

# Stormwater Master Plan for the Town of Mendon, Vermont

## FINAL REPORT

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**Appendix A:** Stormwater Project Location Map (24"x36")

**Appendix B:** Problem Area Summary Table and Prioritization Matrix (11"x17" and 8.5"x11")

**Appendix C:** Conceptual Designs (11"x17")

## 1.0 Introduction

In 2022, Fitzgerald Environmental Associates (FEA) and SLR International Consulting (SLR) were contracted by the Vermont Department of Environmental Conservation (VTDEC) to develop a Stormwater Master Plan (SWMP) for the Town of Mendon. This final SWMP report for the Town of Mendon represents significant efforts and collaborations over the last several years between the Town, FEA, SLR, VTDEC, and other partners, including private landowners and business owners, interested in mitigating stormwater and improving water quality.

### 1.1 Stormwater Master Planning

Stormwater runoff is caused by precipitation, both in the form of rain or melting snow/ice, that is not infiltrated into the ground, absorbed by wetlands, or otherwise intercepted by plants. Human alteration of our landscapes in the form of impervious surfaces (i.e., pavement, rooftops, etc.) and compaction of soils disrupts natural hydrology and causes increased stormwater runoff. Increased stormwater runoff leads to higher magnitude flood flows, greater erosive power in stream channels, and increased delivery of sediment, nutrients, and other pollutants to waterways. Increased stormwater runoff is directly linked to the quality of water in our streams, rivers, ponds, and lakes that we depend on for drinking water, healthy fisheries, and recreation.

Stormwater Master Plans (SWMPs) can address stormwater problem areas either by mitigating impacts before they create problems or by avoiding the creation of issues at vulnerable sites. Prevention is cheaper than restoration, and SWMPs aim to address stormwater problem areas primarily through prevention. If we are to avoid the high cost of restoring degraded surface waters, we must better manage stormwater runoff before those waters become impaired. SWMPs are developed with public involvement and comment and should be as comprehensive as possible in listing all known problem areas within the Town. SWMPs are based on a prioritized list of stormwater projects. This strategic approach is more likely to produce long term water quality resiliency than a reactionary approach that addresses problems as they arise. Historically, almost all Vermont municipalities have responded to stormwater runoff or drainage problems the latter way, often during an emergency or after a structural failure has occurred. SWMPs contain important information and recommendations about preserving natural features and functions of watersheds and provide lists of evaluated alternatives such as using traditional pipe (gray) infrastructure versus green stormwater infrastructure.



## 1.2 Project Goals and Objectives

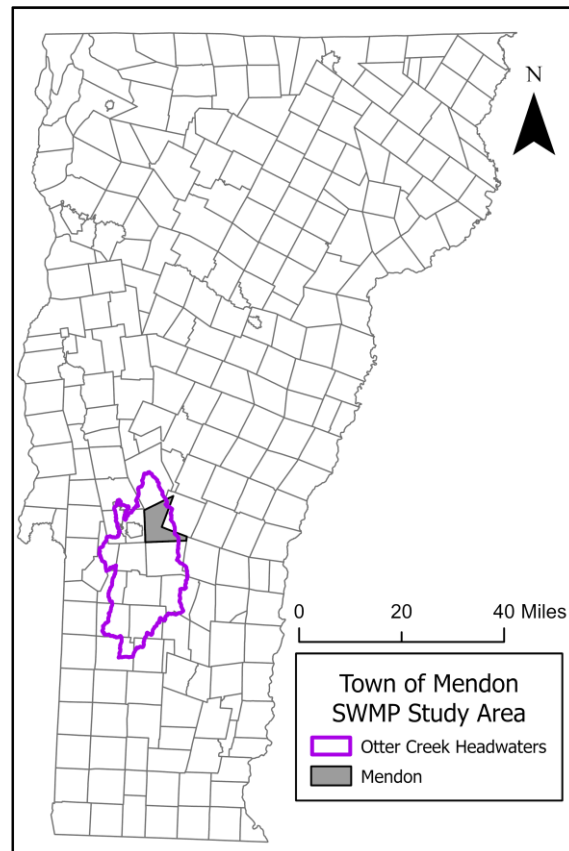
The purpose of this planning effort is to better manage stormwater runoff to reduce sediment and nutrient pollution to the Otter Creek watershed, improve flood resiliency, and reduce the Town's maintenance burden at chronic problem areas. The primary objectives of this SWMP are to:

- Identify opportunities to incorporate stormwater treatment and/or outfall stabilization at the outfalls of existing closed stormwater conveyance systems.
- Identify opportunities to incorporate green stormwater infrastructure within the Route 4 corridor.
- Identify opportunities to improve stormwater management in areas with active erosion and/or poor conveyances.

Project prioritization followed the Unified Scoring Metrics developed by VTDEC (2023) and Non-Unified Scoring Metrics (**Section 4.4**). Conceptual design plans (30% and 10% designs) were prepared for 5 high-priority projects. Phosphorus loading and removal estimates were provided for each project to assist the Town with project implementation prioritization for meeting water quality goals.

## 2.0 Study Area Description

Mendon is a 38.1 square mile town located in Rutland County (**Figure 1**). As of the 2020 census, Mendon has a total population of 1,149 people (U.S. Census Bureau, 2020). The Town's area is primarily forested and is 3.4% developed (**Table 1**). Mendon is bordered by 5 Vermont towns (Chittenden, Killington, Shrewsbury, Clarendon, and Rutland). Most of the roads in Mendon are municipal and private, with 12.4% of the Town's road length on US Route 4 (**Table 2**). The Town of Mendon lies within the Otter Creek Watershed.



**Figure 1:** Town of Mendon and Associated Watershed Location Map





**Table 1:** Land cover in Mendon (Dewitz and U.S Geological Survey 2021)

| Landcover/Landuse Type | Percent of Town Area |
|------------------------|----------------------|
| Agriculture            | 1.0%                 |
| Barren                 | 0.2%                 |
| Developed              | 3.4%                 |
| Forest                 | 92.5%                |
| Grassland/Herbaceous   | 0.2%                 |
| Open Water             | 0.1%                 |
| Shrub/Scrub            | 0.3%                 |
| Wetland                | 2.3%                 |

**Table 2:** Road length by AOT Class in Mendon (Enhanced 911 Board, 2022)

| AOT Class | Description             | Length (miles) | Percent of Town Road Length<br>(excluding discontinued) |
|-----------|-------------------------|----------------|---------------------------------------------------------|
| 1         | Class 1 Town Highway    | -              | -                                                       |
| 2         | Class 2 Town Highway    | 4.23           | 8.9%                                                    |
| 3         | Class 3 Town Highway    | 17.1           | 35.8%                                                   |
| 4         | Class 4 Town Highway    | 3.14           | 6.6%                                                    |
| 5         | State Forest Highway    | 2.1            | 4.4%                                                    |
| 6         | National Forest Highway | -              | -                                                       |
| 7         | Legal Trail             | 5.48           | 11.5%                                                   |
| 8 & 9     | Private Road            | 9.77           | 20.5%                                                   |
| 30        | Vermont State Highway   | -              | -                                                       |
| 40        | US Highway              | 5.91           | 12.4%                                                   |
| Other     | -                       | -              | -                                                       |
| 96        | Discontinued Road       | 0.16           | -                                                       |



Soil mapping for the Town shows that soils are primarily mapped as C-type (somewhat poorly drained). Most of the lower-elevation western edge of the Town is mapped as A-type soils (well drained) (**Table 3**).

**Table 3:** Summary of town-wide soil drainage (VCGI, 2022).

| Soil Hydrogroup | Area (acres) | Percent of Town Area |
|-----------------|--------------|----------------------|
| A               | 3,159        | 13.0%                |
| B               | 4,612        | 19.0%                |
| C               | 12,221       | 50.2%                |
| D               | 4,299        | 17.7%                |
| Water           | 34           | 0.1%                 |

### 3.0 Stormwater Management Planning Library

#### 3.1 Mapping Data

##### VTDEC Municipal Roads Program

A Road Erosion Inventory (REI) for the Town of Mendon was conducted by the Rutland Regional Planning Commission (RRPC) in 2017. The REI was developed for municipalities to fulfill requirements of the VTDEC Municipal Roads General Permit (MRGP). In this inventory, roads are divided into 100-meter (328 ft) segments with unique identification numbers. The segments deemed hydrologically connected to surface waters (rivers, lakes, wetlands, etc.) are assessed in the field and given a road erosion score. This score is determined from characteristics of the roadway and of the stormwater drainage features associated with it (crown, berm, ditch, conveyance stability, culverts, etc). Each segment is classified as “Fully Meets”, “Partially Meets”, or “Does Not Meet”, to reflect the current level of conformance with the MRGP standards. Of the 361 hydrologically connected segments inventoried in Mendon, 9 (2.5%) did not meet MRGP standards and 52 (14.4%) partially met MRGP standards ([link](#)). Roads in the Town with segments that did not meet or partially met MRGP standards included Wheelerville Road, Notch Road, and Orchard Road, among others. The MRGP specifies a timeline for bringing all road segments up to standards. High priority segments identified in the REI are potentially important opportunities to reduce erosion and sediment loading to receiving waters.

##### Light Detection and Ranging (LiDAR)

LiDAR returns for Mendon were collected in a series of flights conducted during 2013 as part of the VT LiDAR Initiative. These data meet the National Digital Elevation Program Quality Level 2 specifications for accuracy satisfactory for generation of a 0.7-meter Digital Elevation Model (DEM) and 1-foot contours. Derivations of LiDAR data, such as Digital Elevation Models (DEMs), terrain models, and contours are useful tools for stormwater feature identification and site design. The 0.7-meter DEM can assist in culvert watershed delineation and the design of stormwater management projects. Terrain models can assist in remote identification of erosion features, such as stormwater gullies.



### Municipal Bridge and Culvert Data

Culvert and bridge data collected by the RRPC for Town roads in Mendon are available online (<https://vtculverts.org/>). The dataset includes the structure dimensions and overall conditions but does not include the presence/absence of erosion. While most culverts were rated as good or excellent, 12% were rated as fair and 9% were rated as poor. The culvert data were reviewed to refine the selection of non-stream culverts focused on during field surveys.

### Town of Mendon Stormwater Infrastructure Mapping Project

This dataset was produced by the Vermont Agency of Natural Resources (VTANR) in 2021. The Stormwater Mapping Project documents the connectivity of stormwater infrastructure on private and public land within the Town of Mendon. The data show the paths of stormwater from different areas of impervious surface. The associated report identifies three high priority sites for improvement, and points to another five sites of moderate priority. Four potential retrofit projects were identified in this study.

### Natural Resources Conservation Service (NRCS) Soils Survey

The NRCS soils survey dataset is valuable for stormwater master planning ([websoilsurvey.sc.egov.usda.gov](https://websoilsurvey.sc.egov.usda.gov)). As part of our initial scoping, we screened problem areas based on the NRCS hydrologic soil groupings (HSG). The HSGs indicate the infiltration potential of the native soil type, which is useful for identifying areas of excessive runoff potential (e.g., HSG D-type) or good infiltration (e.g., HSG A-type) where stormwater infiltration practices should be explored.

### Flood Hazard Mapping

The FEMA DFIRM flood hazard dataset categorizes areas based on flooding potential. This dataset informed planning based on areas where high flow volumes will occur during major storm events. This dataset was also used to inform BMP designs and location. BMPs proposed for locations upgradient of areas that are at high risk of flooding may have the potential to reduce downstream flooding and erosion issues. Prioritization of sites was informed by flood hazard potentials to mitigate flood damage within the Village center.

### River Corridor Mapping

River corridor maps were produced by the Vermont Agency of Natural Resources. These data display both the river channel and the active corridor through which a river can be expected to meander over time. This mapping can inform stormwater mitigation efforts by indicating where rivers and streams might flow during flood events. This dataset also identifies areas where the river channel has been altered or confined. These problem areas are often prone to erosion and flooding.



### **3.2 Watershed Planning**

#### Otter Creek Tactical Basin Plan

The Tactical Basin Plan for Otter Creek was prepared by the Vermont Department of Environmental Conservation Watershed Management Division in December 2019. The Basin includes the Otter Creek, Little Otter Creek, and Lewis Creek watersheds. The Basin Plan catalogs current surface water quality conditions, stressors, and recommended actions for water quality restoration.

Within this Tactical Basin, Mendon is in the Otter Creek watershed, which drains 936 square miles. Near Mendon, the watershed is threatened by physical alterations and insufficient flow due to snowmaking withdrawals from Pico Mountain Ski Resort. The Tactical Basin Plan focuses on several potential projects for the Otter Creek Watershed. Those of relevance to Mendon include implementing high priority projects recommended in the Moon Brook River Corridor Plan and mapping and assessing forest access road networks on state lands.

#### Tenney Brook Watershed Stormwater Report

This report was prepared by the VTANR in 2021. The report includes water quality and macroinvertebrate data from the Tenney Brook Watershed and proposes potential stormwater projects to improve water quality in Mendon and Rutland. The report identifies 9 high priority sites for improvement and points to another fifteen sites of moderate priority. Twelve potential retrofit projects were identified in the report.





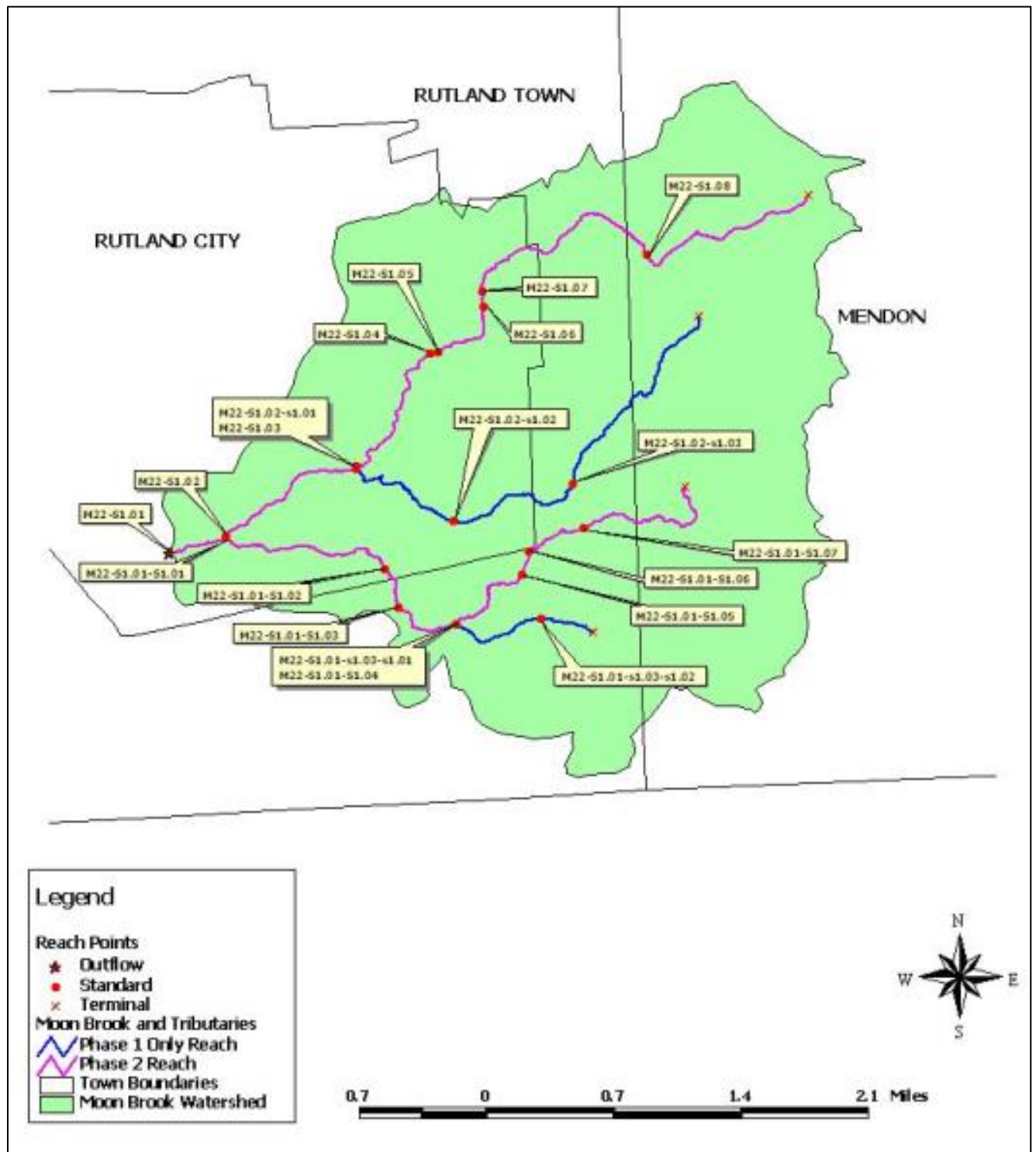
### Moon Brook Watershed River Corridor Plan

The River Corridor Plan for the Moon Brook Watershed was prepared by Bear Creek Environmental for the Rutland Natural Resource Conservation District in March 2008. The associated Phase 2 Stream Geomorphic Assessment (SGA) of selected reaches of the Moon Brook Watershed identified active erosion and incision as issues in Mendon. General information about each reach is summarized in **Table 4**. The locations of these reaches are shown in **Figure 2**. Potential projects identified in these reaches include river corridor protection, improving riparian buffers, and arresting headcuts.

**Table 4:** Summary of Phase 2 Reaches in Mendon

| Stream       | Reach            | Existing Stream Type | Geomorphic Condition |
|--------------|------------------|----------------------|----------------------|
| Moon Brook   | M22-S1.07        | -                    | Fair                 |
|              | M22-S1.08A       | E                    | Fair                 |
|              | M22-S1.08B       | A                    | Good                 |
| Mussey Brook | M22-S1.01-S1.07A | F                    | Fair                 |
|              | M22-S1.01-S1.07B | A                    | Good                 |
|              | M22-S1.01-S1.07C | C                    | Fair                 |





**Figure 2:** Map of Phase 2 Reaches in Mendon (Bear Creek Environmental)



### **3.3 Town Planning and Permitting**

#### Mendon Town Plan

The Mendon Town Plan was adopted by the Town in March 2022 and was prepared by the Mendon Planning Commission with assistance from RRPC. Some of the goals of the plan are to, “preserve the present natural environment, character, rural appearance, and atmosphere of the town” and to, “preserve the existing high scenic quality of Mendon’s gateway, natural, scenic, and historical areas”. Mendon does not have a municipal water supply but has a sewer connection to Rutland City’s treatment plant along the US Route 4 corridor. The Town is susceptible to flooding and FEMA flood hazard mapping helped to inform SWMP project selection to address flood risk and minimize damage.

#### Town of Mendon Vermont Local Hazard Mitigation Plan

This document was prepared by the Mendon Hazard Mitigation Committee with assistance from the RRPC and adopted in March 2017. The purpose of this plan is to identify natural hazards that are more likely to occur, assess their impacts on the community, and generate a list of strategies and actions to reduce the impacts. Of the hazards assessed, flooding/fluviol erosion was found to be one of the hazards to which Mendon is most susceptible. High priority actions and mitigation strategies associated with flooding/fluviol erosion include stabilizing the banks of Mendon Brook and elevating Wheelerville Road.

#### Mendon Zoning Bylaws

This document was completed and implemented by the Mendon Planning Commission in 2010. It contains provisions to promote the development of the Town in a way that minimizes potential damages from future flood events and minimize water quality impacts. It limits development in river corridors, and wetlands. These guidelines helped to inform site selection for the SWMP. Development of BMPs in safer areas was prioritized over those in flood-prone areas.

### **3.4 Data Gaps**

The data sources and information describing stormwater and watershed management in the Town of Mendon are incomplete. Limited stormwater infrastructure mapping has been conducted and there is limited watershed planning information available.

### **4.0 Stormwater Problem Areas**

One of the primary objectives of this SWMP is to "develop a comprehensive list of stormwater problems" within the Town of Mendon. FEA staff made several field visits to the project area and hosted meetings with the Town to identify existing problem areas, evaluate and prioritize sites, and recommend potential solutions.



#### 4.1 Identification of Problem Areas

The initial round of problem area identification began with the identification of stormwater related projects using a desktop exercise scanning the watershed with aerial imagery, NRCS soils data, Town stormwater infrastructure mapping, contour data, and road erosion inventory results in GIS. Potential project areas were identified and mapped for review during site visits. A total of 19 stormwater problem areas were identified and assessed in the field (see map in Appendix A and table in Appendix B). We grouped the problem areas into five project categories described below.

- **Green Stormwater Infrastructure (GSI) Installation/Retrofit (8)** – Opportunity to reduce sediment and nutrient loads through the installation of a new stormwater best management practice (BMP). Also includes sites where nutrient and sediment reductions could be improved through the retrofit of existing stormwater BMPs .
- **Road Erosion Mitigation (8)** – Areas of high sediment and nutrient loading due to road, embankment, and ditch erosion.
- **Stream Restoration (1)** – Problem areas where stream bank or bed erosion is a significant nutrient and sediment source.
- **Culvert Replacement (1)** – Problem areas where undersized or failing culverts are exacerbating erosion issues.
- **Other (1)** – Areas that do not fall into one of the project categories described above. The project in this category is a road drainage improvement project.

#### 4.2 Evaluation and Prioritization of Problem Areas

Eight (8) GSI projects are described in the Unified Prioritization Project Table (Appendix B) where projects are prioritized based on the potential for each project to improve water quality and reduce environmental impact, project feasibility, and co-benefits. Estimated project cost and the phosphorus removal efficiency (\$/lb of P) were included. We followed the methods described in the “Unified Scoring Prioritization for Stormwater Master Plans” document developed by VTDEC (2023). These methods include a total of 19 criteria divided into 3 categories. The final score is expressed as a percentage of the maximum score (50 points). The final project scores ranged from 32% to 68%. Additional information about the unified prioritization methods can be found in **Section 4.3** and **Table 5**.

The 11 non-GSI projects described in the Non-Unified Prioritization Project Table (Appendix B) were assigned several numerical scoring metrics that were 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 and the individual site scores ranged from 13 to 20. Additional information about the non-unified prioritization methods can be found in **Section 4.4**.



### GIS-Based Site Screening

Using the field data points collected with sub-meter GPS during our watershed tours, we evaluated key characteristics for each site indicating the potential for increased stormwater runoff and pollutant loading, among several other factors described below. These GIS-based observations, along with field-based observations of site characteristics, are summarized in the project prioritization table (Appendix B).

The following geospatial data were reviewed and evaluated as part of the GIS-based screening:

- **Subwatershed Mapping** – The contributing drainage area to each problem area was mapped based on field observations and 1-foot contours derived from the 0.7-meter 2013 LiDAR elevation surface.
- **Aerial Photography** – We used the 0.6 m imagery collected in 2021 to review the site land cover characteristics (i.e., forest, grass, impervious).
- **Impervious Surfaces Data** – We used the 2016 statewide high-resolution impervious surfaces data layer developed by the UVM Spatial Analysis Lab.
- **Stormwater Infrastructure** – We used the Stormwater Infrastructure Mapping Project data collected in 2021 with detailed mapping of stormwater infrastructure throughout the Town.
- **NRCS Soils** – We used the VT Soils data to evaluate the inherent runoff and erosion potential of native soil types (i.e., hydrologic soil group, erodible land class). For project sites with potential for green stormwater infrastructure (GSI), we assessed the general runoff characteristics of the drainage area based on hydrologic soil group (HSG).
- **Parcel Data** – We used the parcel data available through VCGI to scope the limits of potential projects based on approximate parcel boundaries and road right-of-way.
- **VTDEC Hydrologically Collected Road Segment Data** – We used a statewide inventory of road erosion risk and hydrologic connectivity of road segments to prioritize areas of potential sediment loading to visit for field surveys.

### **4.3 Unified Matrix Evaluation and Prioritization of Problem Areas**

The 8 GSI projects described in the Unified Prioritization Project Table (Appendix B) were prioritized using the methods described in **Table 5**. Methods for determining project costs are described on page 13. Estimated project cost and the phosphorus removal efficiency (\$/lb of P) were included. We followed the Unified Scoring Prioritization for Stormwater Master Plans document developed by VTDEC, with an adjustment to the phosphorus loading and phosphorus reduction criteria (VTDEC, 2018). This method includes a total of 19 criteria divided into 3 categories. The final score is expressed as a percent of the total score, with slightly different criteria applied to road drainage projects.



**Table 5:** Unified prioritization scoring for Stormwater Master Plans, developed by VTDEC (2023).

| Criteria                                                                                  | Proposed Weight                                                                                                                                                                                                                                                   | Max points |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Water Quality/Environmental impact</b>                                                 |                                                                                                                                                                                                                                                                   |            |
| 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 <a href="#">STP Calculator</a> )                     | 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 |                                                                                                                                                                                                                                                                   |            |
| <b>Total Water Quality Score (out of 21, or 15 if road project)</b>                       |                                                                                                                                                                                                                                                                   |            |
| <b>Feasibility Criteria</b>                                                               |                                                                                                                                                                                                                                                                   |            |
| 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          |
| <b>Total Feasibility Score (out of 20)</b>                                                |                                                                                                                                                                                                                                                                   |            |
| <b>Other considerations/Co-benefits (0=doesn't address concern, 1=addresses concern)</b>  |                                                                                                                                                                                                                                                                   |            |
| 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          |
| <b>Total Co-benefits Score (out of 9)</b>                                                 |                                                                                                                                                                                                                                                                   |            |
| <b>Overall Score (out of 50 or 44)</b>                                                    |                                                                                                                                                                                                                                                                   |            |





### Phosphorus Loads from Sediment

Land cover-based phosphorus loading estimates account for generalized assumptions of sediment mobilization; however, we believe that phosphorus loading from active erosion areas may be underestimated for some of the stormwater problem areas. Other project types such as stream bank restoration or gully stabilization do not fit into the VTDEC Unified Scoring framework. We followed the VTDEC Standard Operating Procedure (SOP) for tracking and accounting of phosphorus associated with the Municipal Roads General Permit (MRGP) to estimate phosphorus loading and reduction associated with road improvements and erosion stabilization (VTDEC 2020).

For estimating the overall phosphorus loading and phosphorus reduction associated with excess sediment mobilization and stabilization, we used methods and loading rates established for the stabilization of roadside gully erosion in the VTDEC SOP. We estimate annual soil loss (in cubic feet) based on our best professional estimate of the age and volume of erosion features. We apply a  $43.38 \text{ kg/ft}^3$  sediment bulk density to volume of erosion and  $0.000396 \text{ kg (P)/ kg sediment (TSS)}$ , the equivalent of an annual loading rate of  $0.017 \text{ kg (P)/ft}^3$  and  $0.037 \text{ kg (P)/ft}^3$  (VTDEC 2020).

### BMP Unit Costs and Adjustment Factors

BMP unit costs (Table 6) and adjustment factors (Table 7) were derived from research completed by the Charles River Watershed Association and the Center for Watershed Protection (EPA, 2016), as well as updates based on actual construction costs in Vermont compiled by FEA and other consultants. The unit cost estimates include a 28% total inflation adjustment for 2017-2023 based on the Consumer Price Indicator Inflation Calculator. Unit construction costs for road drainage projects were based on the estimates provided in the Road Erosion Site Prioritization and Remediation Project Summary (Fitzgerald Environmental Associates and Milone and MacBroom, Inc., 2017). Additional multipliers for site type (Table 7) and level of permitting and engineering required (Table 8) are also shown below.



**Table 6: BMP Unit Costs (\$)**

| <b>BMP Type</b>               | <b>Cost/ft<sup>3</sup> Treatment Volume</b> |
|-------------------------------|---------------------------------------------|
| Constructed Wetland           | \$11.26                                     |
| Dry Pond                      | \$5.77                                      |
| Grass Conveyance Swale        | \$5.13                                      |
| Rain Garden (no underdrain)   | \$19.83                                     |
| Rain Garden (with underdrain) | \$19.83                                     |
| Subsurface Infiltration       | \$8.02                                      |
| Surface Infiltration          | \$8.00                                      |
| Wet Pond                      | \$8.72                                      |
| Swirl Separator (small)       | Lump Sum: \$20,000                          |
| Swirl Separator (medium)      | Lump Sum: \$40,000                          |
| Swirl Separator (large)       | Lump Sum: \$60,000                          |

**Table 7: Site Type Cost Adjustment**

| <b>Site Type</b>                    | <b>Cost Multiplier</b> |
|-------------------------------------|------------------------|
| Existing BMP retrofit               | 0.25                   |
| Complicated retrofit                | 0.75                   |
| New BMP in undeveloped area         | 1.00                   |
| New BMP in partially developed area | 1.50                   |
| New BMP in developed area           | 2.00                   |

**Table 8: Permitting and Engineer (P&E) Cost Adjustment**

| <b>Level of P&amp;E Required</b> | <b>Cost Multiplier</b> |
|----------------------------------|------------------------|
| None                             | 1.00                   |
| Low                              | 1.20                   |
| Moderate                         | 1.25                   |
| High                             | 1.35                   |



#### 4.4 Non-Unified Evaluation and Prioritization of Problem Areas

The 11 non-GSI projects described in the Non-Unified Prioritization Project Table (Appendix B) were prioritized using the methods described below.

- **Water Quality Benefits (15 points total)**
  - **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. 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 Lakeshore Natural Communities** – Project implementation will promote a native vegetated lakeshore buffer and/or provide wildlife habitat along the lakeshore



#### 4.5 Conceptual Designs

FEA hosted a meeting with the Town in April 2024 to discuss project prioritization and selection of 5 projects for conceptual design development. Five (5) projects were selected at this meeting for concept designs. FEA and SLR developed four 30% conceptual designs and one 10% conceptual design along with preliminary cost estimates. Concept designs include:

- A site plan with contours, existing stormwater infrastructure, and proposed design elements
- Where relevant, hydrologic and hydraulic modeling data of the contributing drainage area and proposed BMP sizing and design specifications
- Typical details for proposed practices
- A preliminary cost opinion (not included in 10% designs)

The projects selected for conceptual design were:

1. **Project MEN-03 – Mendon Recreation Area (30%)**

**Problems Identified:** A gravel parking lot drains to the paved road.

**Proposed Best Management Practices:** Infiltration Basin with Vegetated Forebay

**Estimated Cost Effectiveness:** \$90,000-\$110,000/kg P/year

2. **Project MEN-09 – Town Land North of Stoney Meadow Lane (30%)**

**Problems Identified:** There is fine sediment deposition into the wetland with a steep ditch above getting runoff from a commercial property and from Route 4.

**Proposed Best Management Practices:** Wet Pond with Level Spreader Outlet

**Estimated Cost Effectiveness:** \$20,000-\$25,000/kg P/year

3. **Project MEN-10 – Mendon Town Offices (30%)**

**Problems Identified:** A skinny ditch along the west side accepts a lot of slope runoff and impervious runoff. There is additional erosion down the very steep north side of the driveway.

**Proposed Best Management Practices:** Grassed Swale and two (2) Infiltration Basins

**Estimated Cost Effectiveness:** \$80,000-\$90,000/kg P/year

4. **Project MEN-11 – US Route 4 South of Meadow Lake Drive (10%)**

**Problems Identified:** A long grassed ditch leads to a cross culvert. Sediment is mobilized from the gravel road to the church.

**Proposed Best Management Practices:** Bioretention Swale and Grassed Sediment Forebay

**Estimated Cost Effectiveness:** \$10,000-\$15,000/kg P/year



#### 5. **Project MEN-12 – Intersection of Sherwood Drive and Helvi Hill Road (30%)**

**Problems Identified:** Large volumes of sediment and runoff are coming down the steep section of Helvi Hill Road with no ditches. Runoff is crossing the road and filling in the ditch along the east side of Sherwood Drive. Some driveways do not have culverts.

**Proposed Best Management Practices:** Two (2) Infiltration Basins with Level Spreader Outlets

**Estimated Cost Effectiveness:** \$150,000-\$175,000/kg P/year

### 5.0 **Next Steps**

This Stormwater Master Plan represents an extensive effort to identify, describe, and evaluate stormwater issues affecting water quality and localized flooding in the Town of Mendon. For each project recommendation, we provided a preliminary cost estimate and nutrient/sediment treatment estimates to town representatives to assist with planning and prioritizing project implementation. The problem area descriptions for town roads (e.g., roadside ditches) will aid the Town Highway Department in proactively stabilizing and maintaining these features to avoid future stormwater problems, and to come into compliance with the VTANR Municipal Roads General Permit.

We recommend that the Town work with VTDEC and other partners to secure funding for the high priority projects described in Appendices B and C. Landowner outreach should be completed for all projects that are not on Town land or right-of-way. The BMP installation/retrofit opportunities identified in the Unified Prioritization Matrix represent a potential phosphorus load reduction of approximately 37 lb/year. Based on our review and preliminary designs and our experience with previous SWMP efforts, we feel that the projects listed in Appendix C should be considered for further development and implementation.



## 6.0 References

- Bear Creek Environmental, 2008. River Corridor Plan: Moon Brook Watershed.
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- Clean Water Initiative Program, Watershed Management Division, Vermont Department of Environmental Conservation, 2017. Town of Mendon Stormwater Infrastructure Mapping Project
- Dewitz, J., and U.S. Geological Survey, 2021. National Land Cover Database (NLCD) Products (ver. 2.0, June 2021)
- Environmental Protection Agency (EPA), 2016. Methodology for developing cost estimates for Opti-Tool.
- Enhanced 911 Board, 2022. VT Data – E911 Road Centerlines.
- Fitzgerald Environmental Associates (FEA) and Milone and MacBroom (MMI). 2017. Road Erosion Site Prioritization and Remediation Project Summary. Memo prepared for the Chittenden County Regional Planning Commission. Dated December 27, 2017.
- Mendon Hazard Mitigation Committee, 2017. Town of Mendon Vermont Local Hazard Mitigation Plan.
- Mendon Planning Commission, 2022. Mendon Town Plan.
- Mendon Planning Commission, 2010. Town of Mendon Zoning Regulations.
- U.S. Census Bureau, 2020. 2020 United States Census.
- Vermont Center for Geographic Information (VCGI), 2022. VT Data – NRCS Soil Survey Units.
- Vermont Department of Environmental Conservation, 2023. Unified Scoring Prioritization for Stormwater Master Plans (SWMPs).
- Watershed Consulting Associates, LLC. 2018. Stormwater Master Plan for the Town of Berlin, Vermont. Prepared for the Central Vermont Regional Planning Commission. Final Report, January 17, 2018.
- Watershed Management Division, Vermont Agency of Natural Resources, December 2019. Otter Creek Tactical Basin Plan.





## **APPENDIX A**

### **Project Location Map (24"x36")**







# **Appendix B**

## **Project Prioritization Summary Tables**

### **Unified and Non-Unified**

### **(11"x17"& 8.5"x 11")**



Stormwater Master Plan - Town of Mendon  
Unified Prioritization Project Table  
March 28, 2025

| Project ID | Project Type | Location                                            | Description                                                                                                                                                                                                                                 | Preliminary Recommendations                                                                                                                                                                                                                          | Total Acreage | Impervious Acreage | % Impervious | P Load (lb/yr) | WQv (cf) | BMP Type             | BMP Volume (cf) | BMP P Reduction (lb/yr) | Erosion P Reduction (lb/yr) | Total P Reduction (lb/yr) | Gully Mitigation | Landowner | Project/ Permitting Complexity | Infrastructure Conflicts | Total Cost | Project Efficiency \$/lb | Ease of O&M | Co-Benefits Sum | Total Score | Possible | Final Score % |
|------------|--------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------|--------------|----------------|----------|----------------------|-----------------|-------------------------|-----------------------------|---------------------------|------------------|-----------|--------------------------------|--------------------------|------------|--------------------------|-------------|-----------------|-------------|----------|---------------|
| MEN_12     | GSI          | Intersection of Sherwood Drive and Helvi Hill Road  | Large volumes of sediment and runoff are coming down the steep section of Helvi Hill Road with no ditches. Runoff is crossing the road and filling in the ditch along the east side of Sherwood Drive. Some driveways do not have culverts. | There is room for a feature in the area starting around the mailboxes, or in the next area to the south. Install driveway culverts and potentially a cross-culvert at the base of Helvi Hill Road.                                                   | 8.22          | 0.22               | 3%           | 5.70           | 2,227    | Surface Infiltration | 600             | 3.94                    | 2.22                        | 6.16                      | 1                | 3         | 2                              | 1                        | \$ 16,600  | \$ 2,696                 | 2           | 3               | 34          | 50       | 68%           |
| MEN_10     | GSI          | US Route 4 - Mendon Town Offices                    | A skinny ditch along the west side accepts a lot of slope runoff and impervious runoff. There is additional erosion down the very steep north side of the driveway.                                                                         | There is room for a small basin near the cross-culvert inlet.                                                                                                                                                                                        | 11.47         | 0.47               | 4%           | 8.25           | 3,615    | Surface Infiltration | 700             | 5.17                    | 0.22                        | 5.39                      | 0                | 3         | 2                              | 1                        | \$ 15,100  | \$ 2,800                 | 2           | 2               | 30          | 50       | 60%           |
| MEN_11     | GSI          | US Route 4                                          | A long grassed ditch leads to a cross culvert. Sediment is mobilized from the gravel road to the church.                                                                                                                                    | There is room for an enhanced swale with sediment traps in the grassed area along the ROW.                                                                                                                                                           | 10.29         | 1.30               | 13%          | 9.06           | 6,115    | Infiltrating Swale   | 3,670           | 7.96                    | 0.00                        | 7.96                      | 0                | 0         | 2                              | 1                        | \$ 28,200  | \$ 3,541                 | 2           | 2               | 27          | 50       | 54%           |
| MEN_09     | GSI          | US Route 4                                          | There is fine sediment deposition into the wetland with a steep ditch above getting runoff from a commercial property and from Route 4.                                                                                                     | Install an inlet structure at the top of the steep slope to collect water from the existing swale. Direct WQv into a wet pond on the adjacent town-owned parcel. Stabilize existing erosion in the swale.                                            | 21.82         | 3.53               | 16%          | 20.68          | 15,484   | Wet Pond             | 18,470          | 9.55                    | 4.44                        | 13.99                     | 2                | 0         | 2                              | 1                        | \$ 206,300 | \$ 14,748                | 1           | 1               | 25          | 50       | 50%           |
| MEN_03     | GSI          | South Mendon Road - Mendon Recreation Area          | A gravel parking lot drains to the paved road.                                                                                                                                                                                              | The green space at the downhill side of the parking lot could be used to treat runoff. An infiltration feature or small pond could fit in this space.                                                                                                | 0.49          | 0.37               | 76%          | 1.01           | 1,301    | Surface Infiltration | 1,300           | 1.01                    | 0.00                        | 1.01                      | 0                | 3         | 2                              | 1                        | \$ 14,500  | \$ 14,328                | 2           | 2               | 22          | 50       | 44%           |
| MEN_04     | GSI          | US Route 4 and Esquiline Hill - Private Parking Lot | A large private gravel parking lot drains to a culvert.                                                                                                                                                                                     | Install an infiltrating swale along the edge of the parking lot parallel to Route 4.                                                                                                                                                                 | 0.65          | 0.42               | 64%          | 1.21           | 1,485    | Infiltrating Swale   | 1,490           | 1.19                    | 0.00                        | 1.19                      | 0                | 0         | 2                              | 1                        | \$ 11,500  | \$ 9,680                 | 2           | 2               | 22          | 50       | 44%           |
| MEN_05     | GSI          | Park Lane - Mendon Town Garage                      | The Mendon town garage has parking and buildings that drain untreated stormwater.                                                                                                                                                           | Install a small infiltration feature on the north side of the parcel to treat the parking lot and building runoff.                                                                                                                                   | 0.62          | 0.31               | 50%          | 0.99           | 1,121    | Surface Infiltration | 1,120           | 0.95                    | 0.00                        | 0.95                      | 0                | 3         | 2                              | 1                        | \$ 18,100  | \$ 19,133                | 2           | 1               | 18          | 50       | 36%           |
| MEN_13     | GSI          | Deer Run                                            | There is a long section of road with no ditch on the east side with grader berms. There is sediment accumulation and some erosion at the dry hydrant access.                                                                                | Install a vegetated basin near the south end where the area is already partially cleared. Basin will likely require an underdrain due to high water table next to the pond. Install a culvert under the dry hydrant access and a more defined ditch. | 1.50          | 0.37               | 25%          | 0.88           | 1,487    | Infiltrating Swale   | 200             | 0.29                    | 0.19                        | 0.47                      | 0                | 0         | 0                              | 1                        | \$ 6,100   | \$ 12,951                | 2           | 1               | 16          | 50       | 32%           |

Stormwater Master Plan - Town of Mendon  
Non-Unified Prioritization Project Table  
March 28, 2025

|                           | CPA                  | SF                | E           | IC                       | SW                                            | BMP                               | HV              | TH                        | PF                  | L                                     |
|---------------------------|----------------------|-------------------|-------------|--------------------------|-----------------------------------------------|-----------------------------------|-----------------|---------------------------|---------------------|---------------------------------------|
| Additional Benefits Codes | Chronic Problem Area | Seasonal Flooding | Educational | Infrastructure Conflicts | Drains to Connected Stormwater Infrastructure | Improves Existing BMP Performance | High Visibility | Reduces Thermal Pollution | Peak Flow Reduction | Enhance Lakeshore Natural Communities |

| Water Quality Benefits |              |                                                  |                                                                                                                                                                                                           |                                                                                                                                                               |                    |                    |               |                     |                                |                   |                  |                           |                     |                           |             |
|------------------------|--------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|---------------|---------------------|--------------------------------|-------------------|------------------|---------------------------|---------------------|---------------------------|-------------|
| Project ID             | Project Type | Location                                         | Description                                                                                                                                                                                               | Preliminary Recommendations                                                                                                                                   | Nutrient Reduction | Sediment Reduction | Drainage Area | Impervious Drainage | Connectivity to Surface Waters | Landowner Support | O&M Requirements | Cost and Constructability | Additional Benefits | Additional Benefits Score | Total Score |
| MEN_07                 | Road Erosion | Journeys End Road                                | An eroding ditch flows directly into the stream, there is no turnout.                                                                                                                                     | Install a turnout before the ditch reaches the stream. Stabilize the existing ditch with stone.                                                               | 2                  | 2                  | 1             | 3                   | 3                              | 1                 | 1                | 6                         | CPA                 | 1                         | 20          |
| MEN_06                 | Road Erosion | Intersection of Old Turnpike Road and Ridge Road | The steep section of road at the intersection has erosion on the road surface and in the ditch. The two turnouts on the south side are filled in with sediment. The cross culvert is too small.           | Stabilize the ditches and resurface the road. Replace the cross culvert with a 24" pipe and improve turnouts.                                                 | 3                  | 3                  | 1             | 1                   | 2                              | 1                 | 2                | 4                         | CPA                 | 1                         | 18          |
| MEN_14                 | Road Erosion | Old Turnpike Road                                | A long ditch on the south side with lots of flow drains directly to a wetland.                                                                                                                            | Install a turnout approximately 200' up slope, there is an old channel behind a berm that could be reconnected.                                               | 2                  | 1                  | 1             | 2                   | 2                              | 1                 | 1                | 6                         | CPA                 | 1                         | 17          |
| MEN_18                 | Road Erosion | Cream Hill Road                                  | The east side ditch is filled in with gully erosion. This is likely to damage the edge of the pavement.                                                                                                   | Clean out the ditch and stabilize it with stone.                                                                                                              | 2                  | 2                  | 1             | 0                   | 1                              | 1                 | 2                | 6                         | CPA, IC             | 2                         | 17          |
| MEN_01                 | Culvert      | Wheelerville Road                                | An old tank culvert is eroding at the inlet and outlet.                                                                                                                                                   | Replace the culvert and add stone headers. Stabilize upstream and downstream as needed.                                                                       | 1                  | 1                  | 1             | 0                   | 3                              | 1                 | 1                | 4                         | CPA, IC, SW         | 3                         | 15          |
| MEN_08                 | Stream       | US Route 4 - Mendon Brook                        | Multiple large mass failures have formed on the far side of Mendon Brook.                                                                                                                                 | Stabilize the mass failures with stone or bioengineering.                                                                                                     | 4                  | 4                  | 1             | 0                   | 3                              | 0                 | 0                | 1                         | CPA, HV             | 2                         | 15          |
| MEN_19                 | Other        | Brookwood - Commercial Flower Farm               | A field is flooding from road drainage.                                                                                                                                                                   | Install a curtain drain to collect runoff from the road to discharge in the ditch behind the field.                                                           | 0                  | 0                  | 1             | 1                   | 2                              | 2                 | 2                | 5                         | CPA, SF             | 2                         | 15          |
| MEN_02                 | Road Erosion | Wheelerville Road-Hiking Trail Parking Area      | A large gravel parking lot drains to the unditched gravel road. Rill erosion has developed in the parking lot and in the road.                                                                            | Add a short stone-lined ditch and culvert/turnout to keep the parking lot runoff from flowing along the road and picking up more sediment.                    | 1                  | 2                  | 0             | 1                   | 1                              | 1                 | 1                | 4                         | CPA, HV, E          | 3                         | 14          |
| MEN_15                 | Road Erosion | Orchard Road                                     | A steep section of the road is eroding and there is no space to improve ditches.                                                                                                                          | Add turnouts along the road where possible.                                                                                                                   | 2                  | 2                  | 1             | 0                   | 1                              | 1                 | 1                | 5                         | CPA                 | 1                         | 14          |
| MEN_17                 | Road Erosion | Woodward Road                                    | There is minor rill erosion in both ditches on the inlet side of a stream culvert where the ditch empties onto the floodplain. Additional erosion is causing a hole to form on top of the inlet headwall. | Stabilize the eroding area along the headwall of the culvert. Enlarge and stabilize the ditches with stone through the steep sections down to the floodplain. | 1                  | 1                  | 0             | 0                   | 3                              | 1                 | 2                | 5                         | IC                  | 1                         | 14          |
| MEN_16                 | Road Erosion | Helvi Hill Road                                  | There is a fairly small drainage area down a very steep slope with recent tree clearing, starting to erode. The road drains onto a town-owned parcel along the stream.                                    | Stabilize the steep bank with stone and install a stabilized conveyance to transport road runoff down to the stream without further eroding the slope.        | 1                  | 1                  | 0             | 0                   | 3                              | 1                 | 2                | 4                         | CPA                 | 1                         | 13          |

## **APPENDIX C**

Conceptual Designs  
**(11"x17")**





Existing Conditions

- 1-ft Contours (LiDAR)
- Parcel Boundaries (VCGI)
- Drainage Area
- Parking Lot
- Trees
- Road

Proposed Features

- Infiltration Basin
- Vegetated Forebay
- Level Spreader

GRASS

Drainage Area: 0.52 acres  
79% Impervious  
WQv: 1,434 cu. ft.

GRAVEL

SWING SETS

BASKETBALL COURT

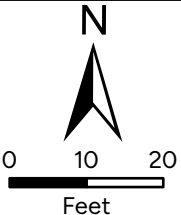
PLAYGROUND

GRAVEL PATH

STONE OUTLET TO ROAD

INFILTRATION BASIN  
(APPROX. 1,500 CU. FT.)

VEGETATED FORBAY  
(APPROX. 500 CU. FT.)



1 S MAIN ST  
WATERBURY, VT 05676  
802.882.8335

Conceptual Design - MEN\_03

Stormwater Master Plan - Town of Mendon  
Fitzgerald Environmental Associates, LLC  
Mendon Recreation Area  
266 Mendon Rd,  
Mendon, Vermont

1 INCH = 25 FEET  
SCALE

11/8/2024  
DATE

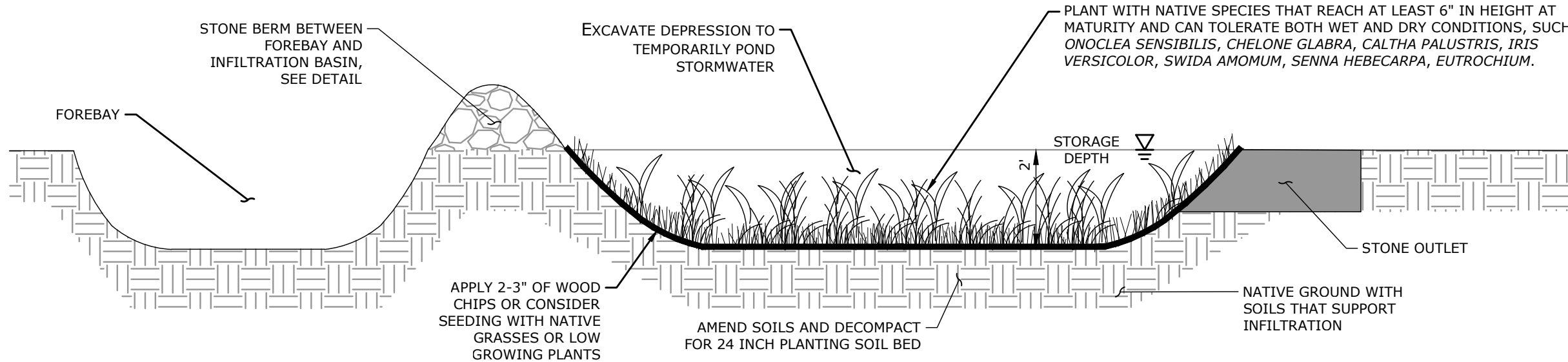
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PROJECT NO.

SHEET 1



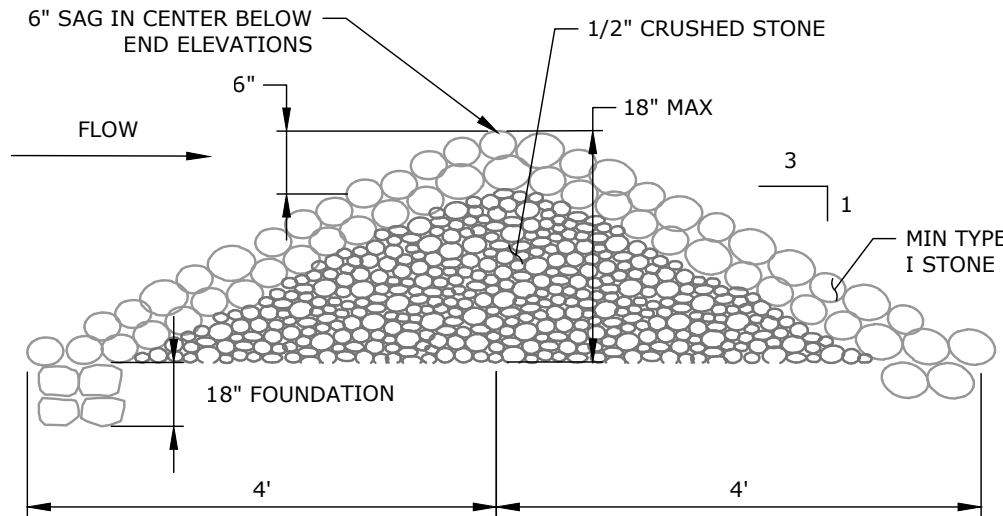
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Plotted by: JALING On this date: Thu, 2024 November 21 - 9:42am



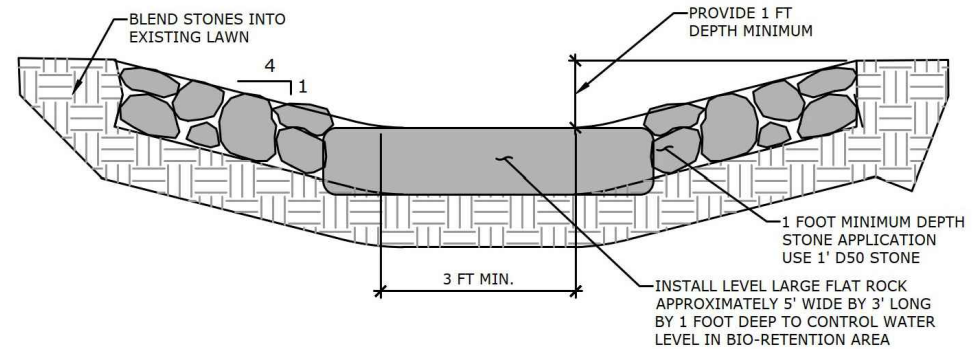
## INFILTRATION BASIN

NOT TO SCALE



## STONE BERM

NOT TO SCALE



## STONE OUTLET

NOT TO SCALE

### Preliminary Cost Opinion

| Item                        | Quantity | Unit | Unit Price | Cost      |
|-----------------------------|----------|------|------------|-----------|
| Mobilization/Demobilization | 1        | LS   | \$ 5,000   | \$ 5,000  |
| Common Excavation           | 250      | CY   | \$ 25      | \$ 6,250  |
| Trucking                    | 250      | CY   | \$ 20      | \$ 5,000  |
| Site Grading                | 1        | LS   | \$ 2,000   | \$ 2,000  |
| Parking Area Stone          | 100      | CY   | \$ 50      | \$ 5,000  |
| Stone Outlet                | 1        | EA   | \$ 1,000   | \$ 1,000  |
| Stone Berm                  | 5        | CY   | \$ 65      | \$ 325    |
| Wood Chip Mulch             | 15       | CY   | \$ 70      | \$ 1,050  |
| Topsoil                     | 20       | CY   | \$ 65      | \$ 1,300  |
| Plantings                   | 1        | LS   | \$ 2,000   | \$ 2,000  |
| Final Design & Permitting   |          |      |            | \$ 10,000 |
| Construction Oversight      |          |      |            | \$ 5,000  |
| Subtotal                    |          |      |            | \$ 43,925 |
| Contingency (20%)           |          |      |            | \$ 8,790  |
| Total                       |          |      |            | \$ 52,715 |

#### INSTALLATION NOTES:

- THE VERMONT STORMWATER MANAGEMENT MANUAL IS A GOOD EDUCATIONAL RESOURCE TO ACCOMPANY THIS PROJECT. ALTERNATIVES TO THE DETAILS PRESCRIBED IN THIS PLAN ARE AVAILABLE IN THAT MANUAL.
- PLANTING DENSITIES ARE RECOMMENDED TO BE ONE PERENNIAL EVERY 2.5 FEET ON CENTER OR ONE SHRUB EVERY 5 FEET ON CENTER.
- INSTALL STONE OUTLET TO DIRECT OVERFLOW TO ROADSIDE.

#### OPERATION AND MAINTENANCE NOTES:

- MAINTENANCE OF THE INFILTRATION BASIN 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.
- DURING THE FIRST YEAR OF OPERATION, WATERING, WEEDING, AND REPLACEMENT OF DEAD PLANTS IS IMPORTANT FOR PROPER ESTABLISHMENT.
- THE ACCUMULATION OF SEDIMENT WITHIN THE INFILTRATION BASIN SHOULD BE MONITORED. REMOVE SEDIMENT AFTER APPROXIMATELY 3 INCHES OF SEDIMENT HAS ACCUMULATED OR RAKE AWAY WHEN DOES NOT DRAIN WITHIN 1 DAY.
- ANNUALLY INSPECT MAKE SURE NO INVASIVE SPECIES ARE PRESENT.
- INSPECT FOR EROSION PATHS OR CONCENTRATED FLOW OVER STONE BERM, AS NEEDED REDISTRIBUTE STONE TO REMOVE CONCENTRATED FLOW PATHS.

#### DESIGN NOTES FOR FINAL DESIGN:

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



1 SOUTH MAIN STREET  
WATERBURY, VT 05676  
802.243.8333  
SLRCONSULTING.COM

REVISIONS

CONCEPT DESIGN

STORMWATER MASTER PLAN - TOWN OF MENDON  
MENDON, VERMONT

DETAILS - MEN\_03

JAG JAG JCL  
DESIGNED DRAWN CHECKED

NOT TO SCALE

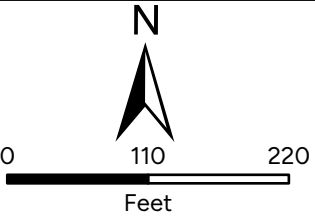
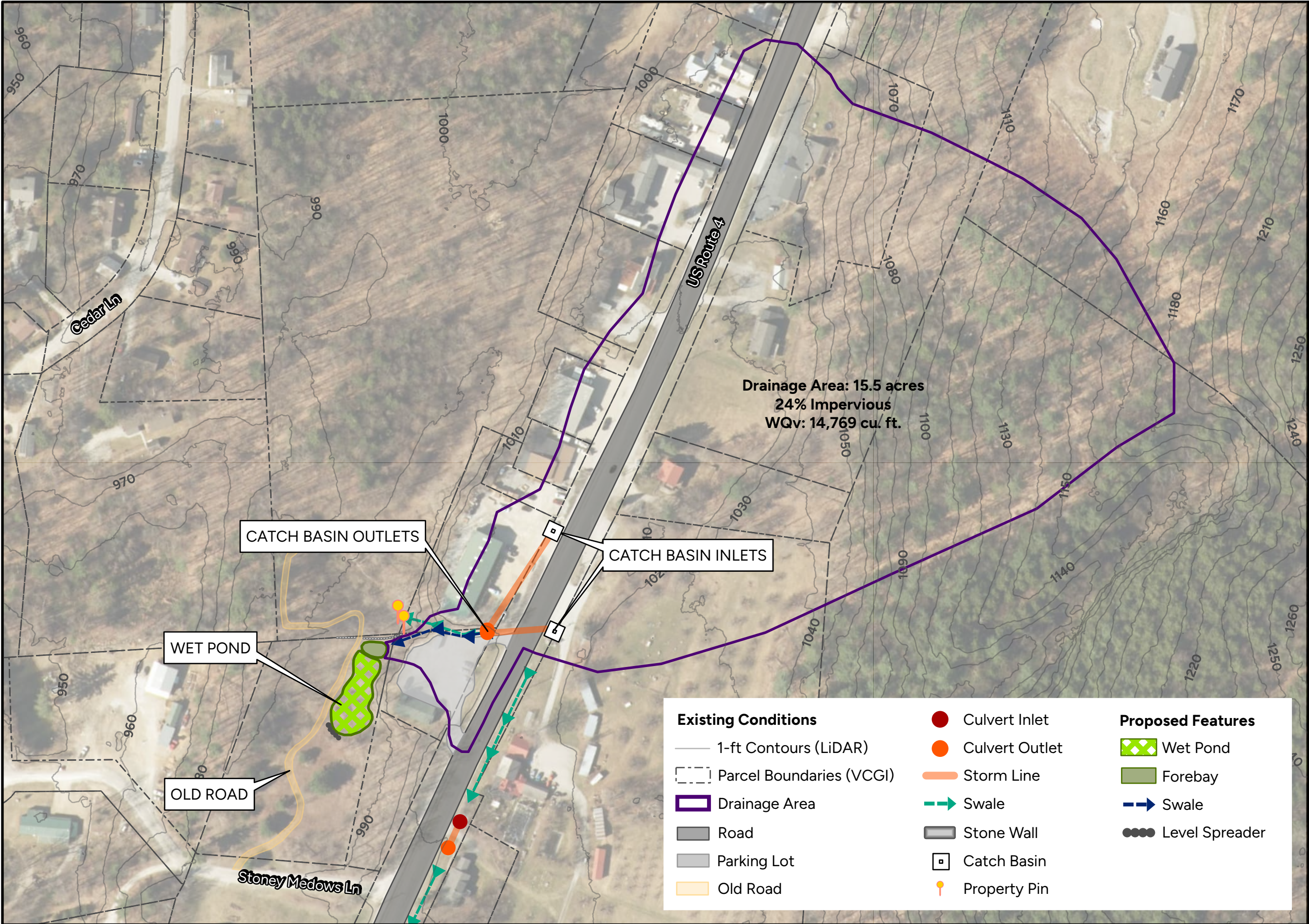
NOVEMBER 13, 2024

14294.00009

DET-1

SHEET NO.





1 S MAIN ST  
WATERBURY, VT 05676  
802.882.8335

Conceptual Design - MEN\_09 Drainage Area

Stormwater Master Plan - Town of Mendon  
Fitzgerald Environmental Associates, LLC

1827 US-4,  
Mendon, Vermont

1 INCH = 25 FEET  
SCALE

11/15/2024  
DATE

14294.00009  
PROJECT NO.

SHEET 1

Existing Conditions

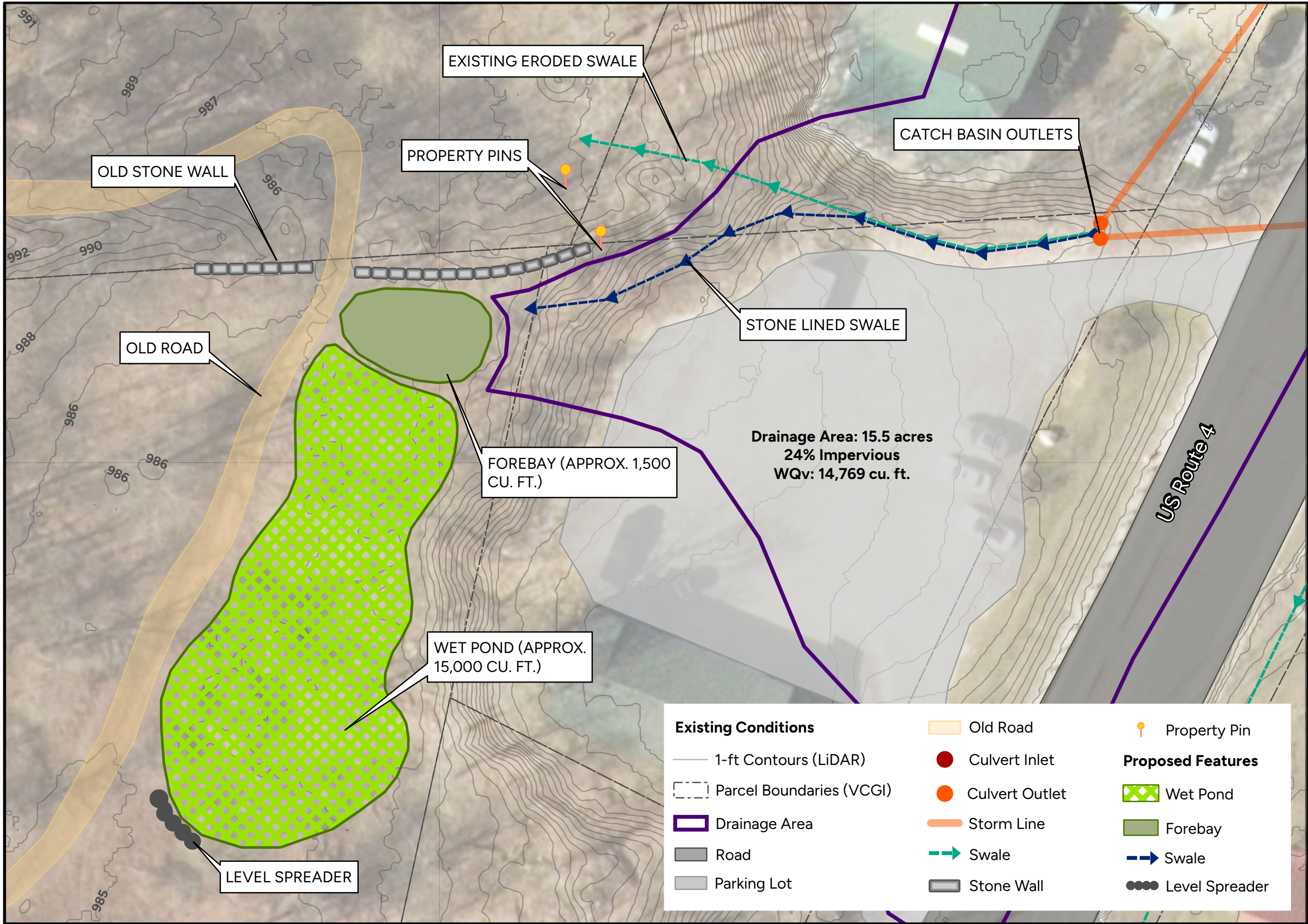
- 1-ft Contours (LiDAR)
- Parcel Boundaries (VCGI)
- Drainage Area
- Road
- Parking Lot
- Old Road

- Culvert Inlet
- Culvert Outlet
- Storm Line
- Swale
- Stone Wall
- Catch Basin
- Property Pin

Proposed Features

- Wet Pond
- Forebay
- Swale
- Level Spreader





Existing Conditions

 1-ft Contours (LiDAR)

 Parcel Boundaries (VCGI)

 Drainage Area

 Road

 Parking Lot

 Old Road

 Culvert Inlet

 Culvert Outlet

 Storm Line

 Swale

 Stone Wall

 Property Pin

Proposed Features

 Wet Pond

 Forebay

 Swale

 Level Spreader

0 10 20  
Feet

1 S MAIN ST  
WATERBURY, VT 05676  
802.882.8335

Conceptual Design - MEN\_09 Wet Pond

Stormwater Master Plan - Town of Mendon  
Fitzgerald Environmental Associates, LLC

1827 US-4,  
Mendon, Vermont

1 INCH = 25 FEET  
SCALE

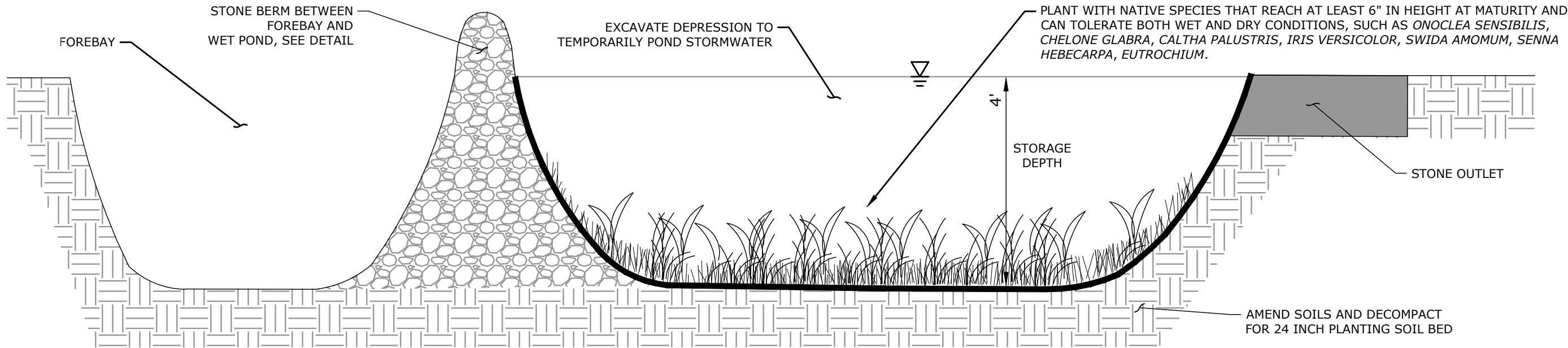
11/19/2024  
DATE

14294.00009  
PROJECT NO.

**SHEET 2**

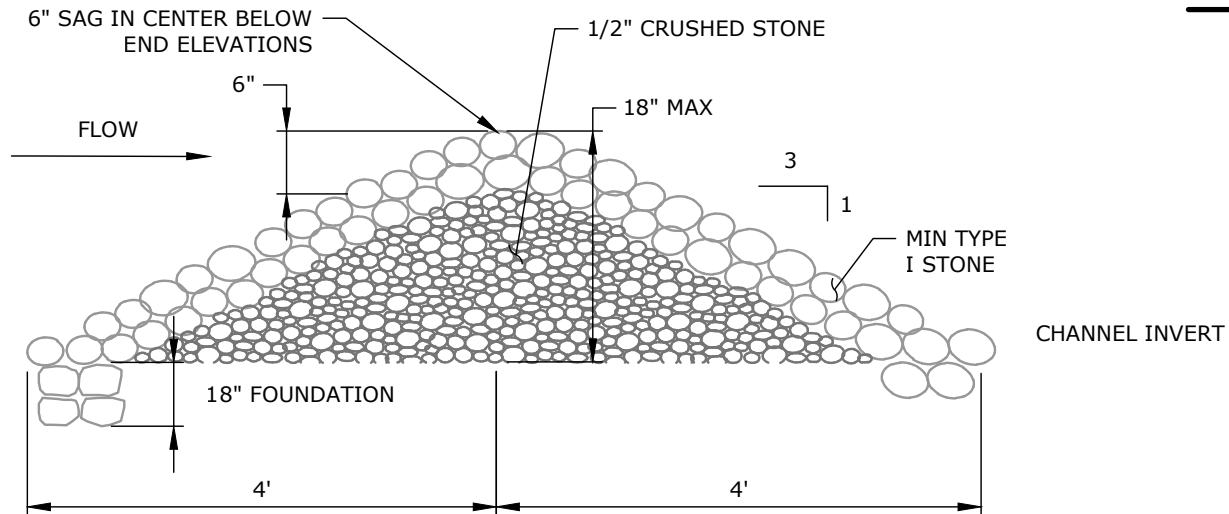


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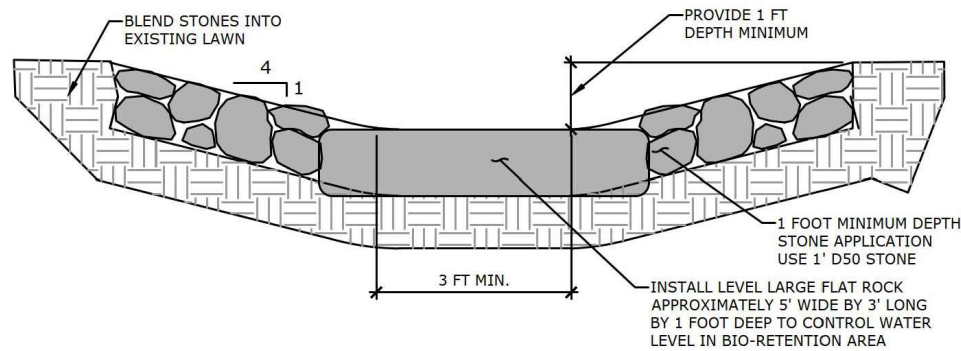
## WET POND

NOT TO SCALE



## STONE BERM

NOT TO SCALE



## STONE OUTLET

NOT TO SCALE

### Preliminary Cost Opinion

| Item                        | Quantity | Unit | Unit Price | Cost       |
|-----------------------------|----------|------|------------|------------|
| Mobilization/Demobilization | 1        | LS   | \$ 5,000   | \$ 5,000   |
| Common Excavation           | 1300     | CY   | \$ 25      | \$ 32,500  |
| Trucking                    | 1300     | CY   | \$ 20      | \$ 26,000  |
| Regrade Swale               | 150      | LF   | \$ 10      | \$ 1,500   |
| Line Swale with Stone       | 150      | LF   | \$ 35      | \$ 5,250   |
| Stone Outlet                | 1        | EA   | \$ 1,000   | \$ 1,000   |
| Topsoil                     | 70       | CY   | \$ 65      | \$ 4,550   |
| Plantings                   | 1        | LS   | \$ 5,000   | \$ 5,000   |
| Final Design & Permitting   |          |      |            | \$ 15,000  |
| Construction Oversight      |          |      |            | \$ 10,000  |
| Subtotal                    |          |      | \$         | \$ 105,800 |
| Contingency (20%)           |          |      | \$         | \$ 21,160  |
| Total                       |          |      | \$         | \$ 126,960 |

#### INSTALLATION NOTES:

- THE VERMONT STORMWATER MANAGEMENT MANUAL IS A GOOD EDUCATIONAL RESOURCE TO ACCOMPANY THIS PROJECT. ALTERNATIVES TO THE DETAILS PRESCRIBED IN THIS PLAN ARE AVAILABLE IN THAT MANUAL.
- PLANTING DENSITIES ARE RECOMMENDED TO BE ONE PERENNIAL EVERY 2.5 FEET ON CENTER OR ONE SHRUB EVERY 5 FEET ON CENTER.
- INSTALL STONE OUTLET TO DIRECT OVERFLOW TO ROADSIDE.

#### OPERATION AND MAINTENANCE NOTES:

- DURING THE FIRST YEAR OF OPERATION, WATERING, WEEDING, AND REPLACEMENT OF DEAD PLANTS IS IMPORTANT FOR PROPER ESTABLISHMENT.
- THE ACCUMULATION OF SEDIMENT WITHIN THE WET POND SHOULD BE MONITORED. REMOVE SEDIMENT AFTER APPROXIMATELY 3 INCHES OF SEDIMENT HAS ACCUMULATED OR RAKE AWAY WHEN DOES NOT DRAIN WITHIN 1 DAY.
- ANNUALLY INSPECT MAKE SURE NO INVASIVE SPECIES ARE PRESENT.
- INSPECT FOR EROSION PATHS OR CONCENTRATED FLOW OVER STONE BERM, AS NEEDED REDISTRIBUTE STONE TO REMOVE CONCENTRATED FLOW PATHS.

#### DESIGN NOTES FOR FINAL DESIGN:

- BASED ON SOIL INFILTRATION, CONSIDER DESIGN OF INFILTRATION BASIN
- TEST INFILTRATION RATE, SHOULD BE AT LEAST 0.2 INCHES PER HOUR FOR INFILTRATION BASIN.
- INVESTIGATE SOILS TO DETERMINE AMENDMENTS NEEDED TO PROVIDE 24 INCHES OF USDA SAND TO LOAMY SAND AS NOTED IN THE VERMONT STORMWATER TREATMENT STANDARDS.



1 SOUTH MAIN STREET  
MENDON, VT 05676  
802.883.8333  
SLRCONSULTING.COM

REVISIONS

CONCEPT DESIGN

STORMWATER MASTER PLAN - TOWN OF MENDON

DETAILS - MEN\_03

MENDON, VERMONT

JAG DESIGNED JAG DRAWN JCL CHECKED

NOT TO SCALE

APRIL 30, 2024

14294.00009

PROJECT NO.

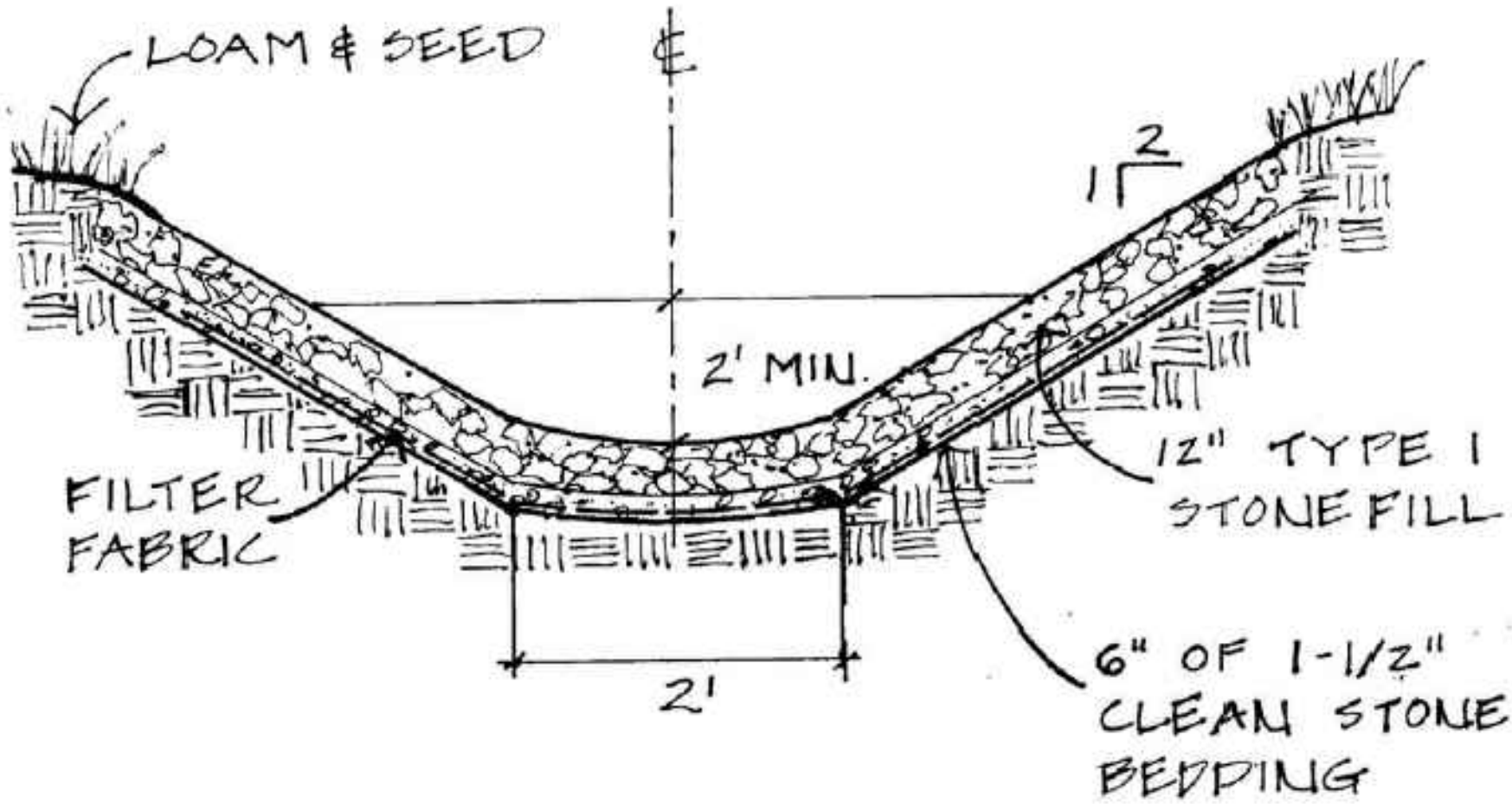
DET-1

SHEET NO.

Plotted by: JKLING On this date: Wed, 2025 April 30 - 1:34pm

Copyright SLR International Corporation - 2024



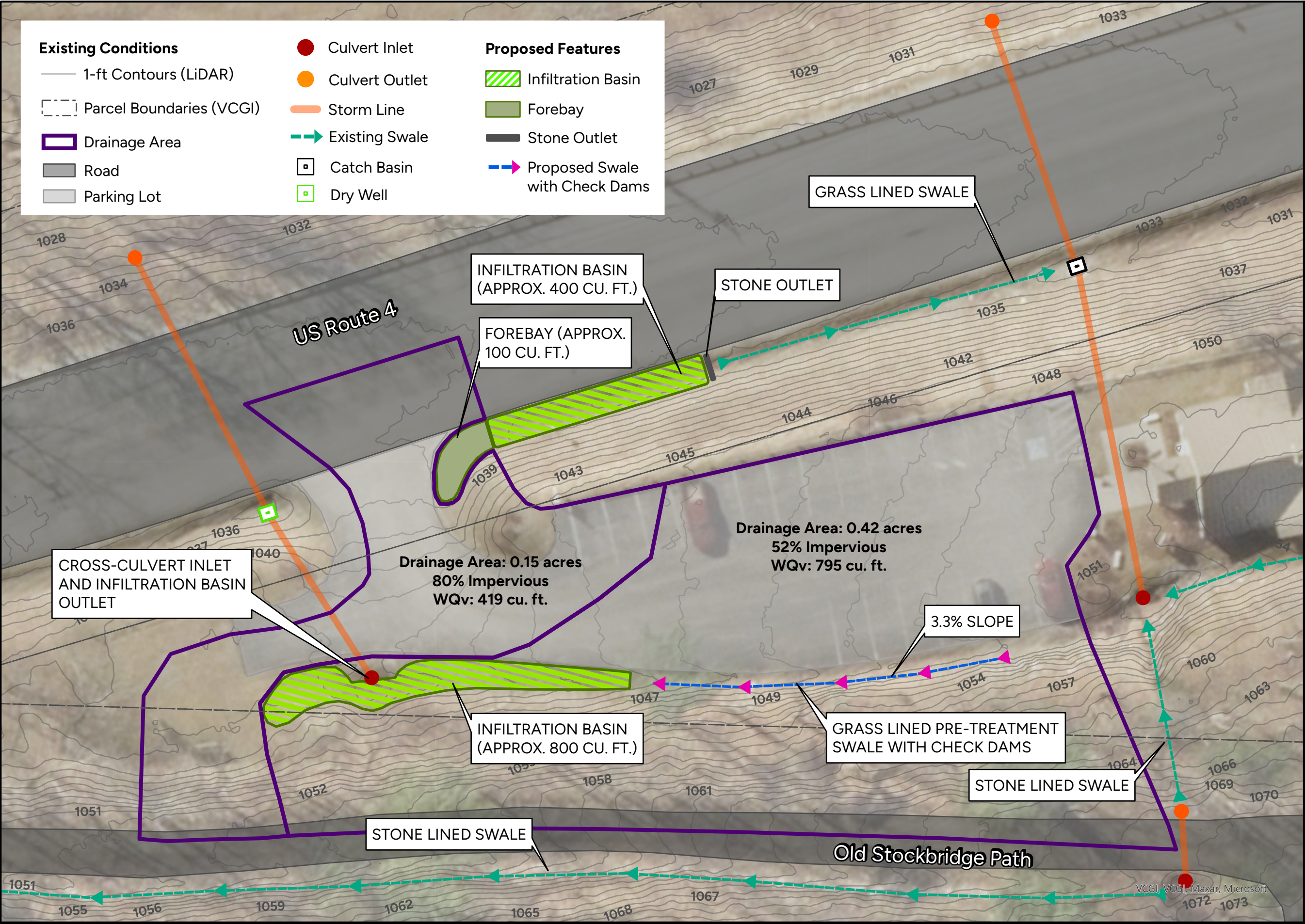


**STONE LINED SWALE**  
NOT TO SCALE

- OPERATION AND MAINTENANCE NOTES:**
- 1. ANNUALLY IN SPRING AFTER THAW AND AFTER LARGE RAINSTORMS, INSPECT FEATURES.
  - 2. NOTE WHERE EROSION IS AFFECTING FEATURE DESIGN.
- REFERENCE NOTES:**
- 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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| <div><div>1 SOUTH MAIN STREET<br/>WATERBURY, VT 05676<br/>802.233.3333<br/>SLRCONSULTING.COM</div></div>                                                                                                                                          |              |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <div>REVISIONS</div> <table><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table> |              |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                      |              |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| <div>DETAILS - MEN_09</div> <div>STORMWATER MASTER PLAN - TOWN OF MENDON</div> <div>MENDON, VERMONT</div> <div>CONCEPT DESIGN</div>                                                                                                                                                                                                  |              |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| JAG<br>DESIGNED                                                                                                                                                                                                                                                                                                                      | JAG<br>DRAWN | JCL<br>CHECKED |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NOT TO SCALE                                                                                                                                                                                                                                                                                                                         |              |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NOVEMBER 19, 2024                                                                                                                                                                                                                                                                                                                    |              |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14294.00009                                                                                                                                                                                                                                                                                                                          |              |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| DET-2                                                                                                                                                                                                                                                                                                                                |              |                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

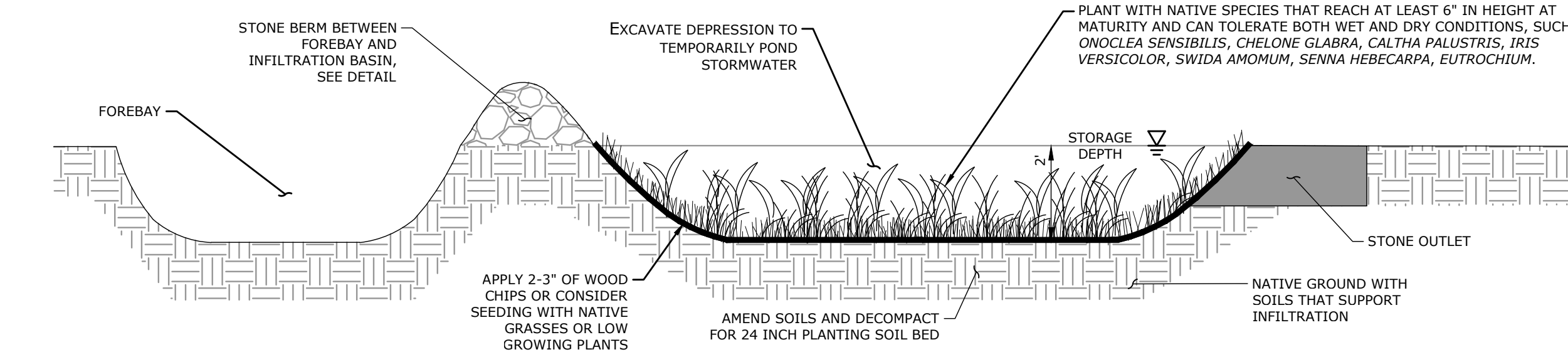






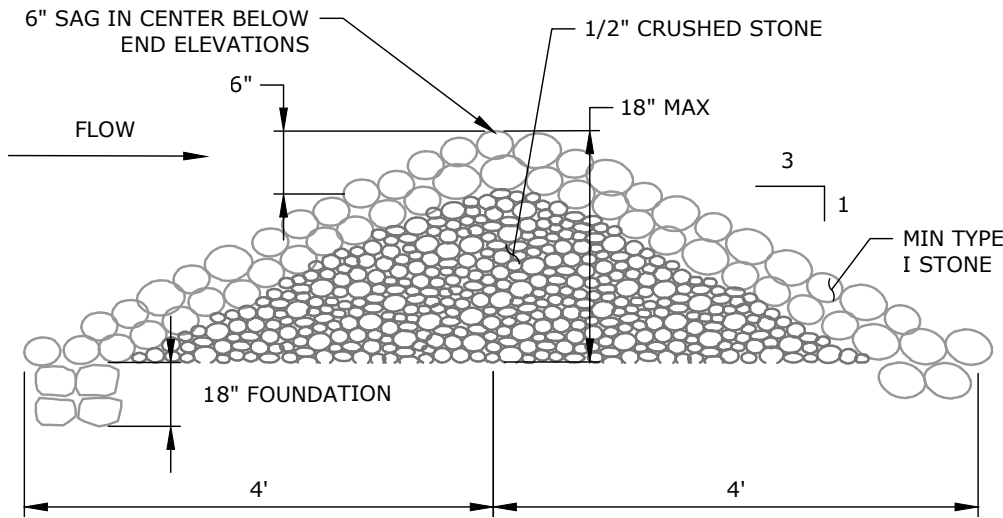
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Plotted by: JALING On this date: Thu, 2024 November 21 - 9:39am



## INFILTRATION BASIN

NOT TO SCALE



## STONE BERM

NOT TO SCALE

### INSTALLATION NOTES:

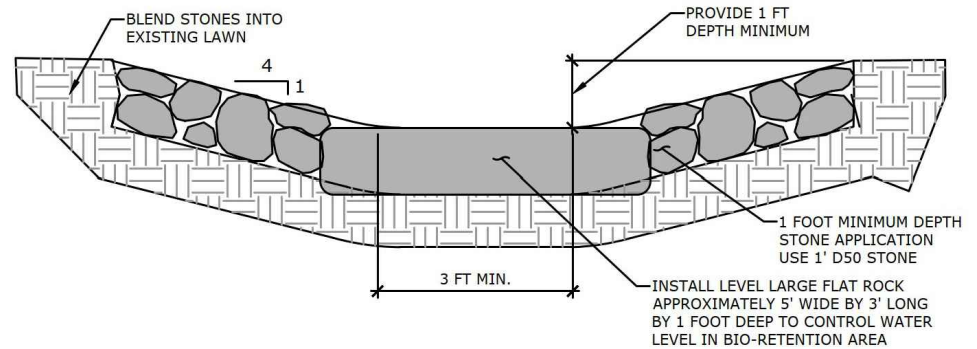
1. THE VERMONT STORMWATER MANAGEMENT MANUAL IS A GOOD EDUCATIONAL RESOURCE TO ACCOMPANY THIS PROJECT. ALTERNATIVES TO THE DETAILS PRESCRIBED IN THIS PLAN ARE AVAILABLE IN THAT MANUAL.
2. PLANTING DENSITIES ARE RECOMMENDED TO BE ONE PERENNIAL EVERY 2.5 FEET ON CENTER OR ONE SHRUB EVERY 5 FEET ON CENTER.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

### OPERATION AND MAINTENANCE NOTES:

1. MAINTENANCE OF THE INFILTRATION BASIN 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.
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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.

### 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

### Preliminary Cost Opinion

| Item                        | Quantity | Unit | Unit Price        | Cost             |
|-----------------------------|----------|------|-------------------|------------------|
| Mobilization/Demobilization | 1        | LS   | \$ 5,000          | \$ 5,000         |
| Common Excavation           | 200      | CY   | \$ 25             | \$ 5,000         |
| Trucking                    | 200      | CY   | \$ 20             | \$ 4,000         |
| Reshape grass swale         | 100      | LF   | \$ 5              | \$ 500           |
| Add Check dams to swale     | 4        | EA   | \$ 1,000          | \$ 4,000         |
| Stone Outlet                | 1        | EA   | \$ 1,000          | \$ 1,000         |
| Wood Chip Mulch             | 20       | CY   | \$ 70             | \$ 1,400         |
| Topsoil                     | 15       | CY   | \$ 65             | \$ 975           |
| Seed                        | 1        | LS   | \$ 1,000          | \$ 1,000         |
| Final Design & Permitting   |          |      |                   | \$ 10,000        |
| Construction Oversight      |          |      |                   | \$ 5,000         |
|                             |          |      | Subtotal          | \$ 37,875        |
|                             |          |      | Contingency (20%) | \$ 7,580         |
|                             |          |      | <b>Total</b>      | <b>\$ 45,455</b> |



1 SOUTH MAIN STREET  
WATERBURY, VT 05676  
802.223.8333  
SLRCONSULTING.COM

REVISIONS

CONCEPT DESIGN

DETAILS - MEN\_10

STORMWATER MASTER PLAN - TOWN OF MENDON

MENDON, VERMONT

JAG DESIGNED JAG DRAWN JCL CHECKED

NOT TO SCALE

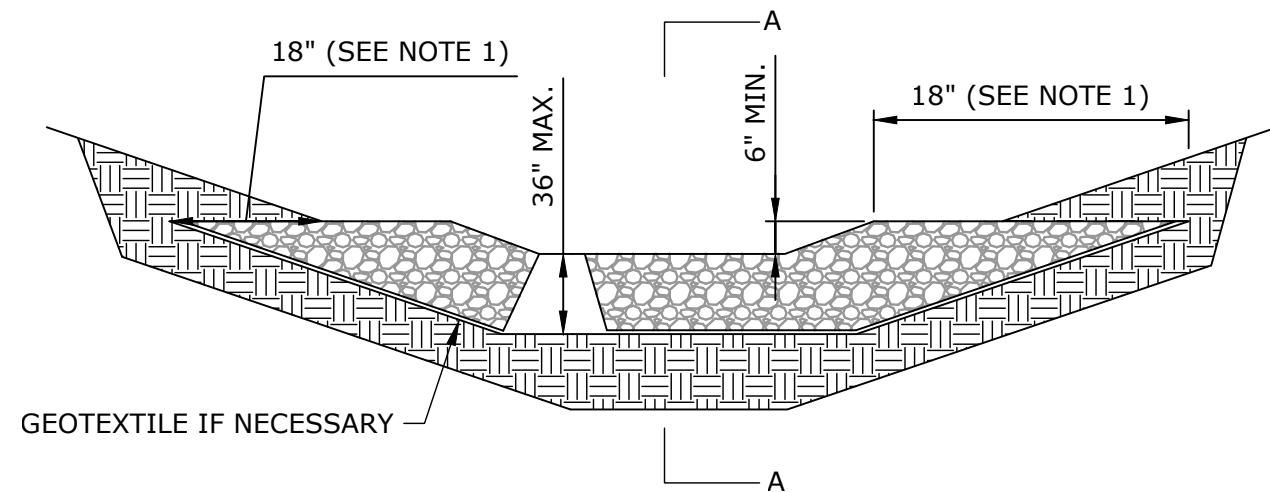
NOVEMBER 13, 2024

14294.00009

DET-1

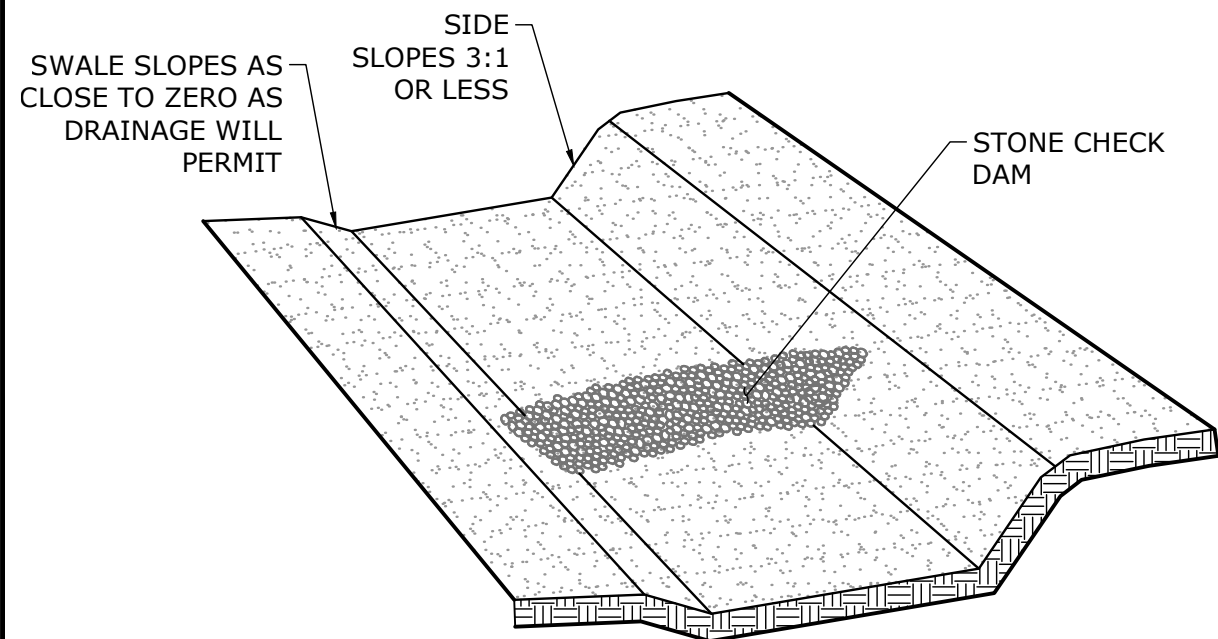
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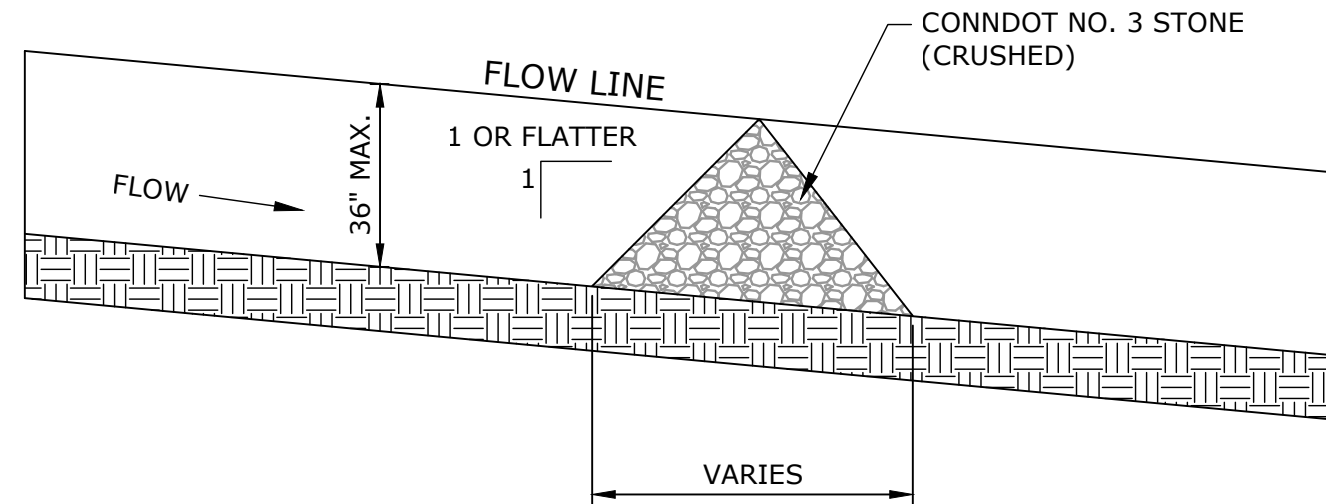
## STONE CHECK DAM UPSTREAM

NOT TO SCALE



## GRASSED SWALE WITH CHECK DAM

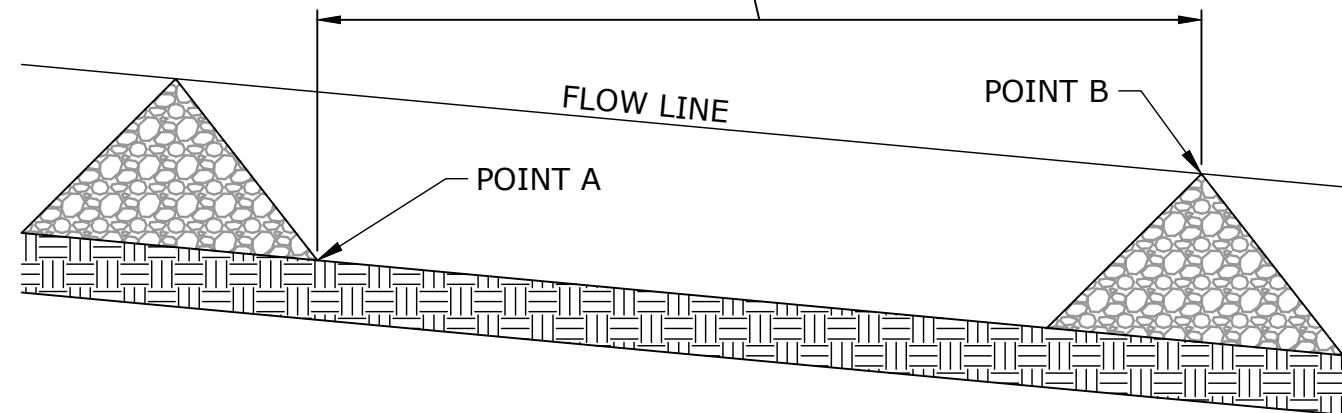
NOT TO SCALE



## SECTION A-A

NOT TO SCALE

L' = DISTANCE SUCH THAT POINTS 'A' AND 'B'  
ARE OF EQUAL ELEVATION



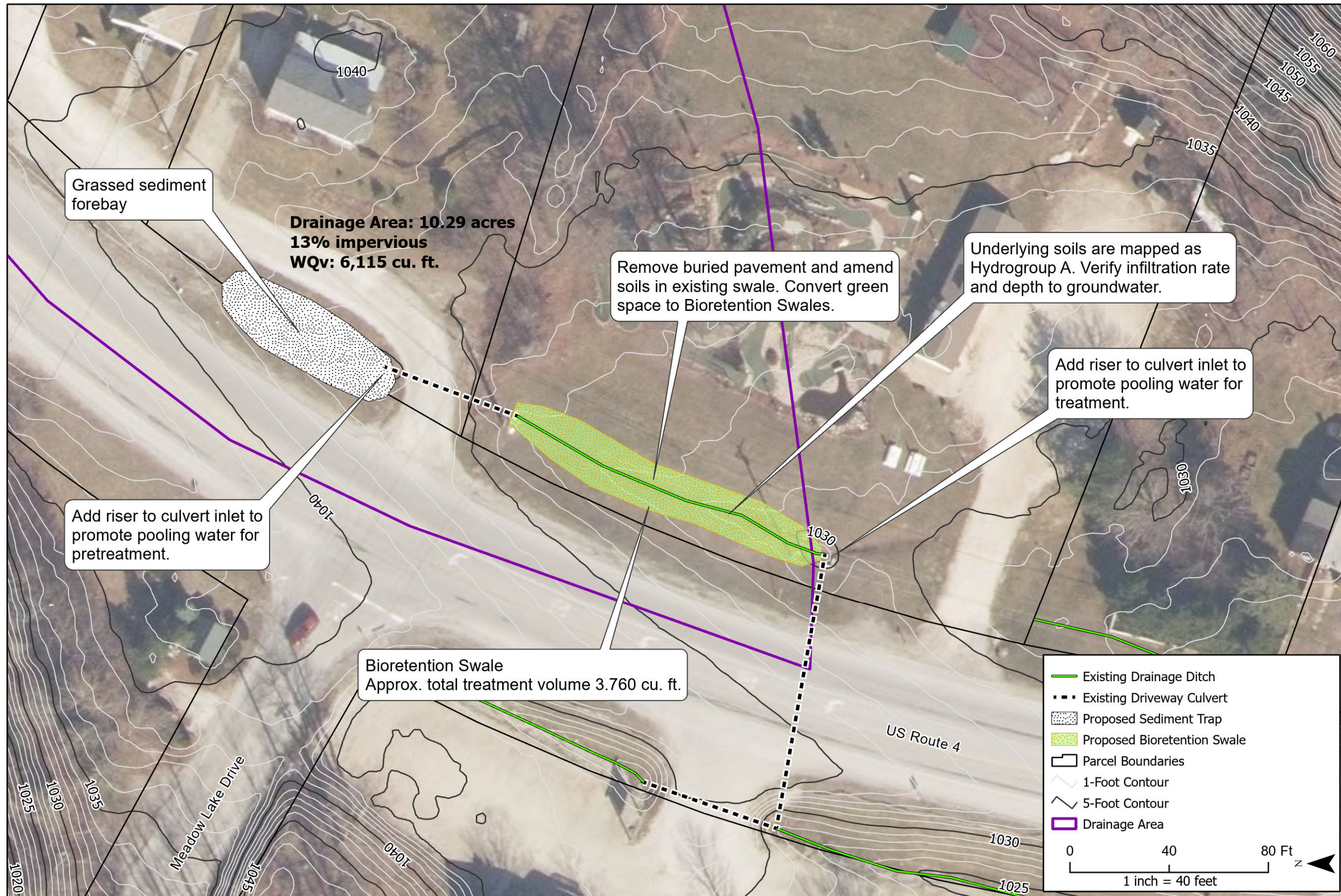
## SPACING BETWEEN CHECK DAMS

NOT TO SCALE

DESIGN NOTES FOR FINAL DESIGN:

1. KEY STONE INTO THE DITCH BANKS AND EXTEND INTO THE ABUTMENTS A MINIMUM OF 18" TO PREVENT FLOW FROM FLANKING THE CHECK DAM.
2. THE MINIMUM DESIGN CAPACITY SHALL CONVEY A 2 YEAR-24 HOUR PEAK FLOW.
3. USE MIX OF 2 TO 9 INCH STONE
4. SIDE SLOPES 2:1 OR FLATTER
5. SPACE SO THAT THE TOE OF THE UPSTREAM DAM IS THE ELEVATION OF THE CREST OF THE DOWNSTREAM DAM
6. PERIODICALLY REMOVE ACCUMULATED SEDIMENT AND DEBRIS TO ALLOW CHANNEL TO DRAIN THROUGH THE STONE AND PREVENT LARGE FLOWS FROM CARRYING SEDIMENT OVER THE DAM
7. IF SIGNIFICANT EROSION OCCURS BETWEEN DAMS, A LINER OF STONE SHOULD BE INSTALLED







Fitzgerald  
Environmental  
Associates, LLC

164 Main Street, Suite 2  
Colchester, VT 05446  
Telephone: 802.876.7778  
[www.fitzgeraldenvironmental.com](http://www.fitzgeraldenvironmental.com)

Notes:

- Conceptual design based on FEA field visit in 2024

Project MEN-11 Conceptual Design  
Stormwater Master Plan

US Route 4  
Mendon, VT

|        |         |
|--------|---------|
| FCP    | JHB     |
| MAP BY | CHECKED |

SCALE

1 inch = 40 feet

DATE

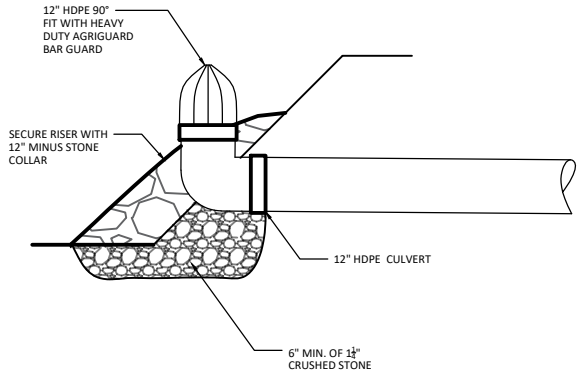
December 19, 2024

SHEET NO.

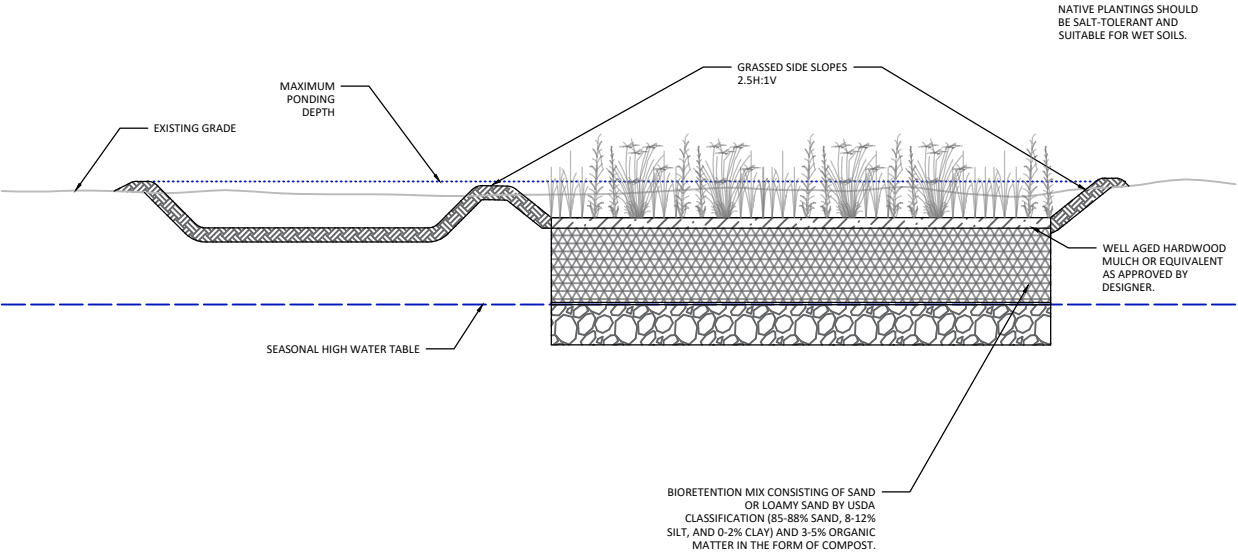
**SHEET 1**



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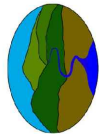
RISER N.T.S.



BIORETENTION N.T.S.

- INSTALLATION NOTES**
- THE VERMONT STORMWATER MANAGEMENT MANUAL IS A GOOD EDUCATIONAL RESOURCE TO ACCOMPANY THIS PROJECT. ALTERNATIVES TO THE DETAILS PRESCRIBED IN THIS PLAN ARE AVAILABLE IN THAT MANUAL.
  - MINIMIZE DISTURBANCE TO EXISTING VEGETATION DURING INSTALLATION.
- OPERATION OF MAINTENANCE NOTES**
- THE FOREBAY SHOULD BE CLEARED OF SEDIMENT WHEN SEDIMENT DEPTH REACHES  $\frac{1}{2}$  OF THE TOTAL DEPTH OF THE FEATURE.
  - THE PROJECT SITE SHOULD BE INSPECTED FOLLOWING ANY MAJOR STORM EVENT WITHIN THE YEAR AFTER INSTALLATION.
  - AFTER THE FIRST YEAR, THE PROJECT SITE SHOULD BE INSPECTED SEMI-ANNUALLY.
  - INSPECT FOR EROSION PATHS OR CONCENTRATED FLOW, AS NEEDED REDISTRIBUTE STONE/EARTH TO REMOVE CONCENTRATED FLOW PATHS.
- DESIGN NOTES FOR FINAL DESIGN**
- THIS PLANSET REPRESENTS A 10% DESIGN. ADDITIONAL TOPOGRAPHIC SURVEY AND FIELD VERIFICATION OF THE SITE ARE REQUIRED FOR FINAL DESIGNS.
  - PRELIMINARY ESTIMATED COST OF PROJECT IMPLEMENTATION: \$40,000 - \$50,000

\*NOTES ADAPTED FROM SLR CONCEPT DESIGNS



Fitzgerald  
Environmental  
Associates, LLC

164 Main Street, Suite 2  
Colchester, VT 05446  
Telephone: 802.876.7778  
[www.fitzgeraldenvironmental.com](http://www.fitzgeraldenvironmental.com)

Notes:

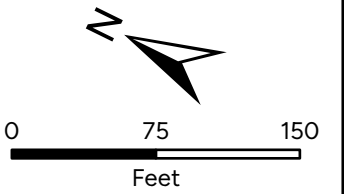
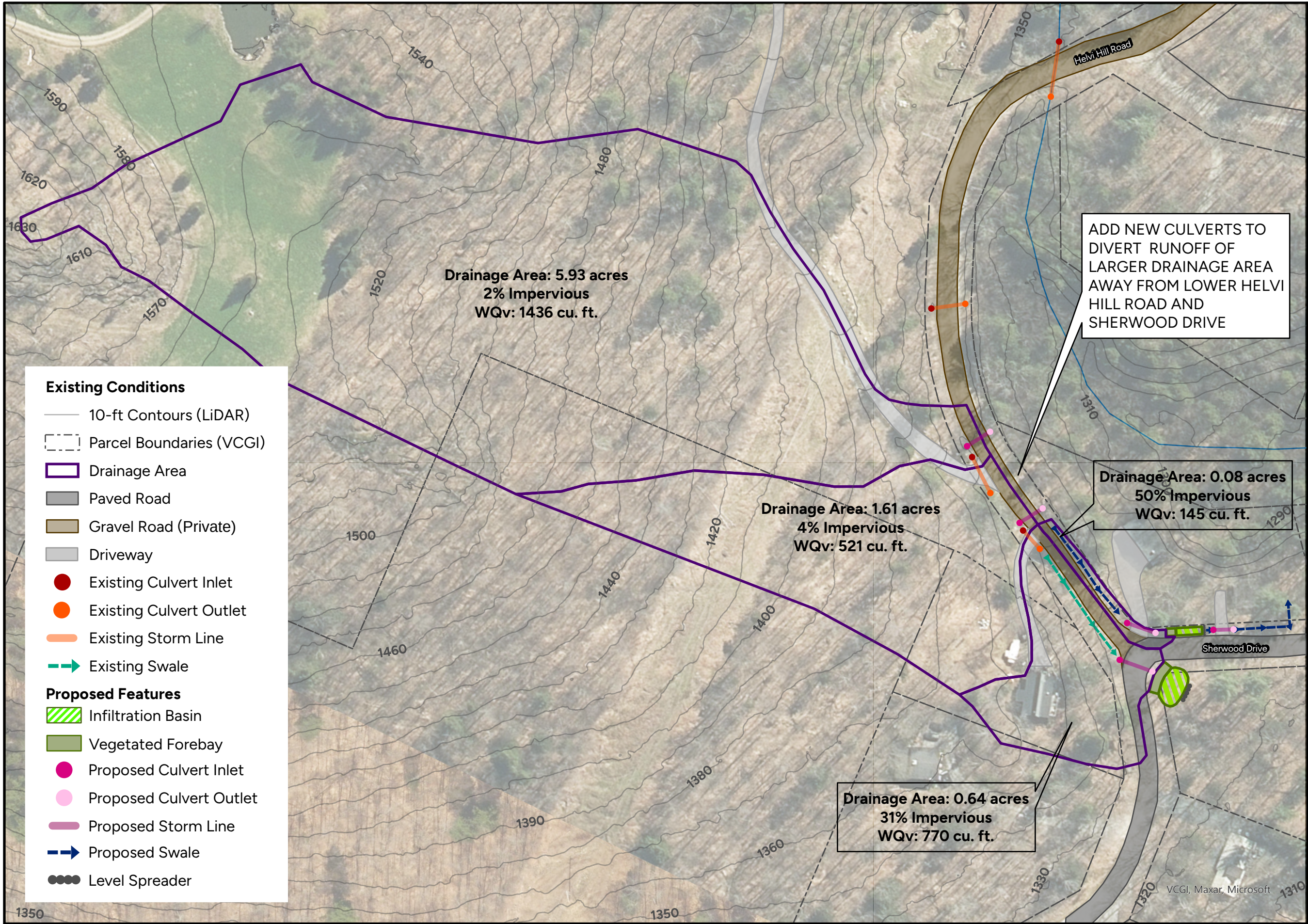
Project MEN-11 Conceptual Design

Stormwater Master Plan

US Route 4  
Mendon, VT  
NOT FOR CONSTRUCTION

|            |         |
|------------|---------|
| FCP        | JHB     |
| DRAWN      | CHECKED |
| N.T.S.     |         |
| SCALE      |         |
| 2024-12-19 |         |
| DATE       |         |
| SHEET 2    |         |
| SHEET NO.  |         |





1 S MAIN ST  
WATERBURY, VT 05676  
802.882.8335

## Conceptual Design - MEN\_12 Drainage Area

Stormwater Master Plan - Town of Mendon

Fitzgerald Environmental Associates, LLC

Mendon Town Office

2282 US-4,  
Mendon, Vermont

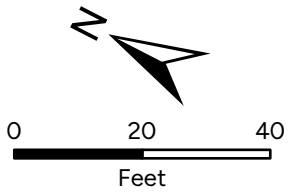
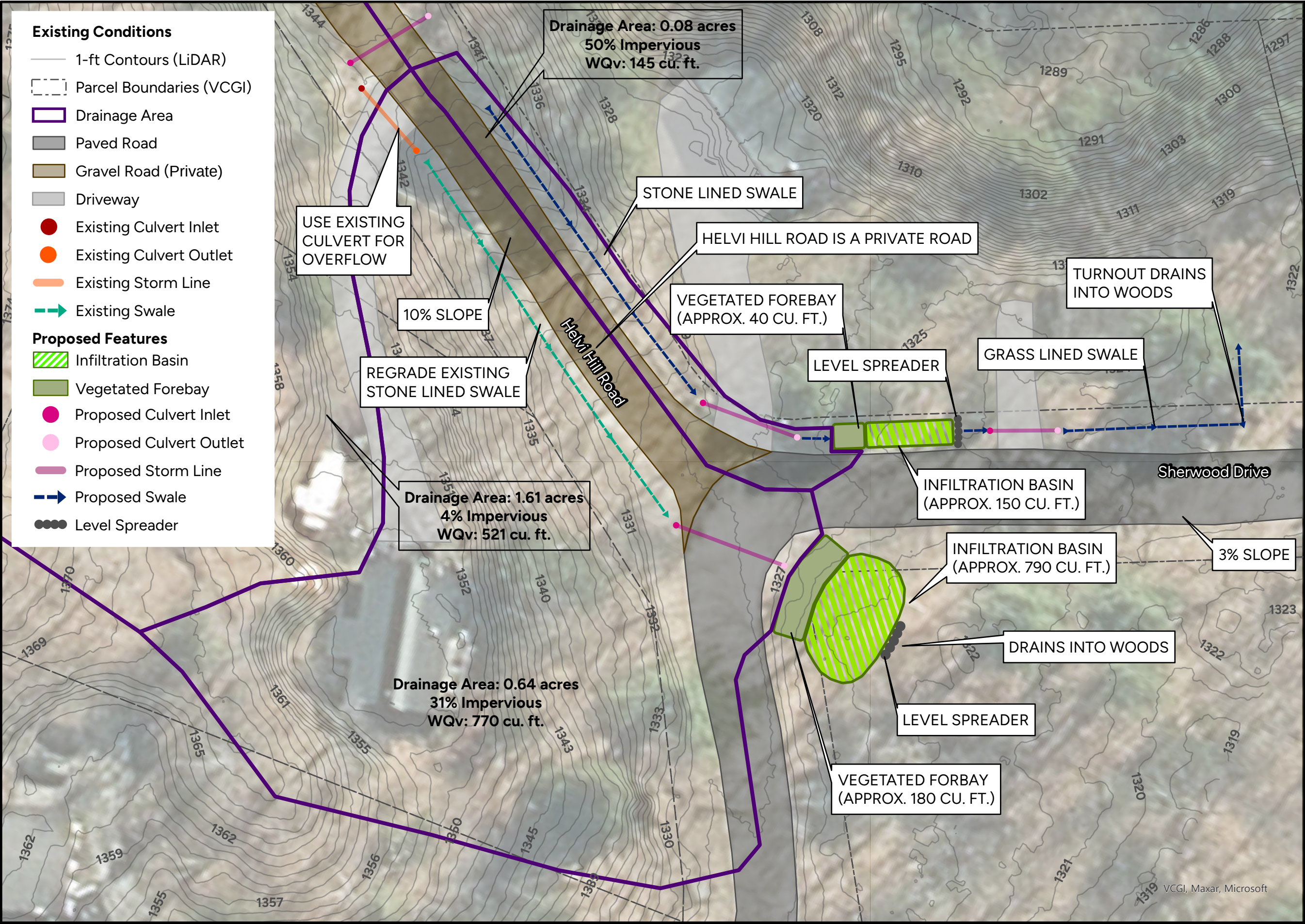
1 INCH = 100 FEET  
SCALE

11/15/2024  
DATE

14294.00009  
PROJECT NO.

# SHEET 1





1 S MAIN ST  
WATERBURY, VT 05676  
802.882.8335

Conceptual Design - MEN\_12

Stormwater Master Plan - Town of Mendon  
Fitzgerald Environmental Associates, LLC  
Mendon Town Office  
2282 US-4,  
Mendon, Vermont

1 INCH = 30 FEET  
SCALE

4/29/2025  
DATE

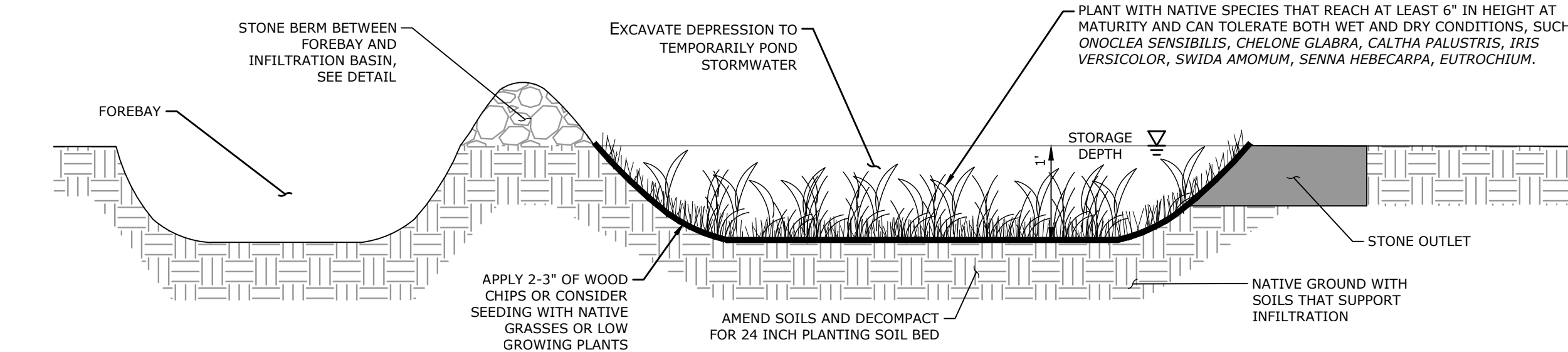
14294.00009  
PROJECT NO.

SHEET 2



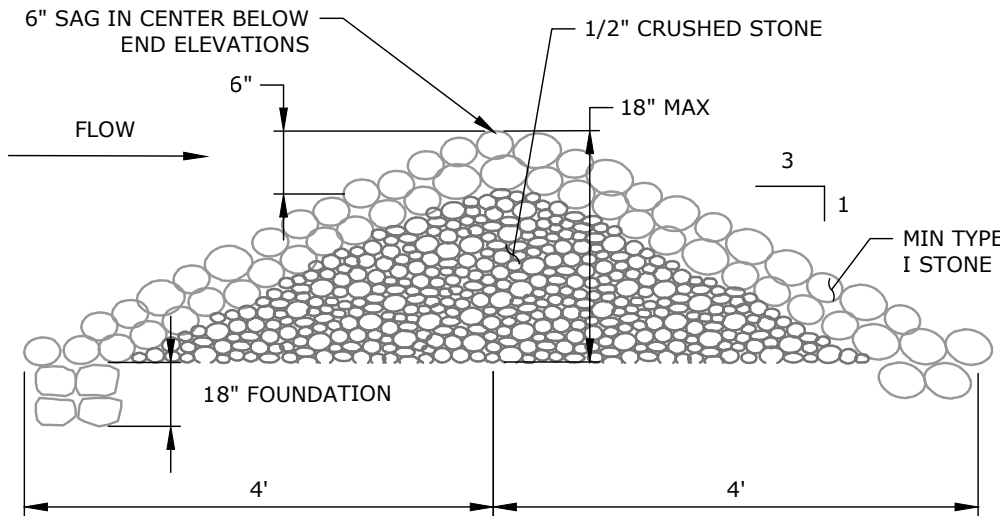
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Plotted by: JALING On this date: Tue, 2024 November 19 - 5:59pm



## INFILTRATION BASIN

NOT TO SCALE



## STONE BERM

NOT TO SCALE

### INSTALLATION NOTES:

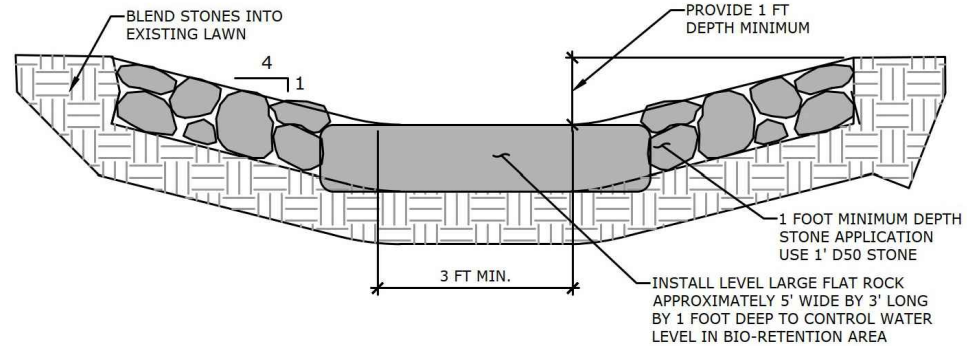
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## STONE OUTLET

NOT TO SCALE

### Preliminary Cost Opinion

| Item                        | Quantity | Unit | Unit Price | Cost      |
|-----------------------------|----------|------|------------|-----------|
| Mobilization/Demobilization | 1        | LS   | \$ 5,000   | \$ 5,000  |
| Common Excavation           | 350      | CY   | \$ 25      | \$ 8,750  |
| Trucking                    | 350      | CY   | \$ 20      | \$ 7,000  |
| New Stone Swale             | 300      | LF   | \$ 35      | \$ 10,500 |
| New Grass Swale             | 120      | LF   | \$ 9       | \$ 1,080  |
| Install Driveway Culvert    | 2        | EA   | \$ 2,000   | \$ 4,000  |
| Install Drainage Culvert    | 3        | EA   | \$ 3,000   | \$ 9,000  |
| Install Stone at Culvert    | 5        | EA   | \$ 500     | \$ 2,500  |
| Install Stone Turnout       | 1        | EA   | \$ 500     | \$ 500    |
| Install Stone Outlet        | 2        | CY   | \$ 300     | \$ 600    |
| Seed                        | 1        | LS   | \$ 1,000   | \$ 1,000  |
| Final Design & Permitting   |          |      |            | \$ 3,000  |
| Construction Oversight      |          |      |            | \$ 5,000  |
| Subtotal                    |          |      |            | \$ 57,930 |
| Contingency (20%)           |          |      |            | \$ 11,590 |
| Total                       |          |      |            | \$ 69,520 |



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REVISIONS

CONCEPT DESIGN

STORMWATER MASTER PLAN - TOWN OF MENDON

MENDON, VERMONT

DETAILS - MEN\_12

JAG JAG JCL  
DESIGNED DRAWN CHECKED

NOT TO SCALE

NOVEMBER 13, 2024

14294.00009

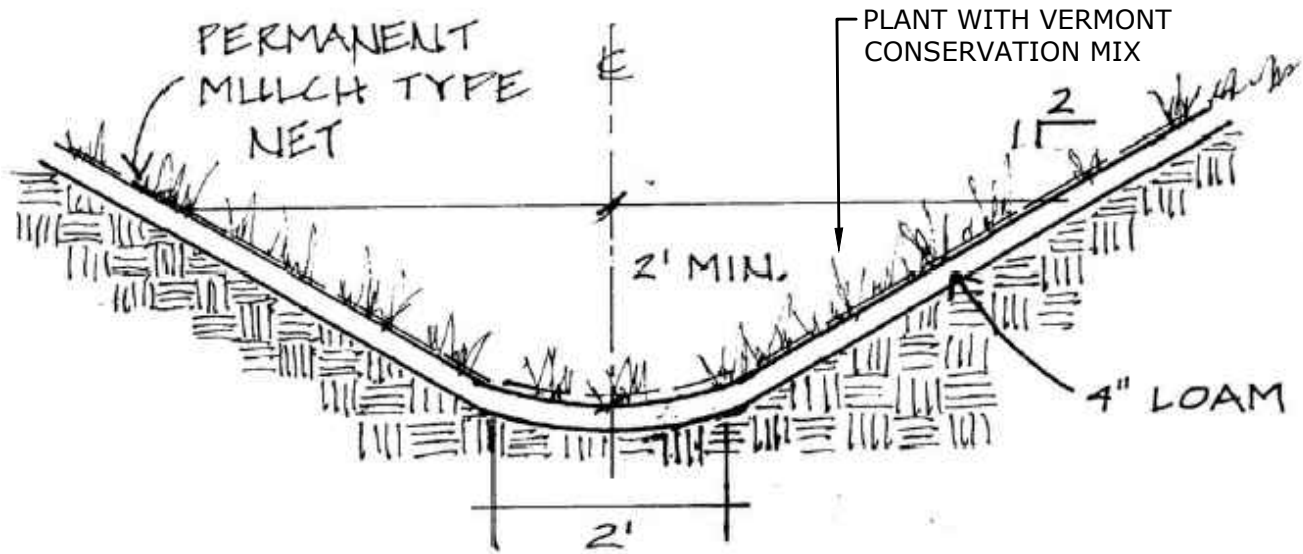
DET-1

SHEET NO.



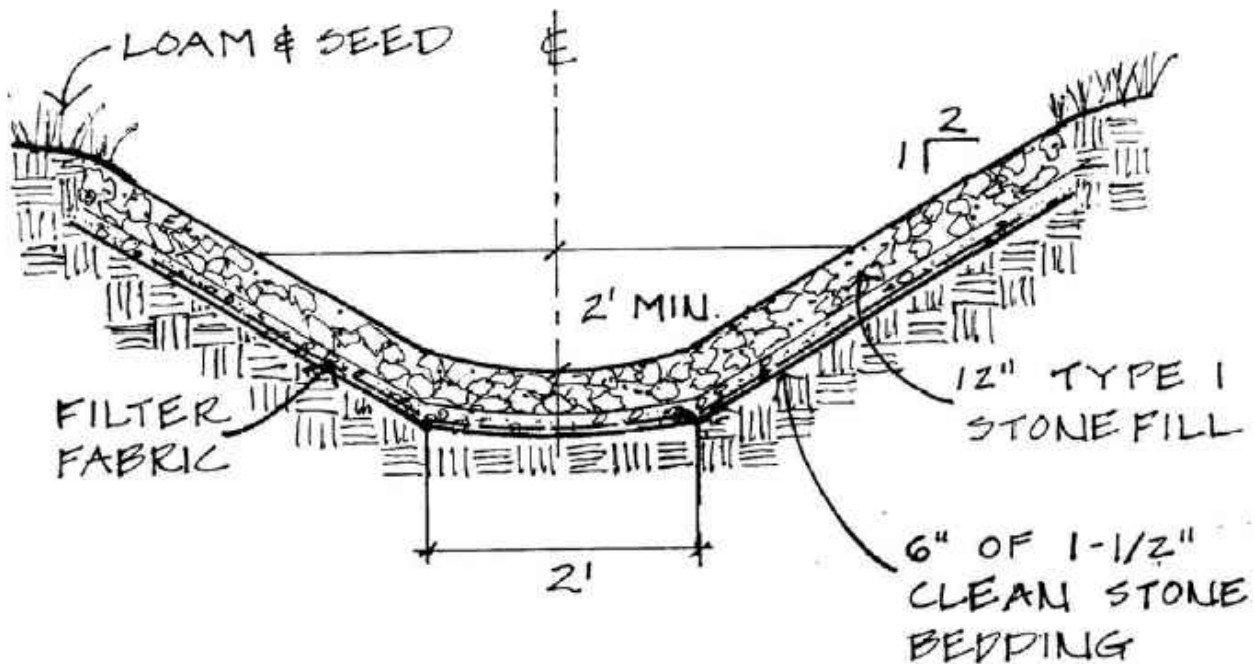
Drawing: C:\AUTOSAVE\WORK\BUSH\_15868\MENDON\_DETAILS.DWG Layout: TBP11X17 - STONESWALE\_MEN\_12

- 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 SWALE

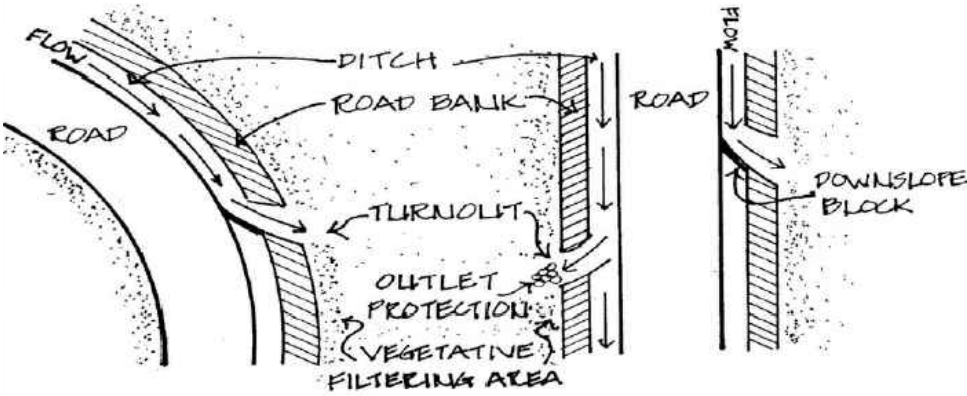
NOT TO SCALE



### STONE LINED SWALE

NOT TO SCALE

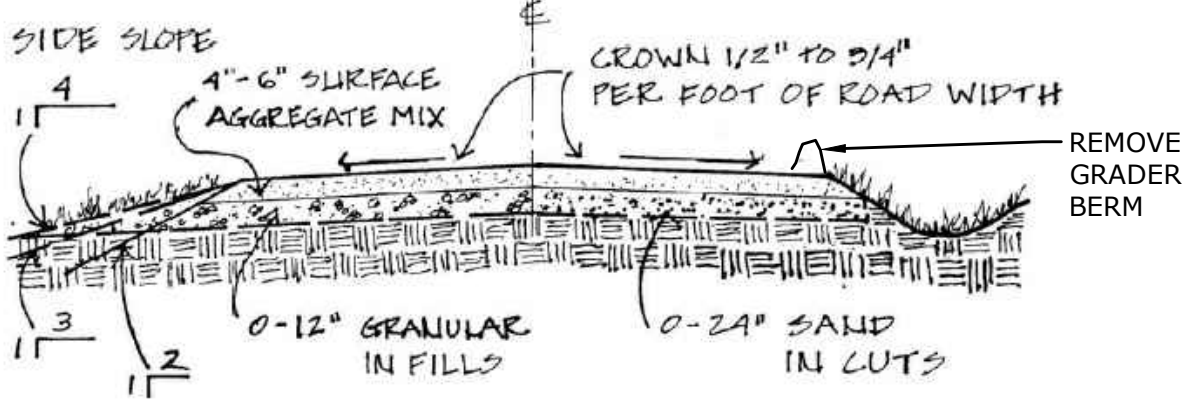
- AVOID DIRECT OUTLET TO SURFACE WATERS
- STABILIZE OUTLET BASED ON SLOPE:
  - 0% TO 5% STABILIZE WITH GRASS
  - 5% TO 10% STABILIZE WITH 6-8 INCH MINUS STONE
  - GREATER THAN 10% STABILIZE WITH 12 INCH MINUS STONE
- REMOVE ACCUMULATED SEDIMENT WHEN HALF FULL



### TURN-OUT

NOT TO SCALE

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



### ROAD CROWN AND PROFILE

NOT TO SCALE

#### OPERATION AND MAINTENANCE NOTES:

1. ANNUALLY IN SPRING AFTER THAW AND AFTER LARGE RAINSTORMS, INSPECT ALL ROAD FEATURES.
2. NOTE WHERE EROSION IS AFFECTING FEATURE DESIGN.

#### REFERENCE NOTES:

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.

Plotted by: JALLING On this date: Tue, 2024 November 19 - 5:41pm



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REVISIONS

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MENDON, VERMONT

DETAILS - MEN\_12

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DESIGNED DRAWN CHECKED

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NOVEMBER 19, 2024

14294.00009

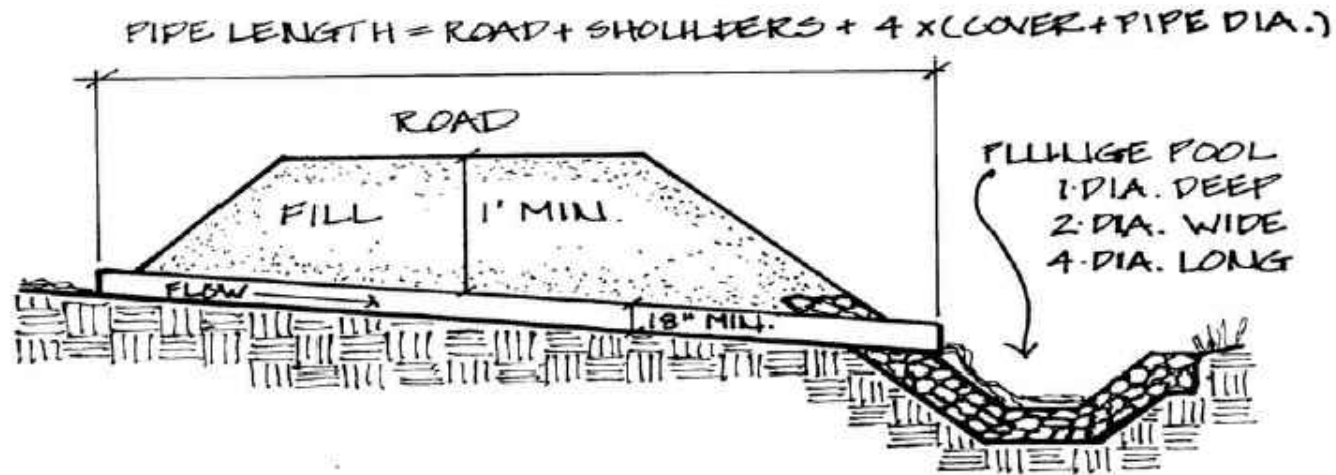
DET-2

SHEET NO.



Drawing: C:\AUTOSAVE\VERMONT\15868\VERMONT\_DETAILS.DWG - Layout: T:\P11\17\_CULVERT.MEN\_12

Plotted by: JALLING On this date: Tue, 2024 November 19 - 5:42pm

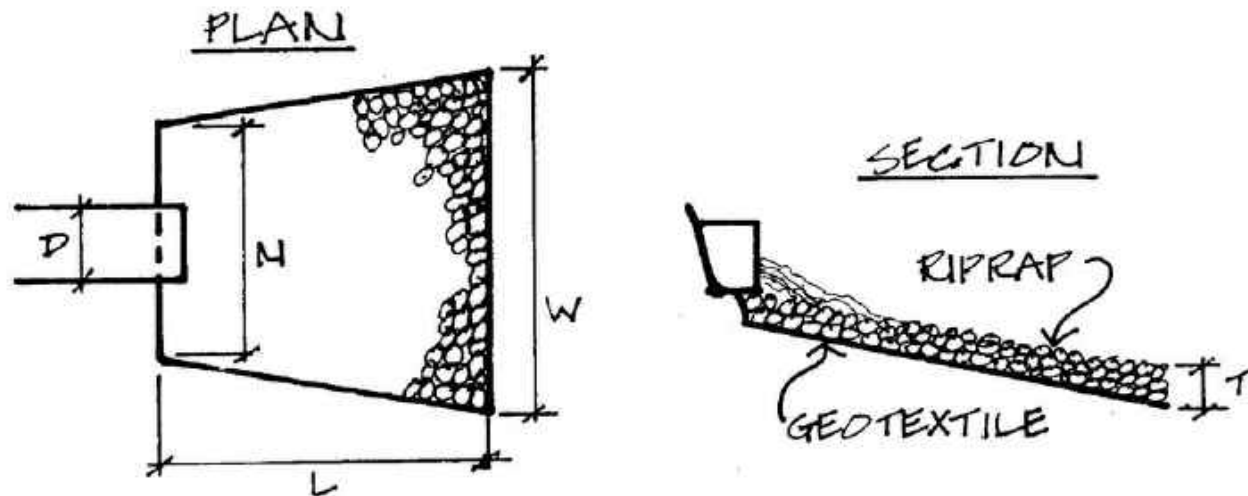


### CULVERT PROFILE

NOT TO SCALE

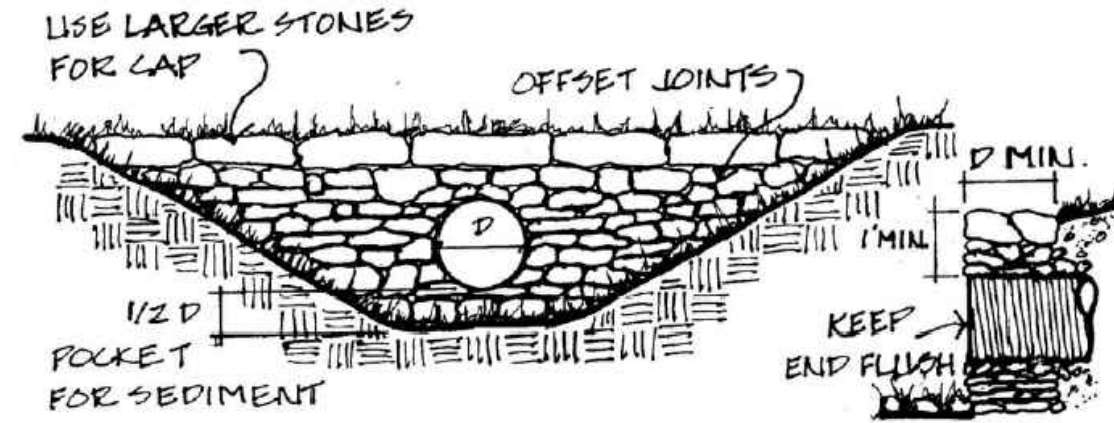
| Rock Apron Specifications |             |         |         |         |         |
|---------------------------|-------------|---------|---------|---------|---------|
| Culvert Diameter (D)      | Riprap Size | T (in.) | N (ft.) | W (ft.) | L (ft.) |
| 18 inches                 | (3-12 inch) | 18      | 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



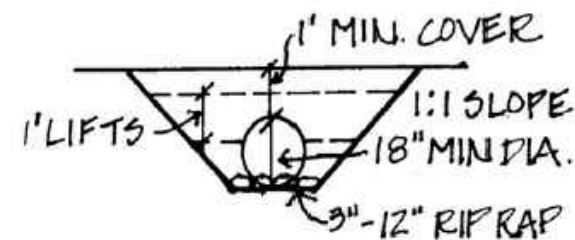
### ROCK APRON

NOT TO SCALE



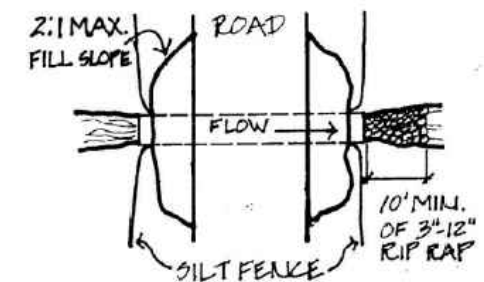
### STONE LINED SWALE

NOT TO SCALE



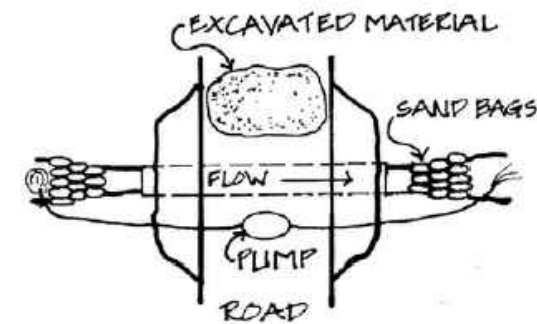
### CULVERT CROSS SECTION

NOT TO SCALE



### CULVERT PLAN VIEW

NOT TO SCALE



### CULVERT INSTALLATION FLOW BYPASS

NOT TO SCALE

#### OPERATION AND MAINTENANCE NOTES:

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

#### REFERENCE NOTES:

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

CONCEPT DESIGN

STORMWATER MASTER PLAN - TOWN OF MENDON  
MENDON, VERMONT

DETAILS - MEN\_12

|                   |       |         |
|-------------------|-------|---------|
| JAG               | JAG   | JCL     |
| DESIGNED          | DRAWN | CHECKED |
| NOT TO SCALE      |       |         |
| NOVEMBER 19, 2024 |       |         |
| DATE              |       |         |
| 14294.00009       |       |         |
| PROJECT NO.       |       |         |
| DET-3             |       |         |
| SHEET NO.         |       |         |

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