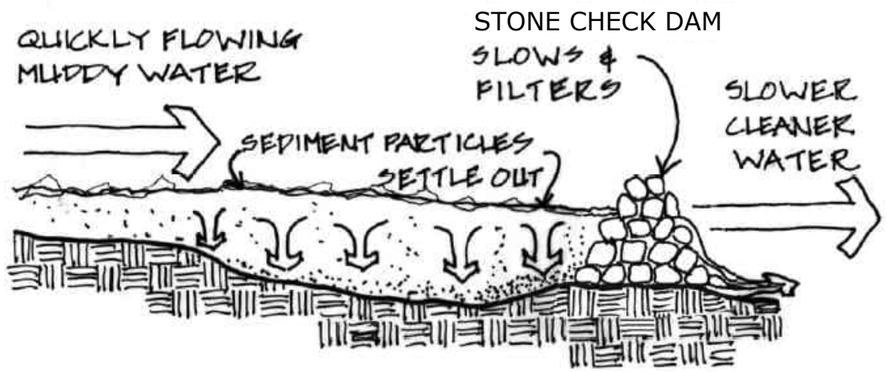
STONE ARMOR OR ROAD EDGE STABILIZATION

- RIRPAP SIZE IS BASED ON QUANTITY AND VELOCITY OF WATER
- ALWAYS CONTACT A STREAM ALTERNATION ENGINEER BEFORE INSTALLING RIPRAP AT A STREAM BANK
- USE ANGULAR STONE
- COVER WITH GRUBBINGS OR TOPSOIL AND SEED. IF ON A STREAM BANK, ONLY APPLY ABOVE ORDINARY HIGH WATER.
- CONSIDER PLANTING WITH ADDITIONAL VEGETATION



TURN-OUT

- AVOID DIRECT OUTLET TO SURFACE WATERS
- STABILIZE OUTLET BASED ON SLOPE:
  - 0% TO 5% STABILIZE WITH GRASS
  - 5% TO 10% STABILIZE WITH 6-8 INCH MINUS STONE
  - GREATER THAN 10% STABILIZE WITH 12 INCH MINUS STONE
- REMOVE ACCUMULATED SEDIMENT WHEN HALF FULL



SEDIMENT TRAP

- INSPECT ANNUALLY AND AFTER LARGE STORMS
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REVISIONS

DETAILS - OTHER

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE
SCALE

FEBRUARY 8, 2024
DATE

14439.00006
PROJECT NO.

DET-3
SHEET NO.

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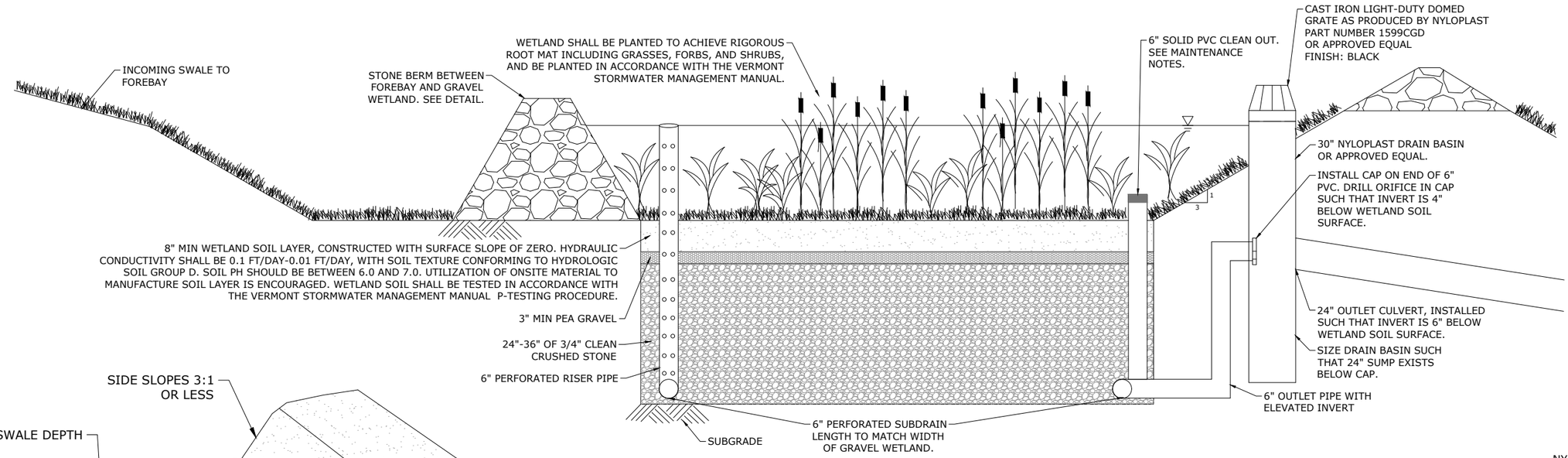
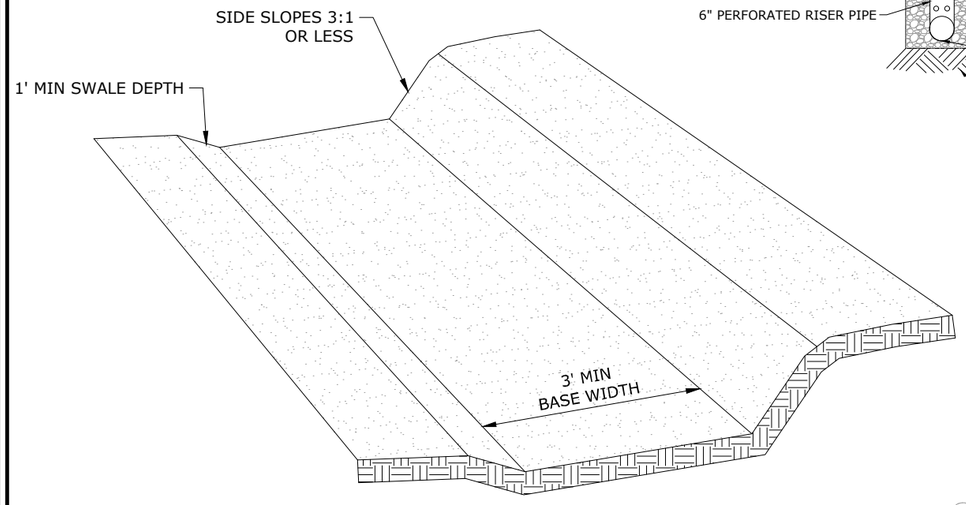


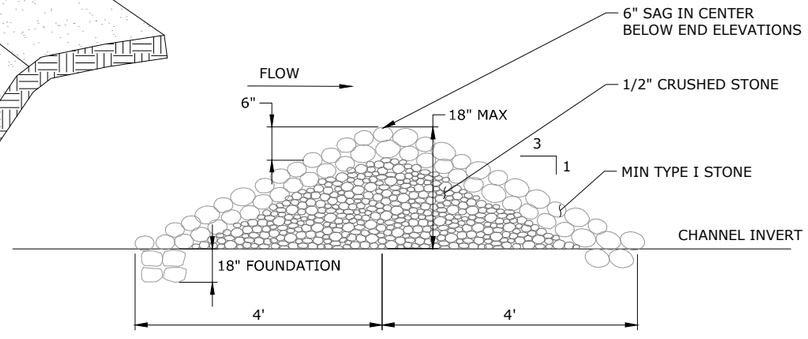
GRAVEL WETLAND SECTION VIEW

NOT TO SCALE



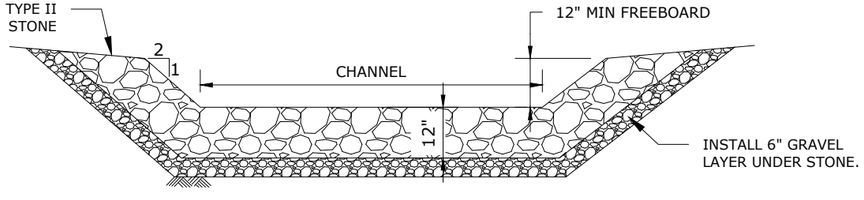
GRASSED SWALE

NOT TO SCALE



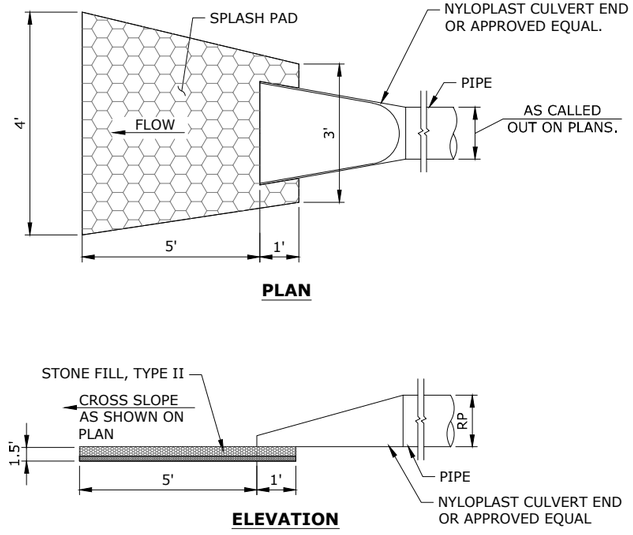
STONE BERM

NOT TO SCALE



EMERGENCY SPILLWAY DETAIL

NOT TO SCALE



FLARED END WITH RIP RAP SPLASH PAD

NOT TO SCALE

OPERATION & MAINTENANCE NOTES:

1. INSPECT SWALES AND FOREBAY FOR EROSION OR SEDIMENT ACCUMULATION.
2. INSPECT GRAVEL WETLAND CELL FOR SEDIMENT ACCUMULATION AND EVIDENCE OF SHORT CIRCUITING OR ANIMAL BURROWS.
3. OUTLET STRUCTURE: INSPECT LOW FLOW ORIFICE, OVERFLOW GRATE, STRUCTURE SUMP, PIPE CONNECTIONS, AND OVERALL STRUCTURE CONDITION. NOTE SUMP DEPTH, DEPTH OF ACCUMULATED SEDIMENT IN SUMP AND OTHER DEBRIS, AND OTHER NEEDED MAINTENANCE. SUMP TO BE CLEANED WHEN 50% FULL. CONFIRM SYSTEM IS DRAINING WITHIN 24-48 HOURS AFTER A RAIN EVENT.
4. INSPECT SLOPES FOR EROSION AND/OR BARE AREAS. NOTE AREAS IN NEED OF REPAIR AND/OR STABILIZATION. NOTE DEAD OR DYING PLANTS. REMOVE VEGETATION FROM GRAVEL WETLAND CELL BOTTOMS TO MAINTAIN NITROGEN REMOVAL PERFORMANCE.
5. OPEN INSPECTION PORTS AND NOTE STANDING WATER OR SEDIMENT ACCUMULATION IN STORAGE PIPING.
6. INSPECT STONE BERM FOR ACCUMULATED SEDIMENT OR NEED FOR REPLACEMENT STONE.

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REVISIONS

DETAILS - GRAVEL WETLAND

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 8, 2024 (DATE)

14439.00006 (PROJECT NO.)

DET-4 (SHEET NO.)

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Plotted by: AMARCUCCI On this date: Thu, 2024 February 8 - 3:45pm

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

SHADOW LANE - ROAD IMPROVEMENTS

Hinesburg, Vermont

14439.00006

February 16, 2024

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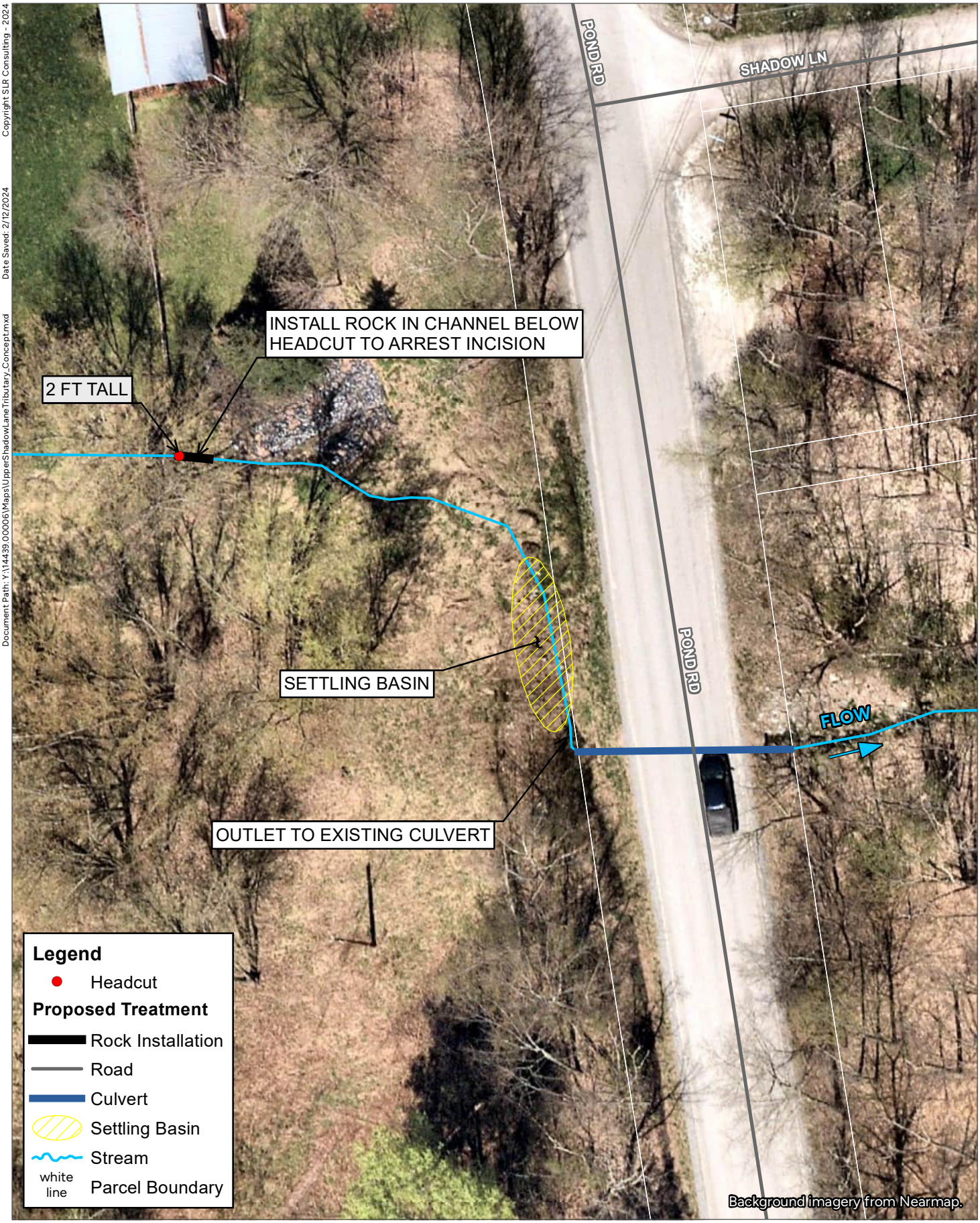
ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION SETUP / CLOSEOUT				
Mobilization	LS	1	$5,000	$5,000
Site preparation and remove minor vegetation	LS	1	$2,000	$2,000
ROAD IMPROVEMENTS				
Install stone sediment trap	EA	5	$350	$1,750
Grade to establish crown	LF	1,100	$0.1	$110
Reshape grass swale	LF	60	$5	$300
New grass swale	LF	350	$9	$3,150
Line swale with stone	LF	1,350	$35	$47,250
Add check dams to swale	LF	1,350	$8	$10,800
Install storm drainage pipe	LF	120	$75	$9,000
Remove sediment and debris from culvert	EA	16	$500	$8,000
CONSTRUCTION SUBTOTAL (ROUNDED) * Gravel wetland not included				**$87,000**
FINAL DESIGN - includes gravel wetland feasibility only, survey, wetland/shore permit				$20,000
GRANT ASSISTANCE (NGO) - simple bid process, outreach, and minor reporting				$10,000
CONSTRUCTION ASSISTANCE - answer questions, check progress, document completion				$12,500
CONSTRUCTION CONTINGENCY (15%)				$13,050
TOTAL (ROUNDED)*				**$143,000**



Date Saved: 2/12/2024

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UPPER SHADOW LANE TRIBUTARY - PROPOSED CONDITIONS

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 15 30

Feet

1 in = 30 feet

N

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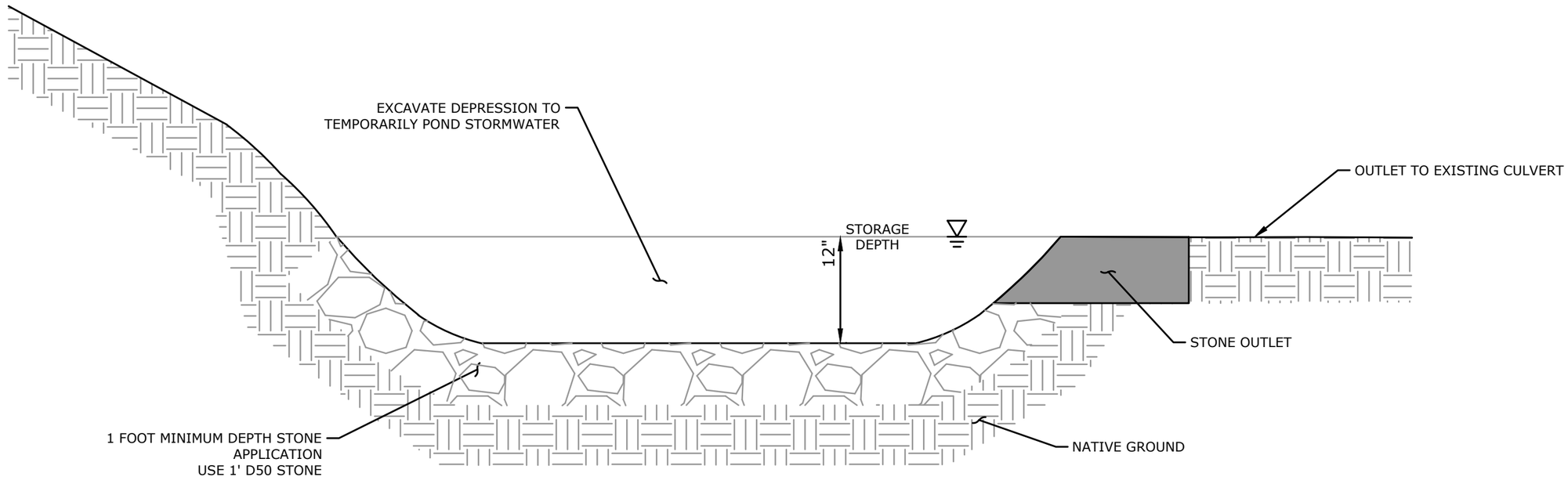
1 SOUTH MAIN ST
SECOND FLOOR
WATERBURY, VT 05676
802.882.8335

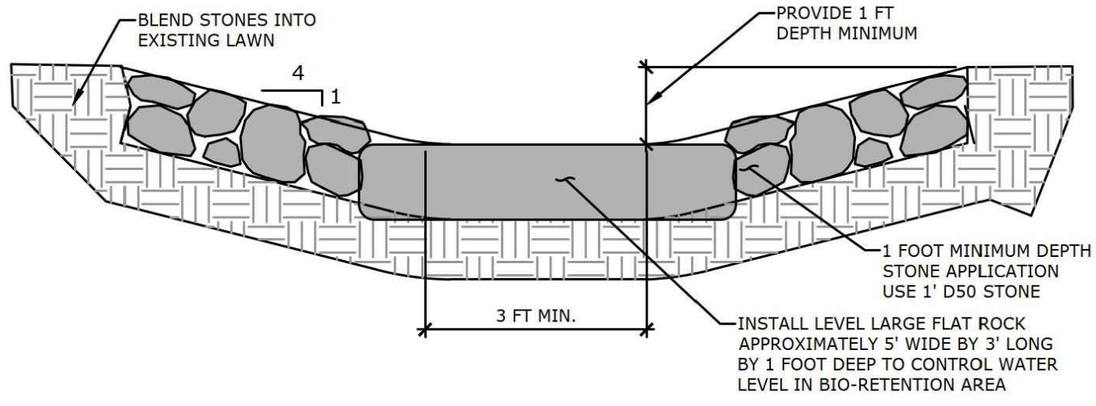


STONE SETTLING BASIN

NOT TO SCALE

OPERATION AND MAINTENANCE NOTES:

1. INSPECT FOR EROSION PATHS OR CONCENTRATED FLOW THROUGH BASIN, AS NEEDED REDISTRIBUTE STONE TO REMOVE CONCENTRATED FLOW PATHS.
2. THE ACCUMULATION OF SEDIMENT WITHIN THE SETTLING BASIN SHOULD BE MONITORED AND INSPECTED A MINIMUM OF ONCE ANNUALLY. REMOVE SEDIMENT AFTER APPROXIMATELY 12 INCHES OF SEDIMENT HAS ACCUMULATED.
3. MAINTENANCE OF THE SYSTEM SHOULD ONLY OCCUR DURING LOW FLOW AND IN THE GROWING SEASON AFTER SPRING RUNOFF.



STONE OUTLET

NOT TO SCALE

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REVISIONS

DETAILS

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

CONCEPT DESIGN

AOM	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 12, 2024 (DATE)

14439.000006 (PROJECT NO.)

DET-1 (SHEET NO.)

Drawing: W:\CADDESIGN\14439.000006-DE\CAD\DETAILS\RAINGARDEN_DETAILS.DWG Layout: Tab:11X17_UPPERSHADOWRIB
Plotted by: AMARCUCCI On this date: Mon, 2024 February 12 - 2:57pm

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

UPPER SHADOW LANE TRIBUTARY - SETTLING BASIN AND ROCK ADDITION

Hinesburg, Vermont

14439.00006

February 16, 2024

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION LABOR & EQUIPMENT				
Labor	HR	48	$60	$2,880
Excavator / Operator	HR	24	$150	$3,600
Haul Materials (assume 1 hr round trip)	HR	16	$150	$2,400
CONSTRUCTION MATERIALS				
Stone for channel stabilization and settling basin	CY	50	$65	$3,250
CONSTRUCTION MISCELLANEOUS				
Mobilization/ Demobilization	LS	1	$3,000	$3,000
Traffic control	LS	1	$2,000	$2,000
Buffer planting	LS	1	$3,000	$3,000
Site Restoration	LS	1	$5,000	$5,000
CONSTRUCTION SUBTOTAL (ROUNDED)				**$25,000**
FINAL DESIGN & PERMITTING - river permits, plans in GIS, no survey				$6,000
GRANT ASSISTANCE (NGO) - simple bid process, minor meetings and reporting				$5,000
CONSTRUCTION PHASE SERVICES - part time				$5,000
CONSTRUCTION CONTINGENCY (15%)				$3,750
TOTAL (ROUNDED)				**$45,000**

Date Saved: 1/26/2024

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ST. GEORGE

HINESBURG

OAKHILL RD

POND RD

SHADOW LN

Lake Iroquois

3 FT HDPE CULVERT

1.5 FT TALL

INSTALL LARGE WOOD IN CHANNEL TO STABILIZE EROSION OF BED AND BANKS AND CAPTURE SEDIMENT

PLANT NATIVE TREES AND SHRUBS TO RESTORE RIPARIAN BUFFER

INSTALL ROCK IN CHANNEL BELOW EACH HEADCUT TO ARREST INCISION

1.5 FT TALL

2.5 FT TALL

2.5 FT TALL

2 FT TALL

2.5 FT TALL

3.5 FT TALL

3 FT HDPE CULVERT

MAJOR INCISION

SLIGHT INCISION

MAJOR INCISION

PINE SHORE DR

Legend

- Headcut

Proposed Treatment

- Rock Installation
- Wood Installation
- Road
- Culvert
- Stream
- Town Boundary
- Parcel Boundary (white line)

SHADOW LANE TRIBUTARY - PROPOSED CONDITIONS

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN
WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

Background imagery from Nearmap.

0 40 80 160
Feet

1 in = 80 feet

N

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1 SOUTH MAIN ST
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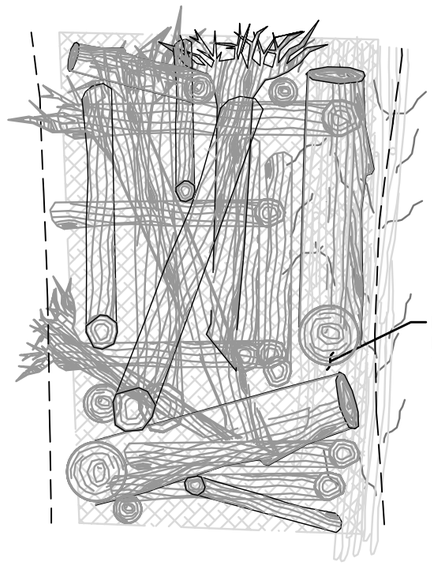
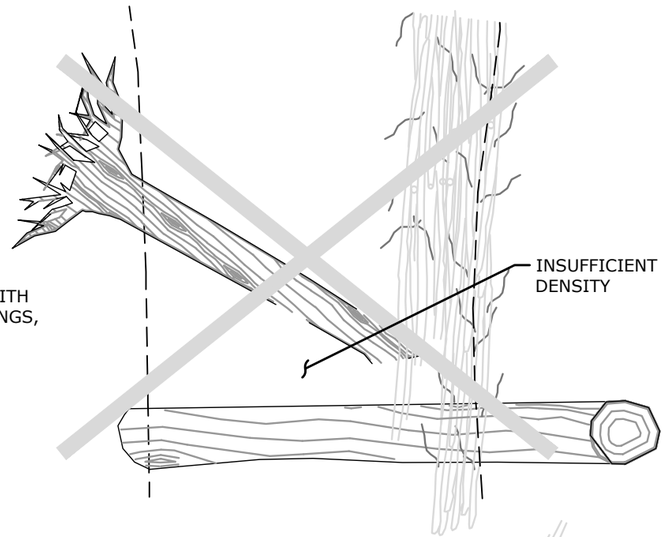
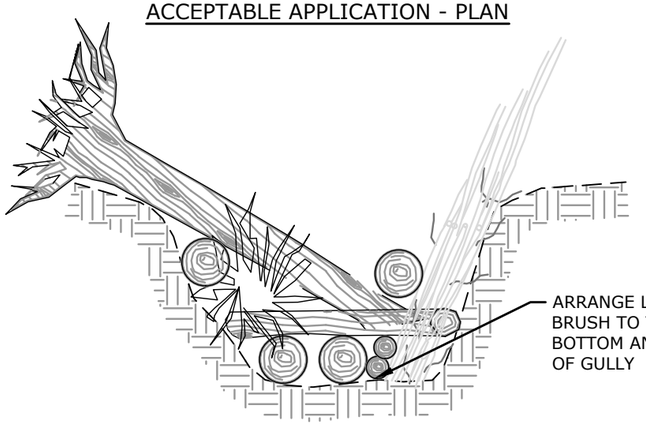
WATERBURY, VT 05676
802.882.8335



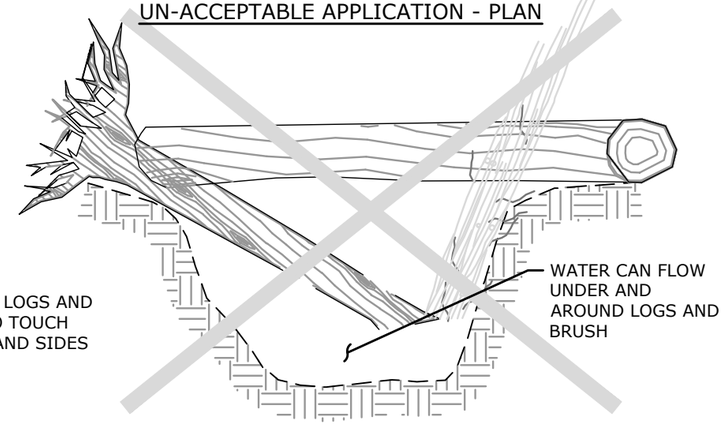
ACCEPTABLE APPLICATION - PLAN



UN-ACCEPTABLE APPLICATION - PLAN



ACCEPTABLE APPLICATION - SECTION



UN-ACCEPTABLE APPLICATION - SECTION

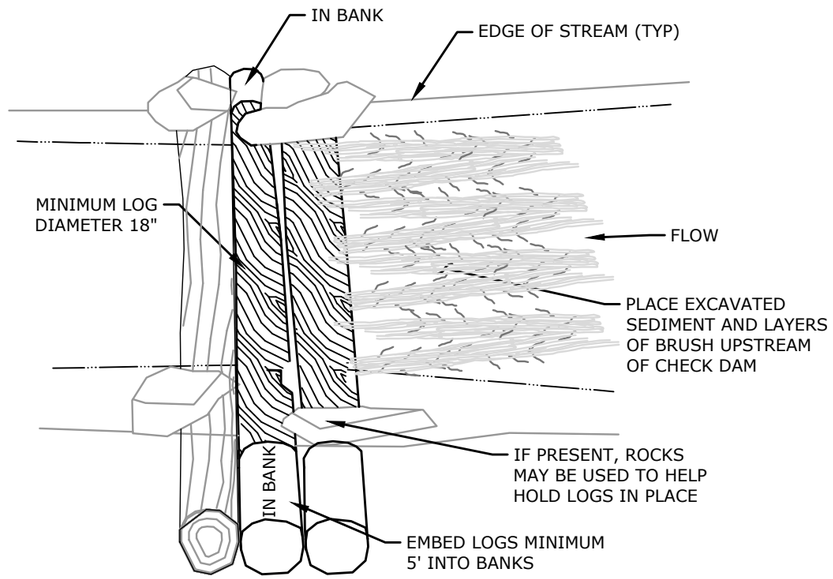
BRUSH AND SMALL LOG APPLICATION

NOT TO SCALE

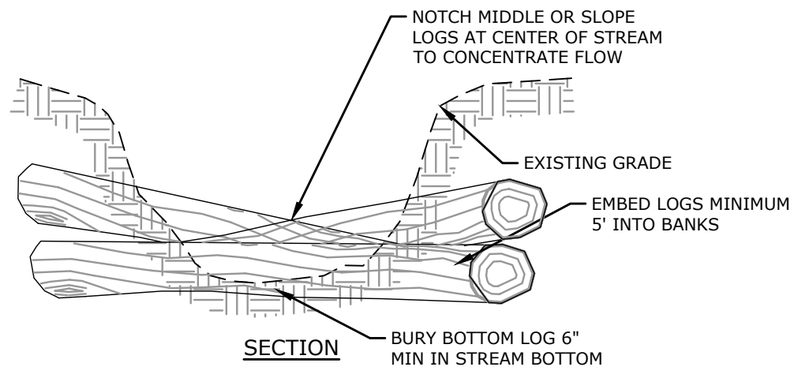
1. INSTALL SMALL LOGS AND BRUSH IN CHANNEL TO STOP EROSION, SLOW FLOW, AND CATCH SEDIMENT.
2. CUT LOGS TO FIT AND FILL THE CHANNEL, EXPECTED LENGTH IS 10' TO 20' LONG. THIS WILL REQUIRE TURNING PIECES AND STACKING SO THAT INDIVIDUAL PIECES FIT DOWN INTO CHANNEL AND TOUCH THE BOTTOM.
3. FILL VOIDS WITH BRUSH CUTTINGS.
4. INSTALLATION IS EXPECTED WITH CHAINSAW AND HANDWORK.
5. USE EXISTING DOWNED WOOD WHERE POSSIBLE.
4. WHERE NEW CUT WOOD IS REQUIRED CONSULT WITH LANDOWNER.

OPERATION AND MAINTENANCE NOTES:

1. ANNUALLY VISIT SITE TO ASSESS SITE CONDITION AND MAINTENANCE NEEDS.
2. THE ACCUMULATION OF SEDIMENT IS EXPECTED UPSTREAM OF LOG STRUCTURES.
3. NOTE NEW HEADCUTS WITH HEIGHT OF GREATER THAN 1.5 FEET TALL.
4. USE PRY BAR AND CHAINSAW TO REARRANGE INSTALLED LOGS AND WOOD TO RESIST FURTHER HEADCUTTING WHERE HEADCUTS ARE OBSERVED.



ISOMETRIC VIEW



SECTION

LOG CHECK DAM

NOT TO SCALE

1. INSTALL SMALL LOGS AND BRUSH IN CHANNEL TO STOP EROSION, SLOW FLOW, AND CATCH SEDIMENT.
2. INSTALLATION IS EXPECTED WITH CHAINSAW AND SMALL EXCAVATOR.
3. USE EXISTING DOWNED WOOD WHERE POSSIBLE.
4. WHERE NEW CUT WOOD IS REQUIRED CONSULT WITH LANDOWNER.
5. FINAL PLACEMENT TO BE APPROVED BY ENGINEER IN FIELD.
6. ADJUST PLACEMENT TO AVOID CONFLICT WITH EXISTING TREES AND ROCK.

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REVISIONS

DETAILS

SHADOW LANE TRIBUTARY
LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

CONCEPT DESIGN

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 8, 2024 (DATE)

14439.00006 (PROJECT NO.)

DET-1 (SHEET NO.)

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

LOWER SHADOW LANE TRIBUTARY - GULLY STABILIZATION AND BUFFER PLANTING

Hinesburg, Vermont

14439.00006

February 16, 2024

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION LABOR & EQUIPMENT				
Labor	HR	80	$60	$4,800
Excavator / Operator	HR	80	$150	$12,000
Haul Materials (assume 1 hr round trip)	HR	16	$150	$2,400
CONSTRUCTION SETUP				
Mobilization	LS	1	$5,000	$5,000
Site preparation and access	LS	1	$5,000	$5,000
GULLY WORK				
Cut and place down live trees, assumes onsite	EA	30	$750	$22,500
Stone for channel stabilization placement	CY	120	$65	$7,800
CONSTRUCTION CLOSEOUT				
Buffer planting	LS	1	$5,000	$5,000
Site restoration	LS	1	$5,000	$5,000
Demobilization	LS	1	$5,000	$5,000
CONSTRUCTION SUBTOTAL (ROUNDED)				**$70,000**
FINAL DESIGN & PERMITTING - river permits, plans in GIS, no survey				$10,000
GRANT ASSISTANCE (NGO) - simple bid process, minor meetings and reporting				$5,000
CONSTRUCTION PHASE SERVICES - part time				$10,000
CONSTRUCTION CONTINGENCY (15%)				$10,500
TOTAL (ROUNDED)				**$106,000**

Date Saved: 2/15/2024

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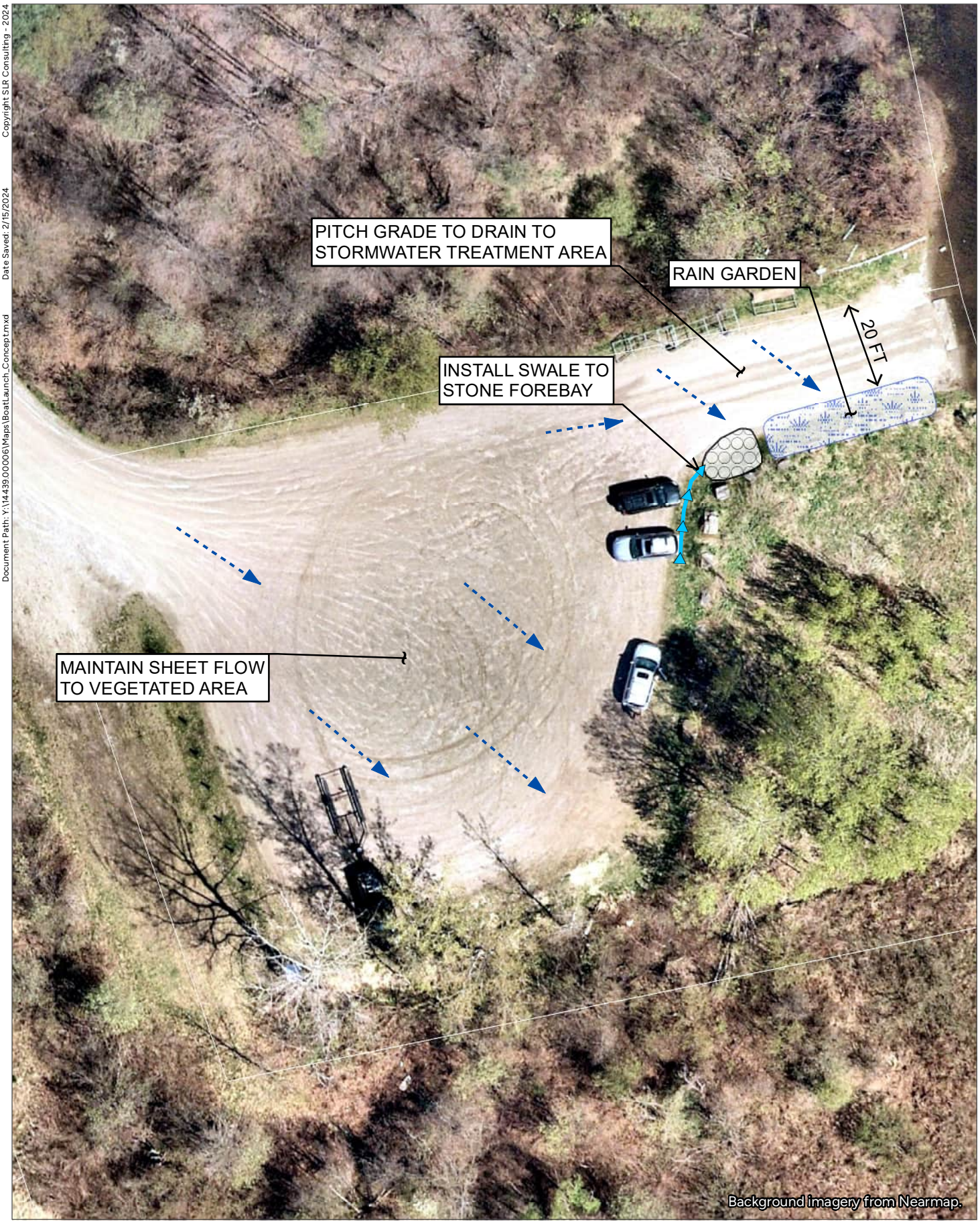

STORMWATER MANAGEMENT - BOAT LAUNCH

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 12.5 25

Feet

1 in = 30 feet

N

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1 SOUTH MAIN ST
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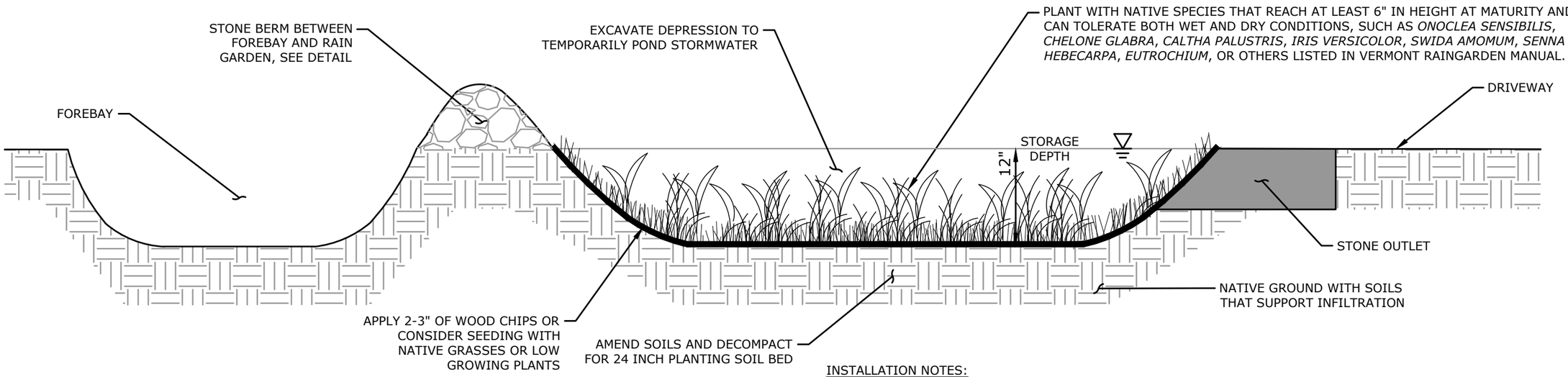


RAIN GARDEN

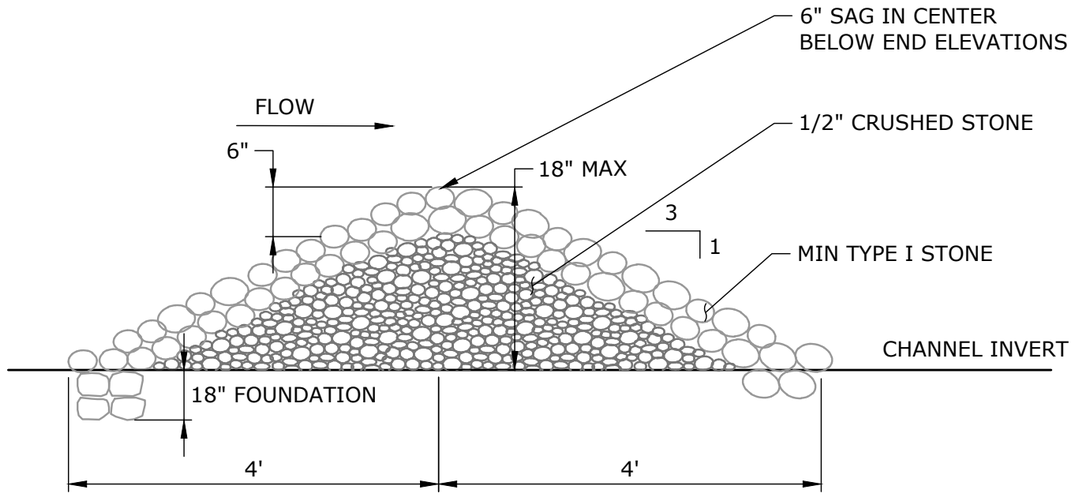
NOT TO SCALE

INSTALLATION NOTES:

1. THE VERMONT RAINGARDEN MANUAL IS A GOOD EDUCATIONAL RESOURCE TO ACCOMPANY THIS PROJECT. ALTERNATIVES TO THE DETAILS PRESCRIBED IN THIS PLAN ARE AVAILABLE IN THAT MANUAL INCLUDING ADDITIONAL APPROPRIATE PLANT SPECIES.
2. PLANTING DENSITIES ARE RECOMMENDED TO BE ONE PERENNIAL EVERY 2.5 FEET ON CENTER OR ONE SHRUB EVERY 5 FEET ON CENTER.
3. INSTALL STONE OUTLET TO DIRECT OVERFLOW TO ROADSIDE SWALE.

OPERATION AND MAINTENANCE NOTES:

1. MAINTENANCE OF THE RAIN GARDEN IS VERY SIMILAR TO PLANTED LANDSCAPED BEDS. REPLACEMENT OF SOME MULCH MAY BE REQUIRED IN THE SPRING. OCCASIONAL WEEDING WILL BE REQUIRED TO MAINTAIN THE SELECTED PLANTS AESTHETICALLY PLEASING.
2. DURING THE FIRST YEAR OF OPERATION, WATERING, WEEDING, AND REPLACEMENT OF DEAD PLANTS IS IMPORTANT FOR PROPER ESTABLISHMENT.
3. THE ACCUMULATION OF SEDIMENT WITHIN THE RAIN GARDEN SHOULD BE MONITORED. REMOVE SEDIMENT AFTER APPROXIMATELY 3 INCHES OF SEDIMENT HAS ACCUMULATED OR RAKE AWAY WHEN DOES NOT DRAIN WITHIN 1 DAY.
4. ANNUALLY INSPECT MAKE SURE NO INVASIVE SPECIES ARE PRESENT.
5. INSPECT FOR EROSION PATHS OR CONCENTRATED FLOW OVER STONE BERM, AS NEEDED REDISTRIBUTE STONE TO REMOVE CONCENTRATED FLOW PATHS.

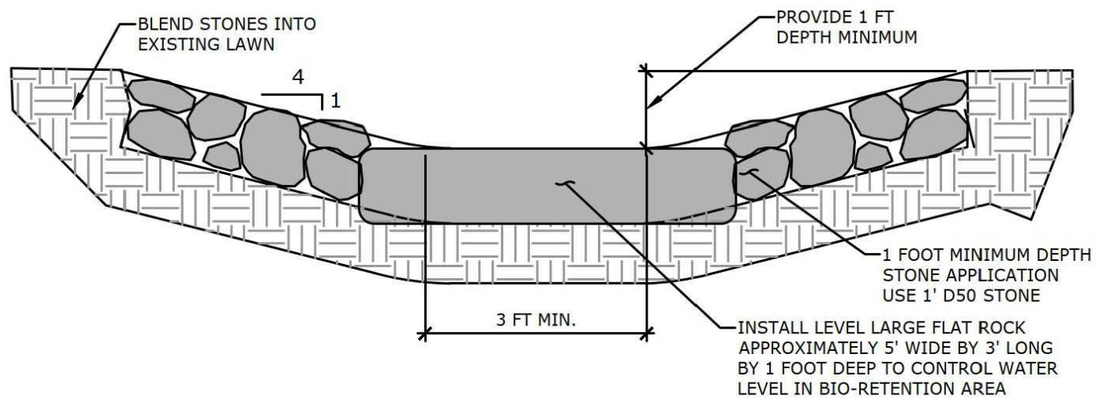


STONE BERM

NOT TO SCALE

DESIGN NOTES FOR FINAL DESIGN:

1. TEST INFILTRATION RATE, SHOULD BE AT LEAST 0.2 INCHES PER HOUR.
2. INVESTIGATE SOILS TO DETERMINE AMENDMENTS NEEDED TO PROVIDE 24 INCHES OF USDA SAND TO LOAMY SAND AS NOTED IN THE VERMONT STORMWATER TREATMENT STANDARDS.



STONE OUTLET

NOT TO SCALE

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REVISIONS

CONCEPT DESIGN

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

DETAILS

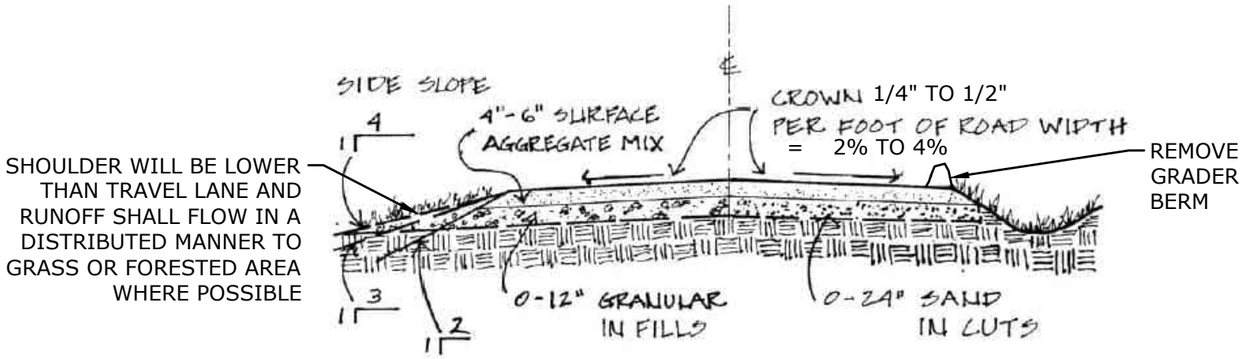
AOM	AOM	JCL
DESIGNED	DRAWN	CHECKED

SCALE: NOT TO SCALE

DATE: MARCH 6, 2024

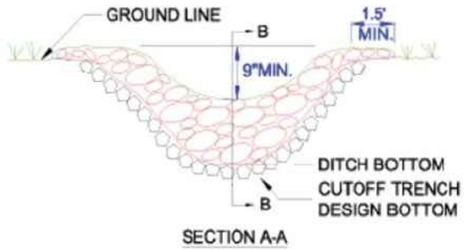
PROJECT NO.: 14439.000006

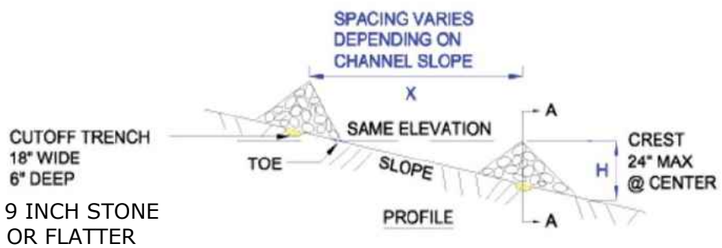
SHEET NO.: DET-1



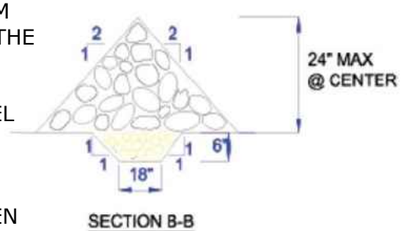
ROAD CROWN & PROFILE

- REGRADE ROAD SURFACE TO REMOVE RUTS, EROSION, AND GRADER/PLOW BERMS
- CROWN SHOULD BE MAINTAINED





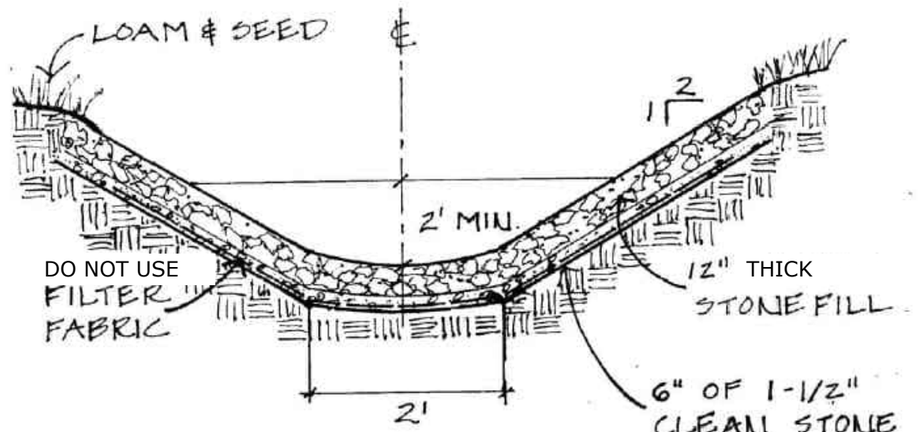
- USE MIX OF 2 TO 9 INCH STONE
- SIDE SLOPES 2:1 OR FLATTER
- SPAN WIDTH OF CHANNEL AND UP SIDES OF BANKS
- SPACE SO THAT THE TOE OF THE UPSTREAM DAM IS THE ELEVATION OF THE CREST OF THE DOWNSTREAM DAM
- PERIODICALLY REMOVE ACCUMULATED SEDIMENT AND DEBRIS TO ALLOW CHANNEL TO DRAIN THROUGH THE STONE AND PREVENT LARGE FLOWS FROM CARRYING SEDIMENT OVER THE DAM
- IF SIGNIFICANT EROSION OCCURS BETWEEN DAMS, A LINER OF STONE SHOULD BE INSTALLED



STONE CHECK DAM

OPERATION & MAINTENANCE NOTES:

ANNUALLY IN SPRING AFTER THAW AND AFTER LARGE RAINSTORMS, INSPECT ALL ROAD FEATURES.
NOTE WHERE EROSION IS AFFECTING FEATURE DESIGN.
SPECIFIC OPERATION & MAINTENANCE NOTES LISTED FOR EACH FEATURE.

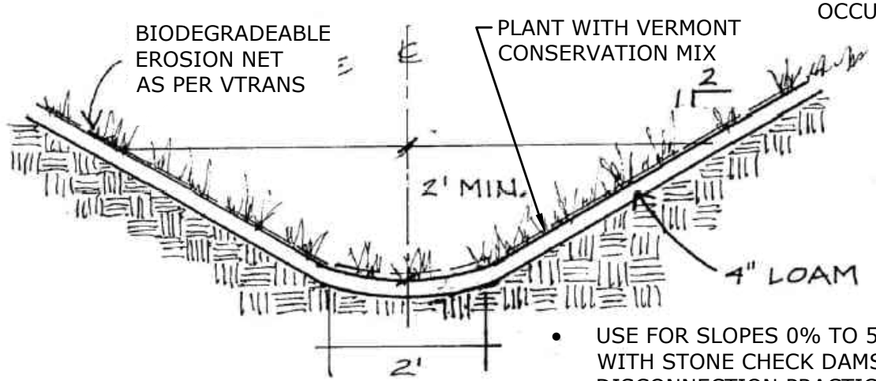


STONE FILL SIZE:

- SLOPES 5% TO 10% USE 6-8 INCH MINUS
- SLOPES MORE THAN 10% USE 12 INCH MINUS

STONE LINED DITCH

- RESHAPE SWALE AND REAPPLY SURFACE TREATMENT WHERE GULLY EROSION (>1 FT DEEP) IS OCCURRING



- USE FOR SLOPES 0% TO 5% OR 5% TO 8% WITH STONE CHECK DAMS OR DISCONNECTION PRACTICES EVERY 164 FEET
- NO BARE SOILS ALLOWED
- USE TRAPEZOIDAL OR PARABOLIC CROSS SECTION

GRASS LINED DITCH

REFERENCE NOTE: ADAPTED FROM "VERMONT BETTER BACKROADS MANUAL, CLEAN WATER YOU CAN AFFORD" A PULICATION OF THE NORTHERN VERMONT & GEORGE D. AIKEN RESOURCE CONSERVATION DEVELOPMENT (R C& D) COUNCILS, NOVEMBER 1995, UPDATED 2002, 2009.

STONE CHECK DAM DETAIL FROM STATE OF VERMONT AGENCY OF NATURAL RESOURCES DEPARTMENT OF ENVIRONMENTAL CONSERVATION VERMONT POLLUTION DISCHARGE ELIMINATION SYSTEM (VPDES) GENERAL PERMIT 3-9040 FOR STORMWATER DISCHARGES FROM MUNICIPAL ROADS, FINAL DRAFT.

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REVISIONS

DETAILS - ROAD SECTION

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG VERMONT

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE (SCALE)

FEBRUARY 8, 2024 (DATE)

14439.00006 (PROJECT NO.)

DET-2 (SHEET NO.)

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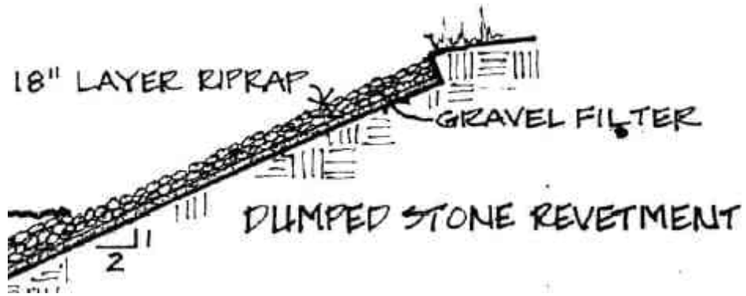
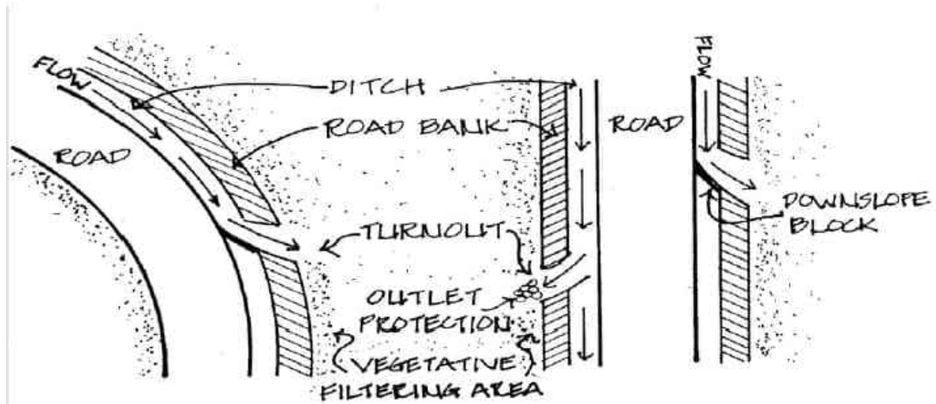


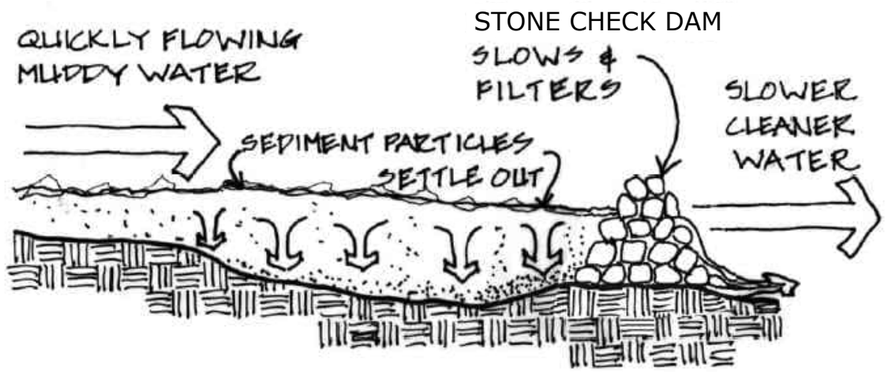
STONE ARMOR OR ROAD EDGE STABILIZATION

- RIRPAP SIZE IS BASED ON QUANTITY AND VELOCITY OF WATER
- ALWAYS CONTACT A STREAM ALTERNATION ENGINEER BEFORE INSTALLING RIPRAP AT A STREAM BANK
- USE ANGULAR STONE
- COVER WITH GRUBBINGS OR TOPSOIL AND SEED. IF ON A STREAM BANK, ONLY APPLY ABOVE ORDINARY HIGH WATER.
- CONSIDER PLANTING WITH ADDITIONAL VEGETATION



TURN-OUT

- AVOID DIRECT OUTLET TO SURFACE WATERS
- STABILIZE OUTLET BASED ON SLOPE:
  - 0% TO 5% STABILIZE WITH GRASS
  - 5% TO 10% STABILIZE WITH 6-8 INCH MINUS STONE
  - GREATER THAN 10% STABILIZE WITH 12 INCH MINUS STONE
- REMOVE ACCUMULATED SEDIMENT WHEN HALF FULL



SEDIMENT TRAP

- INSPECT ANNUALLY AND AFTER LARGE STORMS
- REMOVE ACCUMULATED SEDIMENT WHEN HALF FULL.

REFERENCE NOTE: ADAPTED FROM "VERMONT BETTER BACKROADS MANUAL, CLEAN WATER YOU CAN AFFORD" A PULICATION OF THE NORTHERN VERMONT & GEORGE D. AIKEN RESOURCE CONSERVATION DEVELOPMENT (R C& D) COUNCILS, NOVEMBER 1995, UPDATED 2002, 2009.

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REVISIONS

DETAILS - OTHER

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

JCL	AOM	JCL
DESIGNED	DRAWN	CHECKED

NOT TO SCALE
SCALE

FEBRUARY 8, 2024
DATE

14439.00006
PROJECT NO.

DET-3
SHEET NO.

Drawing: W:\CADDESIGN\14439.00006-DE\CAD\MR-DETAILS.DWG Layout: Tab:OTHER
Plotted by: AMARCUCCI On this date: Thu, 2024 February 8 - 2:56pm

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

LAKE IROQUOIS BOAT LAUNCH RAIN GARDEN

Williston, Vermont

14439.00006

February 16, 2024

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION LABOR & EQUIPMENT				
Mobilization/ Demobilization	LS	1	$3,000	$3,000
Labor	HR	16	$60	$960
Excavator / Operator	HR	16	$150	$2,400
Grader / Operator	HR	8	$150	$1,200
Haul Fill Off Site (1 hr round trip)	HR	5	$120	$600
Haul Materials to Site (assume 1 hr round trip)	HR	8	$120	$960
CONSTRUCTION MATERIALS				
Topsoil	CY	20	$65	$1,300
Woodchip Mulch	CY	5	$70	$350
Stone for forebay	CY	10	$65	$650
Stone for spillways	CY	10	$65	$650
Gravel for grading	CY	10	$50	$500
Straw Mulch	LS	1	$500	$500
Seed for Restoring Disturbed Areas	LS	1	$500	$500
Plants	LS	1	$3,000	$3,000
CONSTRUCTION SUBTOTAL (ROUNDED)				**$17,000**

Date Saved: 2/9/2024
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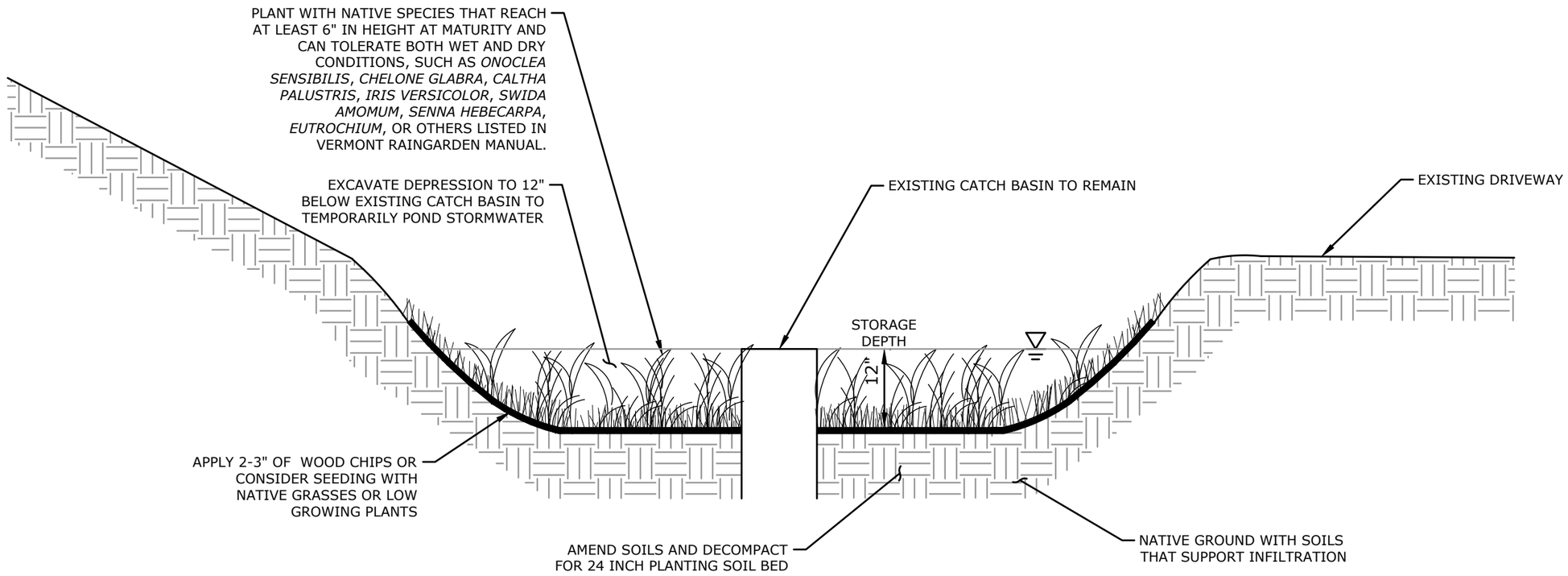
RAIN GARDEN - HUNT PROPERTY

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN
WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 10 20
Feet
1 in = 20 feet

N

SLR
1 SOUTH MAIN ST
SECOND FLOOR
WATERBURY, VT 05676
802.882.8335



INSTALLATION NOTES:

1. THE VERMONT RAINGARDEN MANUAL IS A GOOD EDUCATIONAL RESOURCE TO ACCOMPANY THIS PROJECT. ALTERNATIVES TO THE DETAILS PRESCRIBED IN THIS PLAN ARE AVAILABLE IN THAT MANUAL INCLUDING ADDITIONAL APPROPRIATE PLANT SPECIES.
2. PLANTING DENSITIES ARE RECOMMENDED TO BE ONE PERENNIAL EVERY 2.5 FEET ON CENTER OR ONE SHRUB EVERY 5 FEET ON CENTER.

OPERATION AND MAINTENANCE NOTES:

1. MAINTENANCE OF THE RAIN GARDEN IS VERY SIMILAR TO PLANTED LANDSCAPED BEDS. REPLACEMENT OF SOME MULCH MAY BE REQUIRED IN THE SPRING. OCCASIONAL WEEDING WILL BE REQUIRED TO MAINTAIN THE SELECTED PLANTS AESTHETICALLY PLEASING.
2. DURING THE FIRST YEAR OF OPERATION, WATERING, WEEDING, AND REPLACEMENT OF DEAD PLANTS IS IMPORTANT FOR PROPER ESTABLISHMENT.
3. THE ACCUMULATION OF SEDIMENT WITHIN THE RAIN GARDEN SHOULD BE MONITORED. REMOVE SEDIMENT AFTER APPROXIMATELY 3 INCHES OF SEDIMENT HAS ACCUMULATED OR RAKE AWAY WHEN DOES NOT DRAIN WITHIN 1 DAY.
4. ANNUALLY INSPECT MAKE SURE NO INVASIVE SPECIES ARE PRESENT.

RAIN GARDEN

NOT TO SCALE

DESIGN NOTES FOR FINAL DESIGN:

1. TEST INFILTRATION RATE, SHOULD BE AT LEAST 0.2 INCHES PER HOUR.
2. GRADE TO DIRECT WATER AWAY FROM DRIVEWAY.
3. INVESTIGATE SOILS TO DETERMINE AMENDMENTS NEEDED TO PROVIDE 24 INCHES OF USDA SAND TO LOAMY SAND AS NOTED IN THE VERMONT STORMWATER TREATMENT STANDARDS.

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SLRCONSULTING.COM

REVISIONS

RAIN GARDEN DETAILS

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

CONCEPT DESIGN

AOM	AOM	JCL
DESIGNED	DRAWN	CHECKED

SCALE: NOT TO SCALE

DATE: MARCH 6, 2024

PROJECT NO.: 14439.000006

SHEET NO.: DET-1

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HUNT RAIN GARDEN

St. George, Vermont

14439.00006

February 16, 2024

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION LABOR & EQUIPMENT				
Mobilization/ Demobilization	LS	1	$2,000	$2,000
Labor	HR	16	$60	$960
Excavator / Operator	HR	8	$150	$1,200
Haul Fill Off Site (1 hr round trip)	HR	4	$120	$480
Haul Materials to Site (assume 1 hr round trip)	HR	4	$120	$480
CONSTRUCTION MATERIALS				
Topsoil	CY	10	$65	$650
Woodchip Mulch	CY	3	$70	$210
Stone for spillway	CY	4	$65	$260
Straw Mulch	LS	1	$500	$500
Seed for Restoring Disturbed Areas	LS	1	$500	$500
Plants	LS	1	$2,000	$2,000
CONSTRUCTION SUBTOTAL (ROUNDED)				**$9,000**
FINAL DESIGN - plans in GIS, no survey				$4,000
GRANT ASSISTANCE (NGO) - simple bid process, minor meetings and reporting				$2,500
CONSTRUCTION PHASE SERVICES - part time				$5,000
CONSTRUCTION CONTINGENCY (15%)				$1,350
TOTAL (ROUNDED)				**$22,000**

Date Saved: 2/9/2024
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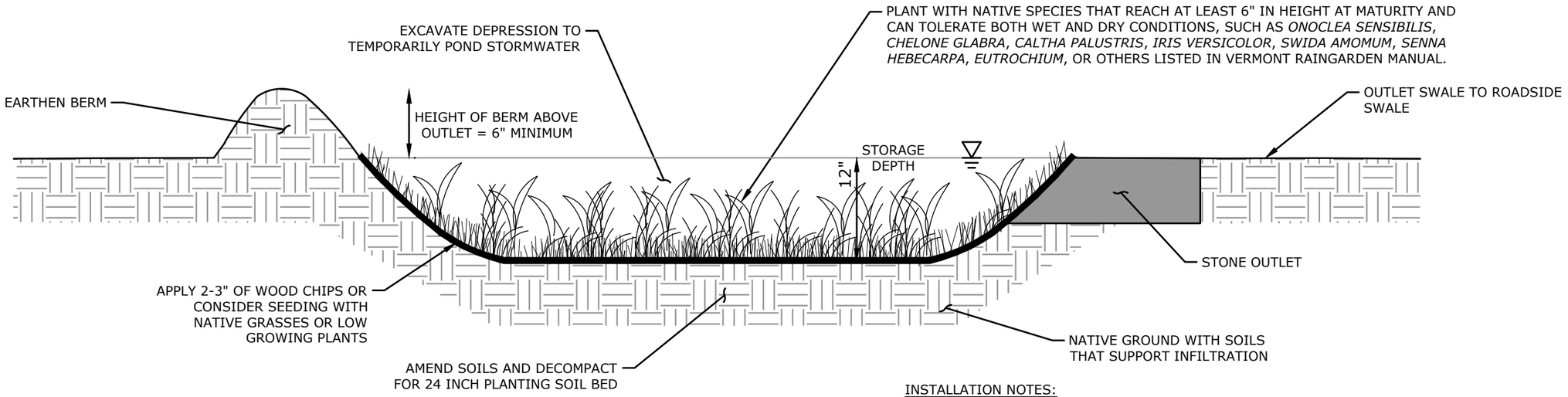
RAIN GARDEN - CARROLL PROPERTY

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN
WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

0 10 20
Feet
1 in = 20 feet

N

SLR
1 SOUTH MAIN ST
SECOND FLOOR
WATERBURY, VT 05676
802.882.8335



RAIN GARDEN

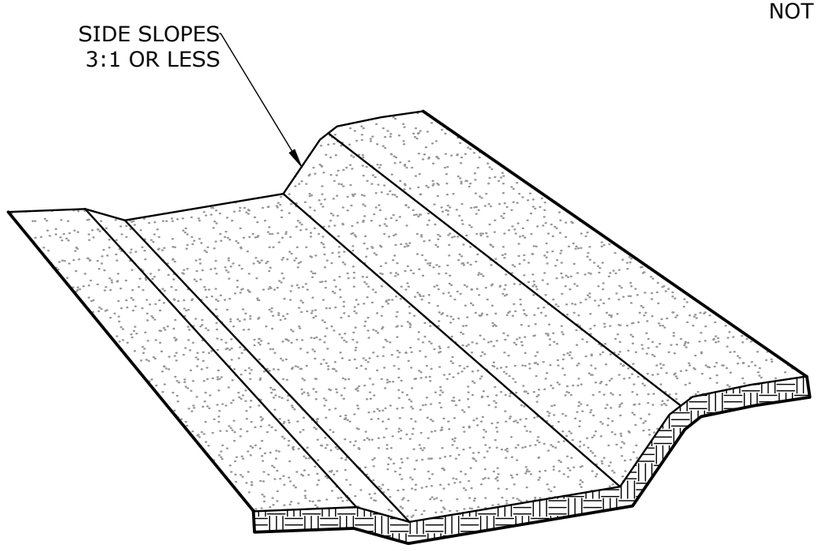
NOT TO SCALE

INSTALLATION NOTES:

1. THE VERMONT RAINGARDEN MANUAL IS A GOOD EDUCATIONAL RESOURCE TO ACCOMPANY THIS PROJECT. ALTERNATIVES TO THE DETAILS PRESCRIBED IN THIS PLAN ARE AVAILABLE IN THAT MANUAL INCLUDING ADDITIONAL APPROPRIATE PLANT SPECIES.
2. PLANTING DENSITIES ARE RECOMMENDED TO BE ONE PERENNIAL EVERY 2.5 FEET ON CENTER OR ONE SHRUB EVERY 5 FEET ON CENTER.
3. INSTALL STONE OUTLET TO DIRECT OVERFLOW TO ROADSIDE SWALE.

OPERATION AND MAINTENANCE NOTES:

1. MAINTENANCE OF THE RAIN GARDEN IS VERY SIMILAR TO PLANTED LANDSCAPED BEDS. REPLACEMENT OF SOME MULCH MAY BE REQUIRED IN THE SPRING. OCCASIONAL WEEDING WILL BE REQUIRED TO MAINTAIN THE SELECTED PLANTS AESTHETICALLY PLEASING.
2. DURING THE FIRST YEAR OF OPERATION, WATERING, WEEDING, AND REPLACEMENT OF DEAD PLANTS IS IMPORTANT FOR PROPER ESTABLISHMENT.
3. THE ACCUMULATION OF SEDIMENT WITHIN THE RAIN GARDEN SHOULD BE MONITORED. REMOVE SEDIMENT AFTER APPROXIMATELY 3 INCHES OF SEDIMENT HAS ACCUMULATED OR RAKE AWAY WHEN DOES NOT DRAIN WITHIN 1 DAY.
4. ANNUALLY INSPECT MAKE SURE NO INVASIVE SPECIES ARE PRESENT.

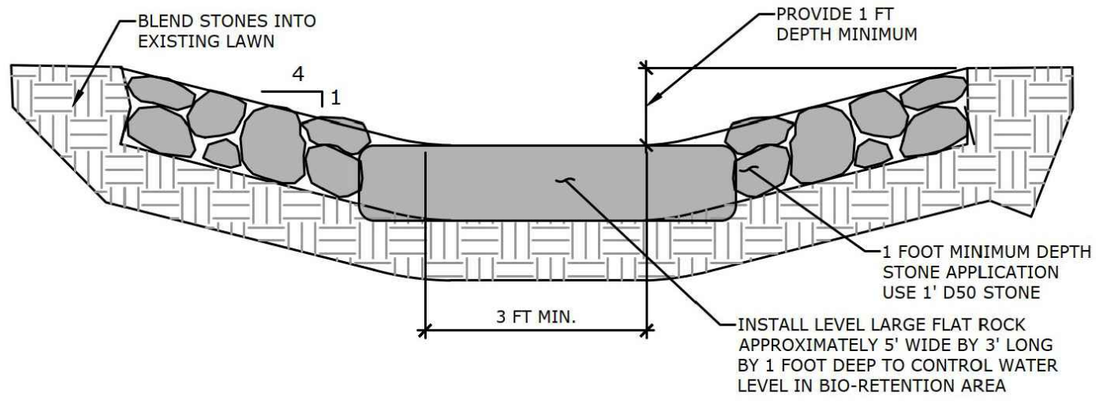


GRASSED SWALE

NOT TO SCALE

DESIGN NOTES FOR FINAL DESIGN:

1. TEST INFILTRATION RATE, SHOULD BE AT LEAST 0.2 INCHES PER HOUR.
2. GRADE TO DIRECT WATER AWAY FROM HOUSE
3. INVESTIGATE SOILS TO DETERMINE AMENDMENTS NEEDED TO PROVIDE 24 INCHES OF USDA SAND TO LOAMY SAND AS NOTED IN THE VERMONT STORMWATER TREATMENT STANDARDS.



STONE OUTLET

NOT TO SCALE

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REVISIONS

RAIN GARDEN DETAILS

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

CONCEPT DESIGN

AOM	AOM	JCL
DESIGNED	DRAWN	CHECKED

SCALE: NOT TO SCALE

DATE: MARCH 6, 2024

PROJECT NO.: 14439.000006

SHEET NO.: DET-1

Drawing: W:\CAD\DESIGN\14439.00006-DE\CAD\DETAILS\RAINGARDEN_DETAILS.DWG Layout: Tab:11X17_CARROLL
Plotted by: AMARCUCCI On this date: Wed, 2024 March 6 - 2:00pm

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

CARROLL RAIN GARDEN

Hinesburg, Vermont

14439.00006

February 16, 2024

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION LABOR & EQUIPMENT				
Mobilization/ Demobilization	LS	1	$2,000	$2,000
Labor	HR	24	$60	$1,440
Excavator / Operator	HR	16	$150	$2,400
Haul Fill Off Site (1 hr round trip)	HR	4	$120	$480
Haul Materials to Site (assume 1 hr round trip)	HR	4	$120	$480
CONSTRUCTION MATERIALS				
Topsoil	CY	10	$65	$650
Woodchip Mulch	CY	3	$70	$210
Stone for spillway	CY	4	$65	$260
Gutters	LF	40	$50	$2,000
Straw Mulch	LS	1	$500	$500
Seed for Restoring Disturbed Areas	LS	1	$500	$500
Plants	LS	1	$2,000	$2,000
CONSTRUCTION SUBTOTAL (ROUNDED)				**$13,000**
FINAL DESIGN - plans in GIS, elevation checks				$4,000
GRANT ASSISTANCE (NGO) - simple bid process, minor meetings and reporting				$2,500
CONSTRUCTION PHASE SERVICES - part time				$5,000
CONSTRUCTION CONTINGENCY (15%)				$1,950
TOTAL (ROUNDED)				**$26,000**

Date Saved: 2/15/2024

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HINESBURG

PLANT NATIVE TREES AND SHRUBS TO CREATE BUFFER AROUND POND

STABILIZE POND INLET WITH ROCK

EXCAVATE SETTLING AREA AND PLANT WITH RAIN GARDEN VEGETATION

INSTALL FILTER BERM AT OUTLET

INSTALL FILTER BERM

INSTALL FILTER BERM

LOW FLOW SWALE

UTILITY BOX

EXCAVATE DEPRESSION AND PLANT WITH RAIN GARDEN VEGETATION

PINE SHORE DR

EXCAVATE DEPRESSION AND PLANT WITH RAIN GARDEN VEGETATION

EXISTING VEGETATED SETTLING AREA

Legend

Road Feature - Existing & Proposed

- Swale
- Culvert
- Road
- white line — Parcel Boundary

PINE SHORE DRIVE - PROPOSED CONDITIONS

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN
WINOOSKI NATURAL RESOURCES CONSERVATION DISTRICT

Background imagery from Nearmap.

0 20 40
Feet

1 in = 20 feet

N

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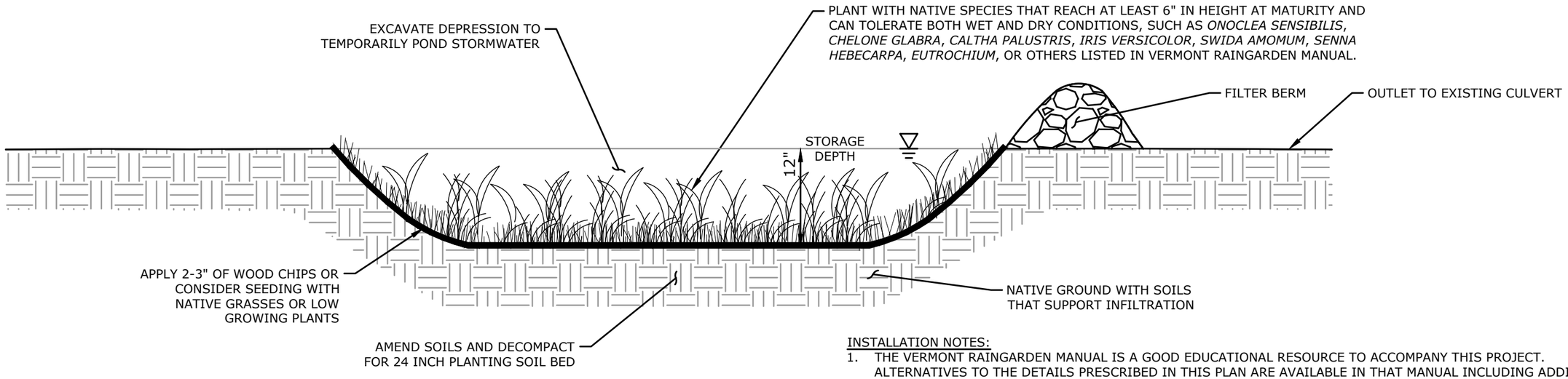
1 SOUTH MAIN ST
SECOND FLOOR
WATERBURY, VT 05676
802.882.8335



RAIN GARDEN

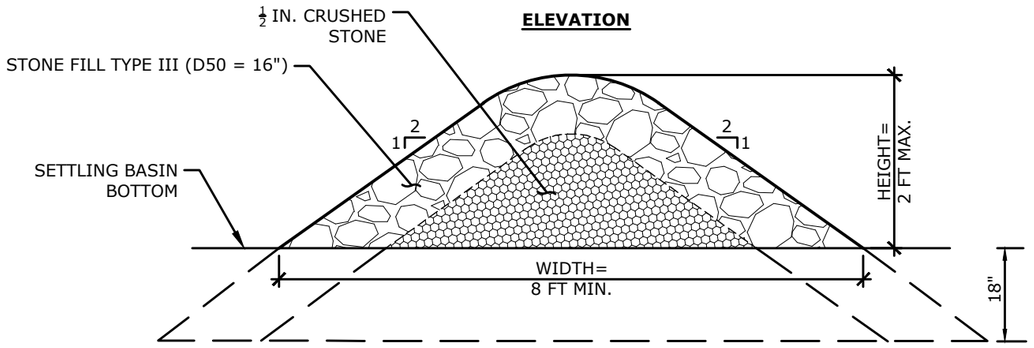
NOT TO SCALE

INSTALLATION NOTES:

1. THE VERMONT RAINGARDEN MANUAL IS A GOOD EDUCATIONAL RESOURCE TO ACCOMPANY THIS PROJECT. ALTERNATIVES TO THE DETAILS PRESCRIBED IN THIS PLAN ARE AVAILABLE IN THAT MANUAL INCLUDING ADDITIONAL APPROPRIATE PLANT SPECIES.
2. PLANTING DENSITIES ARE RECOMMENDED TO BE ONE PERENNIAL EVERY 2.5 FEET ON CENTER OR ONE SHRUB EVERY 5 FEET ON CENTER.
3. INSTALL STONE OUTLET TO DIRECT OVERFLOW TO ROADSIDE SWALE.

OPERATION AND MAINTENANCE NOTES:

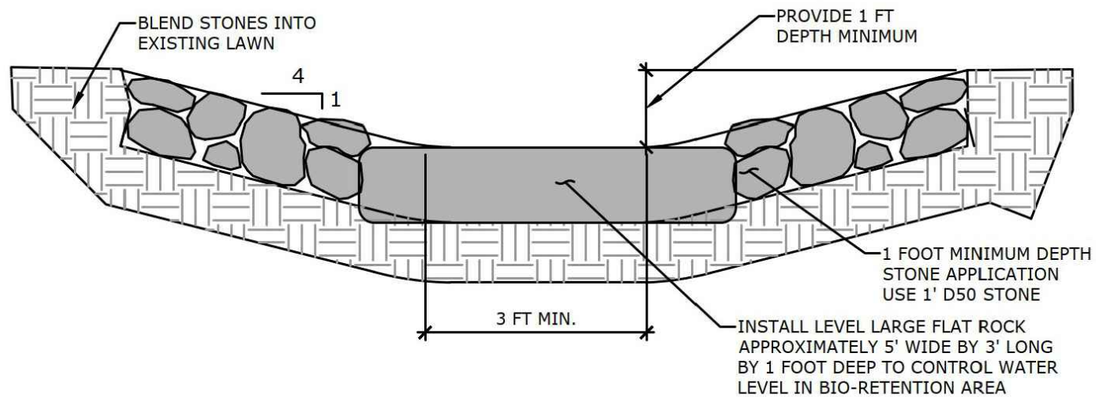
1. MAINTENANCE OF THE RAIN GARDEN IS VERY SIMILAR TO PLANTED LANDSCAPED BEDS. REPLACEMENT OF SOME MULCH MAY BE REQUIRED IN THE SPRING. OCCASIONAL WEEDING WILL BE REQUIRED TO MAINTAIN THE SELECTED PLANTS AESTHETICALLY PLEASING.
2. DURING THE FIRST YEAR OF OPERATION, WATERING, WEEDING, AND REPLACEMENT OF DEAD PLANTS IS IMPORTANT FOR PROPER ESTABLISHMENT.
3. THE ACCUMULATION OF SEDIMENT WITHIN THE RAIN GARDEN SHOULD BE MONITORED. REMOVE SEDIMENT AFTER APPROXIMATELY 3 INCHES OF SEDIMENT HAS ACCUMULATED OR RAKE AWAY WHEN DOES NOT DRAIN WITHIN 1 DAY.
4. ANNUALLY INSPECT MAKE SURE NO INVASIVE SPECIES ARE PRESENT.
5. PERIODICALLY, INCLUDING AFTER LARGE STORMS AND REGULARLY DURING THE FALL, REMOVE LEAVES AND DEBRIS ACCUMULATED AT FILTER BERMS.
6. INSPECT FOR EROSION PATHS OR CONCENTRATED FLOW OVER FILTER BERMS, AS NEEDED REDISTRIBUTE STONE TO REMOVE CONCENTRATED FLOW PATHS.



NOTES:
EXTEND THE STONE A MINIMUM OF 18 INCHES INTO BANKS AND BOTTOM TO PREVENT CUTTING AROUND THE ENDS OR UNDER THE FILTER BERM.

STONE FILTER BERM

NOT TO SCALE



STONE OUTLET

NOT TO SCALE

DESIGN NOTES FOR FINAL DESIGN:

1. TEST INFILTRATION RATE, SHOULD BE AT LEAST 0.2 INCHES PER HOUR.
2. INVESTIGATE SOILS TO DETERMINE AMENDMENTS NEEDED TO PROVIDE 24 INCHES OF USDA SAND TO LOAMY SAND AS NOTED IN THE VERMONT STORMWATER TREATMENT STANDARDS.

SLR
1 SOUTH MAIN STREET
WATERBURY, VT 05676
802.882.8355
SLRCONSULTING.COM

REVISIONS

CONCEPT DESIGN

DETAILS

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

HINESBURG, VERMONT

AOM	AOM	JCL
DESIGNED	DRAWN	CHECKED

SCALE: NOT TO SCALE

DATE: MARCH 6, 2024

PROJECT NO.: 14439.000006

SHEET NO.: DET-1

Drawing: W:\CAD\DESIGN\14439.00006-DE\CAD\DETAILS\RAINGARDEN_DETAILS.DWG Layout Tab:11X17_PINESHORE
Plotted by: AMARCUCCI On this date: Wed, 2024 March 6 - 2:09pm

BALLPARK OPINION OF PROBABLE CONSTRUCTION COST

LAKE IROQUOIS-PATRICK BROOK WATERSHED ACTION PLAN

PINE SHORE DRIVE RAIN GARDENS

Hinesburg, Vermont

14439.00006

February 16, 2024

SLR

ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
CONSTRUCTION LABOR & EQUIPMENT				
Mobilization/ Demobilization	LS	1	$2,000	$2,000
Labor	HR	80	$60	$4,800
Excavator / Operator	HR	24	$150	$3,600
Haul Fill Off Site (1 hr round trip)	HR	8	$120	$960
Haul Materials to Site (assume 1 hr round trip)	HR	8	$120	$960
CONSTRUCTION MATERIALS				
Topsoil	CY	30	$65	$1,950
Woodchip Mulch	CY	7	$70	$490
Stone for spillways / berms	CY	20	$65	$1,300
Straw Mulch	LS	1	$750	$750
Seed for Restoring Disturbed Areas	LS	1	$750	$750
Plants	LS	1	$3,000	$3,000
Buffer planting	LS	1	$3,000	$3,000
CONSTRUCTION SUBTOTAL (ROUNDED)				**$24,000**
FINAL DESIGN - plans in GIS, elevation checks				$5,000
GRANT ASSISTANCE (NGO) - simple bid process, minor meetings and reporting				$2,500
CONSTRUCTION PHASE SERVICES - part time				$6,500
CONSTRUCTION CONTINGENCY (15%)				$3,600
TOTAL (ROUNDED)				**$42,000**

Making Sustainability Happen