

# AHEAD OF THE STORM

Site: Thorp Brook Headwaters Restoration

Location: East Thompson Point Road, Charlotte, Vermont



## Primary Problem

The swale along the north side of East Thompson's Point Road at the Mack Farm field collects runoff from portions of East Thompson's Point Road, Greenbush Road, residential properties, and portions of two farms (drainage area = 17.3 acres). The drainage ditch next to the road is undersized and eroding and causes water to overtop and erode the adjacent field. The sediment laden water is directly discharged to Thorp Brook impacting water quality and channel stability. (See existing conditions site summary and plan.)

The primary goals are to improve water quality protection and flood resiliency by slowing runoff, reducing erosion, and enhancing vegetation. This project will improve water quality where past sampling has shown high levels of suspended solids, nitrogen, and phosphorus in streams. The project will also help stabilize the Thorp Brook river corridor. This project will begin to reverse the cumulative impacts of incremental development in the Thorp Brook watershed.

## Final Treatment Recommendations

Two Optimal Conservation Practices (OCPs) are recommended to mitigate stormwater runoff at the site.

1. Create a three-cell bio-retention area by installing stone filter berms. The filter berms and bio-retention area will slow water, reduce erosion, and filter sediment and nutrients currently entering the stream.
2. Improve the swale including realigning the flow path to eliminate the sharp bend and provide for more snow storage next to the road, reshaping and revegetating the eroding swale, replacing a farm access culvert with a stone reinforced driving surface, installing a stone-lined swale with stone check dams, and providing a buffer along the swale. This project will improve water quality by reducing sediment produced by erosion of the swale and access, reduce field rill erosion from overflows, and slow and retain water and sediment.

## Site Constraints and Design Basis

This project is partially within the Town right of way and includes a portion of adjacent private land to provide an appropriate buffer to the swale and bio-retention area outside the right of way. A mutually agreeable management plan and agreement for entry have been created with the landowners. The design maximizes treatment while largely maintaining current land use, site features, and minimizing maintenance needs and costs. Runoff calculations indicate that 24% of the 1-inch rain storm (i.e., the Water Quality Volume – WQv) can be treated in the bio-retention area (Table 1). The swales have been designed to carry the 100-year storm flow. The field access crossing was designed to pass the 10-year flood and with stone reinforcing to accommodate overtopping during large floods. (See attached concept design plans.)

Table 1: Summary of Hydrology Calculations

Drainage Location	Total Drainage Area (Acres)	Impervious Area (%)	WQv for Total Drainage Area (Cubic Feet)	Channel Protection Volume, CPv (Cubic Feet)	10-yr Volume (Cubic Feet)	Treatment Volume (Cubic Feet)	Treatment Volume (%)
To Thorp Brook	17.3	12.0	9,922	48,010	99,046	2,300	24% of WQv

## Cost

Construction and engineering oversight is estimated to cost \$34,196. Two Fiscal Year 2017 VTrans Better Back Roads grants were applied for and received by the Town to complete this project. The 20% grant match includes funds from the Town Highway budget and a perpetual 10-foot grass filter strip on the edge of the agricultural field to be managed by the Mack Farm.

# AHEAD OF THE STORM

## EXISTING CONDITIONS SUMMARY

Location: East Thompson Point Road, Charlotte, Vermont



### Site Description

The swale along the north side of East Thompson Point Road at the Mack Farm field collects runoff from 17.3 acres including portions of East Thompson Point and Greenbush Roads, residential properties, and portions of two farms (Figure 1). Stormwater runoff has occasionally spilled out of the swales and caused erosion in the adjacent farm field. This project will improve water quality and flood resiliency.

### Drainage Patterns

Water generally flows from northwest to southeast from Greenbush Road across farm lands to Thorp Brook.

Swales have been created bordering farm field that intercept water and direct it along the west and south sides of the Mack farm field. The swale along East Thompson Point road is in the Town road right-of-way.

The swales around the field are not adequate to carry runoff all of the time, especially when they are filled with snow and ice, causing runoff to exit the swales and travel across the farm fields leading to erosion. The swale size was previously constrained by both town-owned trees in the ROW that have now been moved, and the agricultural use of the field. Both swales are partially vegetated with grass and have some exposed soils.

The road swale is crossed by a field access where water flows through a 12-inch corrugated metal pipe. The swale has a slope of 1.8% to the west of the field access and between 4.3 and 5.5 % to the east of the field access.

Runoff from other portions of the Mack field travel down a steep terrace to Thorp Brook at multiple other locations. Gully erosion is occurring at some of the flow paths. This gully erosion should be further investigated as a future potential project.

### Site Constraints

Trees previously located in the road ROW have been moved to a different location and are no longer a site constraint.

Soils along the road swale are Enosburg and Whatley soils that are not highly erodible. The soils have a Hydrologic Soil Group of C, indicating that infiltration potential is limited. Soils along the north-south swale are Vergennes clay and are potentially highly erodible. The soils have a Hydrologic Soil Group of C, indicating that the infiltration potential is limited.

The agricultural use of the field is currently to the edge of the swale. The field has been planted with a cover crop that is to remain for a minimum of 5 years.

Plowed snow and converted ice pack now fill the swale in late winter and early spring and will need a location to be stored to keep the swale functioning property during spring rains when most of the ground is frozen.

### Possible Treatment Options Identified

1. Improve swales around the field to increase capacity, slow velocity, create inline storage, and provide sediment retention.
2. Create a naturally vegetated buffer between the active farm field and the edge of the road swale.
3. Discuss snow storage with the Town Road Foreman to reduce ice and snow clogging of road swale.
4. Create a bioretention area at the end of the road swale prior to water entering Thorp Brook.
5. Manage agricultural use of field to reduce concentration of flow at field edges.
6. Adjust farm practices to reduce rutting of field.

Ahead of the Storm  
Existing Conditions Photo Documentation Summary  
East Thompson Point Road, Charlotte, Vermont



*Figure 1: Runoff from Greenbush Road and homes on the far side of the road travels through the adjacent farm fields to Mack's farm field.*



*Figure 3: A swale runs from north to south along the west edge of the Mack's farm field, carrying water to the East Thompson Point Road swale.*



*Figure 2: Runoff from fields and Greenbush Road travel through farm fields down to the site.*



*Figure 4: The swale from the north turns sharply to the east, joining the East Thompson Point Road swale.*

Ahead of the Storm  
Existing Conditions Photo Documentation Summary  
East Thompson Point Road, Charlotte, Vermont



*Figure 5: Rill erosion has occurred in the Mack farm field when water in the swale traveling from the north leaves the swale and cuts across the field to the road swale.*



*Figure 7: The Mack farm field is harvested close to the edge of the swale. The trees in this photo have been moved.*

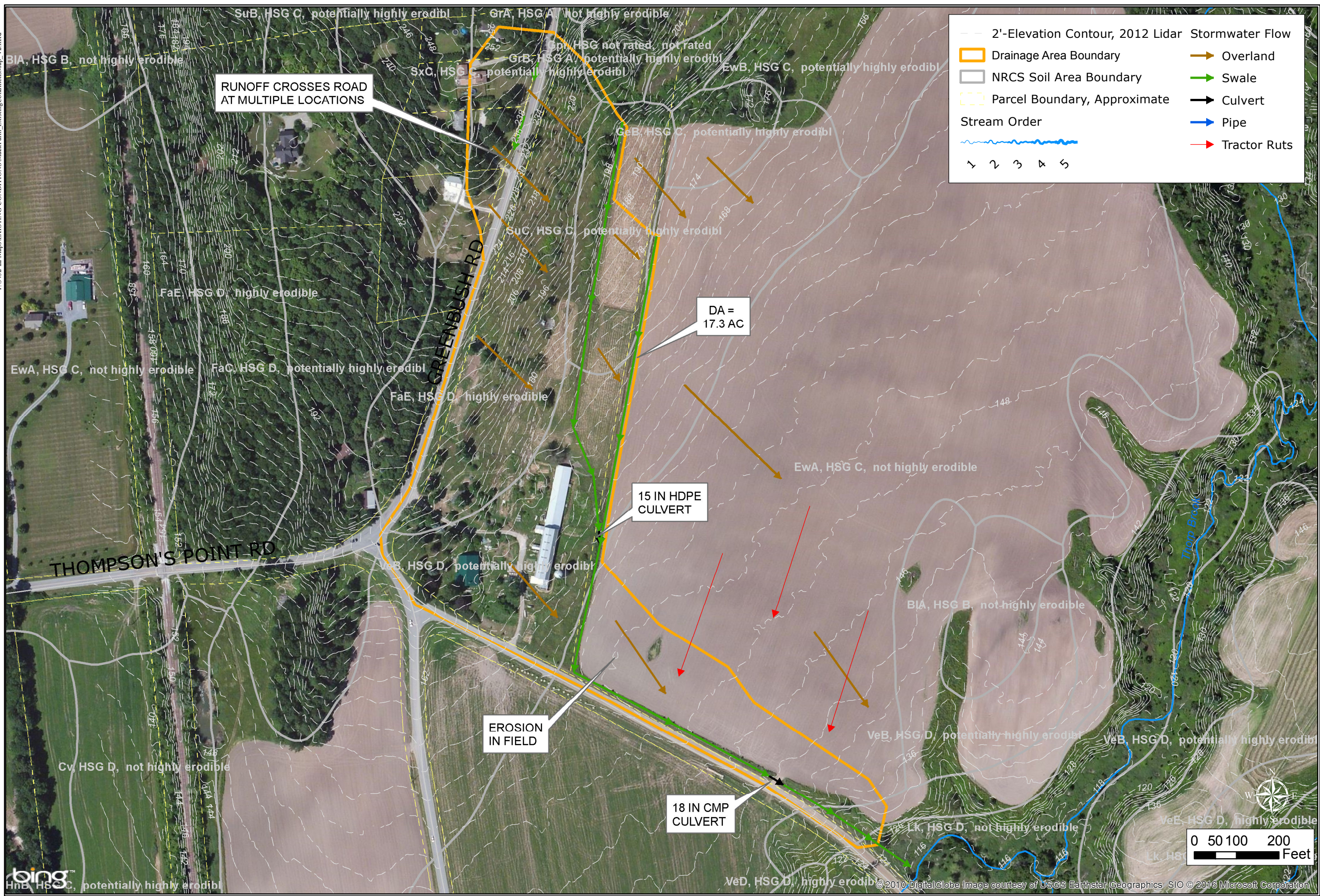


*Figure 6: A vegetated swale travels along East Thompson Point Road. The trees in this photo have been moved.*



*Figure 8: Possible location of a bioretention area adjacent to East Thompson Point Road, prior to water entering Thorp Brook*

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RUNOFF CROSSES ROAD AT MULTIPLE LOCATIONS

DA = 17.3 AC

15 IN HDPE CULVERT

EROSION IN FIELD

18 IN CMP CULVERT

2'-Elevation Contour, 2012 Lidar

Stormwater Flow

- Drainage Area Boundary
- NRCS Soil Area Boundary
- Parcel Boundary, Approximate
- Stream Order

- Overland
- Swale
- Culvert
- Pipe
- Tractor Ruts

1 2 3 4 5

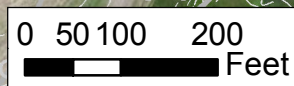
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**SOURCE(S):**  
 2012 LIDAR 2 FT CONTOURS, VCGI  
 BING AERIAL  
 NRCS SOIL MAPPING  
 MMI FIELD DATA

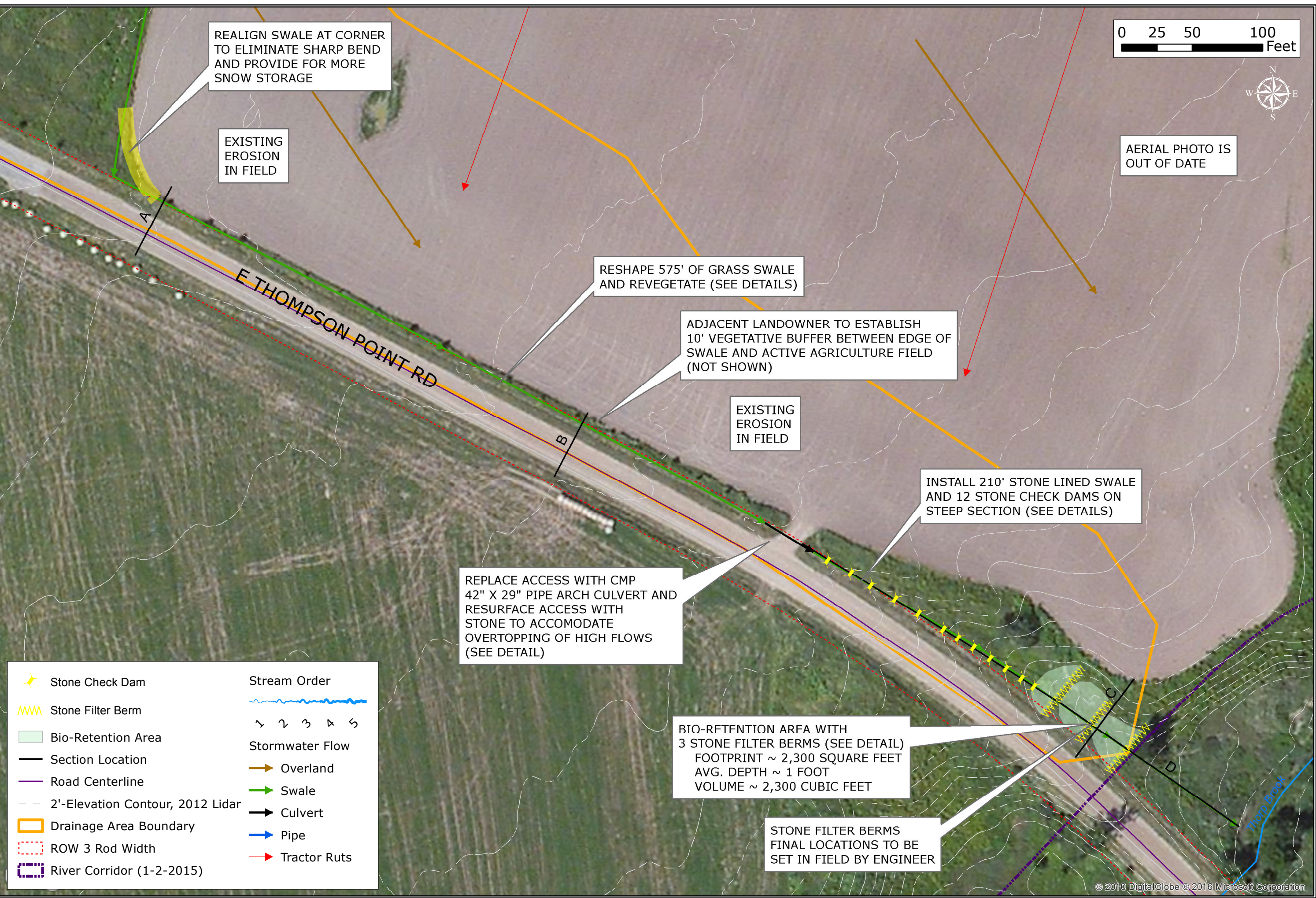
**EXISTING CONDITIONS**  
**AHEAD OF THE STORM**  
**THORP BROOK HEADWATERS RESTORATION**  
 EAST THOMPSON POINT ROAD  
 CHARLOTTE, VERMONT

**CONCEPT DESIGN**

Map By: JCL  
 MMI #: 3452-22  
 MXD:  
 1st Version: 4/8/2016  
 Revision:  
 Scale: 1"=200'



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REALIGN SWALE AT CORNER TO ELIMINATE SHARP BEND AND PROVIDE FOR MORE SNOW STORAGE

EXISTING EROSION IN FIELD

RESHAPE 575' OF GRASS SWALE AND REVEGETATE (SEE DETAILS)

ADJACENT LANDOWNER TO ESTABLISH 10' VEGETATIVE BUFFER BETWEEN EDGE OF SWALE AND ACTIVE AGRICULTURE FIELD (NOT SHOWN)

EXISTING EROSION IN FIELD

INSTALL 210' STONE LINED SWALE AND 12 STONE CHECK DAMS ON STEEP SECTION (SEE DETAILS)

REPLACE ACCESS WITH CMP 42" X 29" PIPE ARCH CULVERT AND RESURFACE ACCESS WITH STONE TO ACCOMODATE OVERTOPPING OF HIGH FLOWS (SEE DETAIL)

BIO-RETENTION AREA WITH 3 STONE FILTER BERMS (SEE DETAIL) FOOTPRINT ~ 2,300 SQUARE FEET AVG. DEPTH ~ 1 FOOT VOLUME ~ 2,300 CUBIC FEET

STONE FILTER BERMS FINAL LOCATIONS TO BE SET IN FIELD BY ENGINEER

0 25 50 100 Feet



AERIAL PHOTO IS OUT OF DATE

- Stone Check Dam
- Stone Filter Berm
- Bio-Retention Area
- Section Location
- Road Centerline
- 2'-Elevation Contour, 2012 Lidar
- Drainage Area Boundary
- ROW 3 Rod Width
- River Corridor (1-2-2015)
- Stream Order
- Stormwater Flow
- Overland
- Swale
- Culvert
- Pipe
- Tractor Ruts

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**SOURCE(S):**  
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 VCGI 2013 15 CM CHITTENDEN  
 COUNTY IMAGERY  
 MMI FIELD DATA

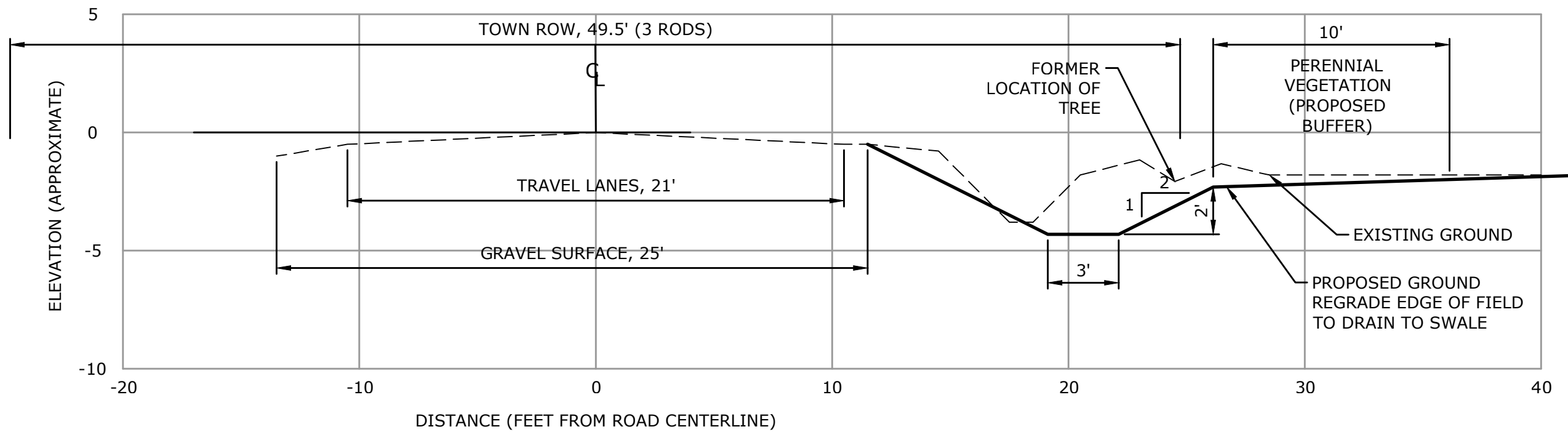
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**AHEAD OF THE STORM**  
**THORP BROOK HEADWATERS RESTORATION**  
 EAST THOMPSON POINT ROAD  
 CHARLOTTE, VERMONT

**CONCEPT DESIGN**

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 MXD:  
 1st Version: 4/8/2016  
 Revision:  
 Scale: 1"=60'

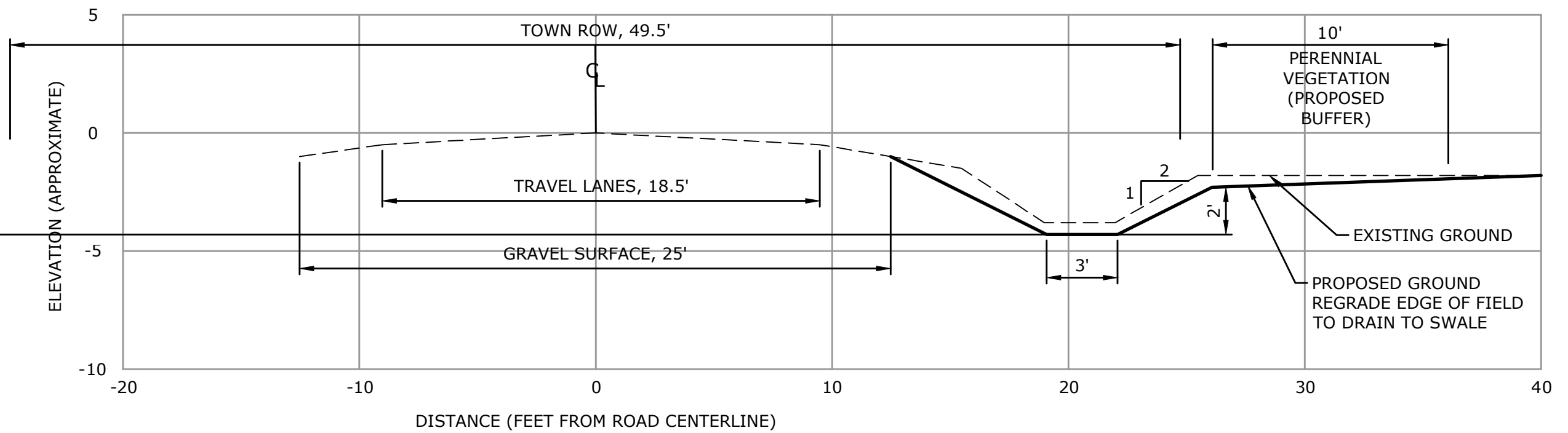
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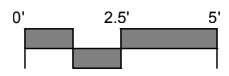
**ROAD CROSS SECTION - A**

SCALE: 1"=5'



**ROAD CROSS SECTION - B**

SCALE: 1"=5'



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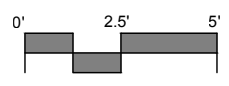
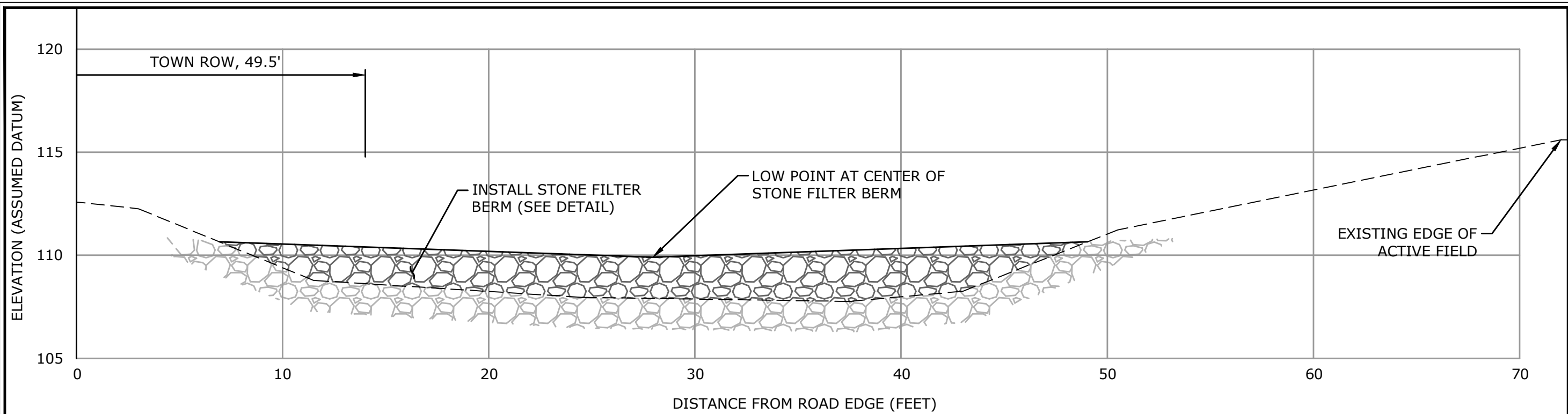
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DETAILS - ROAD CROSS SECTIONS  
 AHEAD OF THE STORM  
 THORP BROOK HEADWATER RESTORATION  
 EAST THOMPSON POINT ROAD  
 CHARLOTTE, VERMONT

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DATE 4/8/2016		
PROJECT NO. 3452-22		

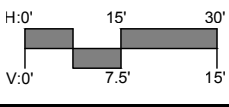
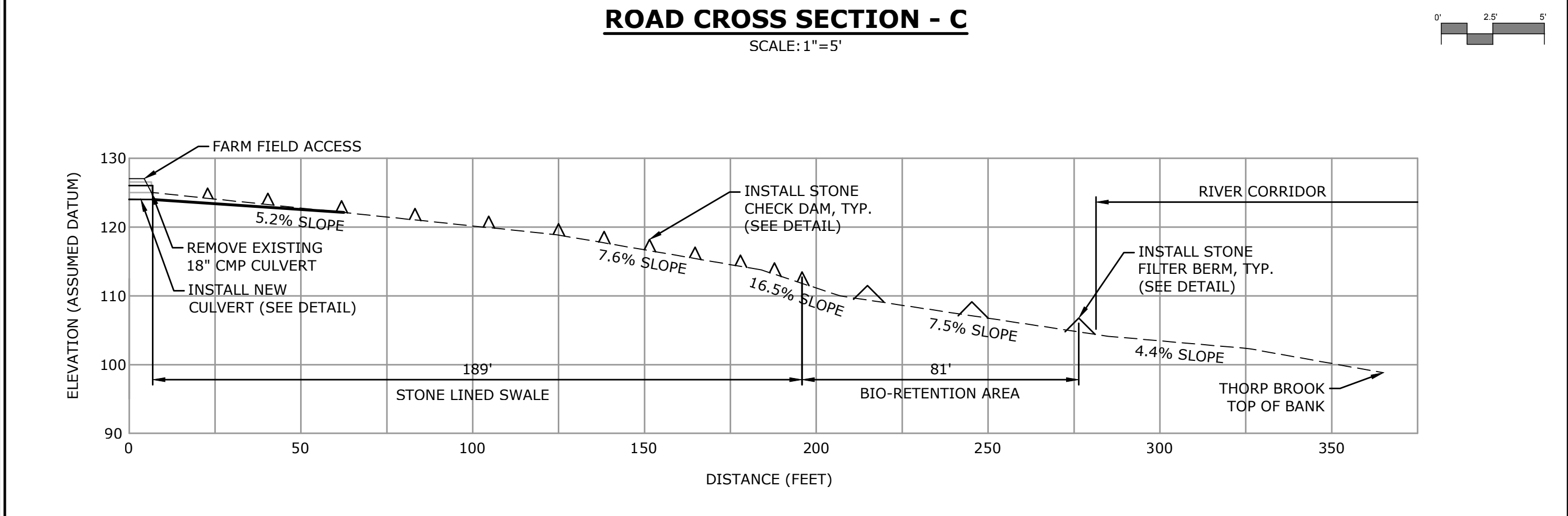
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REVISIONS  
 CONCEPT DESIGN

**DETAILS - SECTION AND PROFILE**  
 AHEAD OF THE STORM  
 THORP BROOK HEADWATER RESTORATION  
 EAST THOMPSON POINT ROAD  
 CHARLOTTE, VERMONT

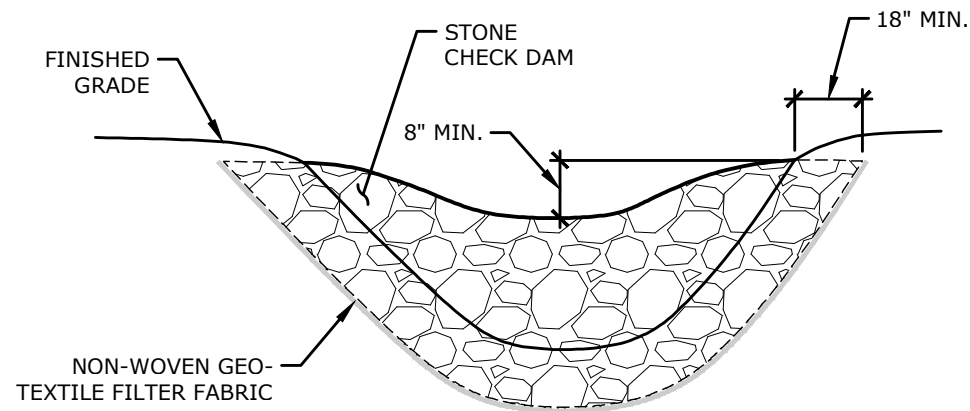
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PROJECT NO. 3452-22		

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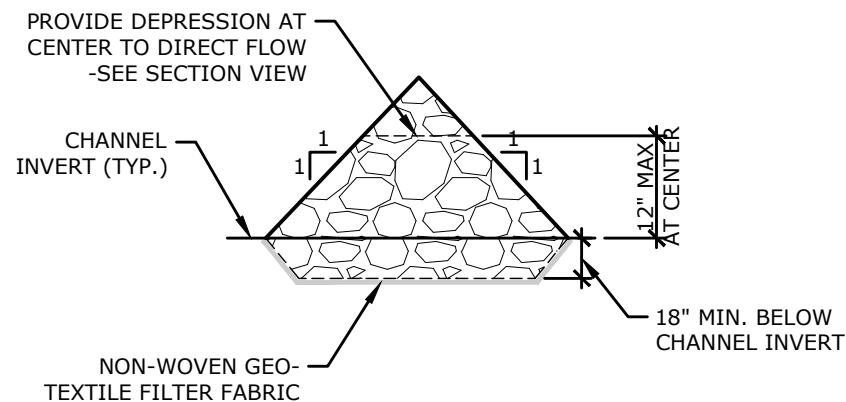
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**SECTION VIEW**



**ELEVATION VIEW**

**NOTES:**

EXTEND THE STONE A MINIMUM OF 18 INCHES BEYOND THE BANKS AND CHANNEL INVERT OF THE SWALE TO PREVENT CUTTING AROUND THE ENDS OF OR UNDERNEATH THE CHECK DAM

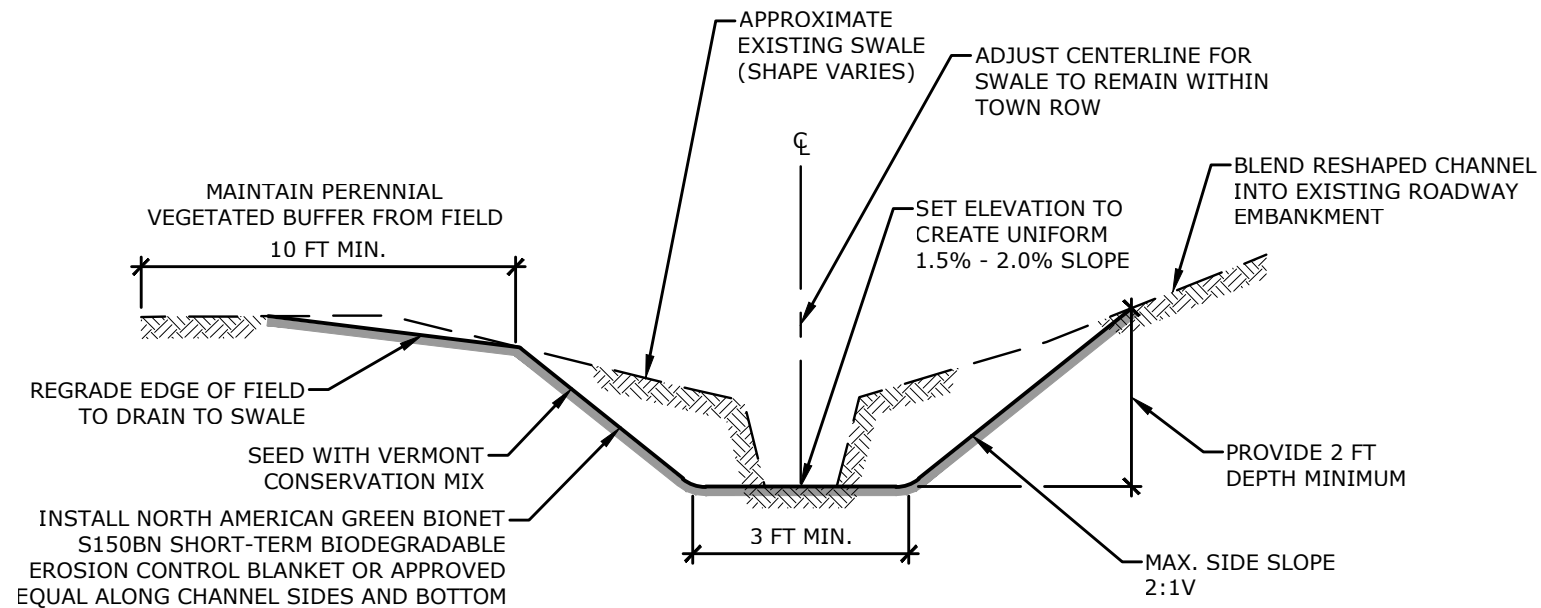
USE TYPE II STONE FILL (D50=12") OR 6"-12" EROSION STONE AS PER PIKE INDUSTRIES, NEW HAVEN, VT

USE CONTECH GEOTEX 801 NON-WOVEN GEOTEXTILE FILTER FABRIC OR APPROVED EQUAL ALONG THE BOTTOM OF THE CUTOFF TRENCH AS A FILTER

FINAL LOCATION OF CHECK DAMS TO BE DETERMINED BY ENGINEER IN FIELD. PLACE TO MATCH ELEVATION OF DOWNSTREAM DAM TO BASE OF UPSTREAM DAM.

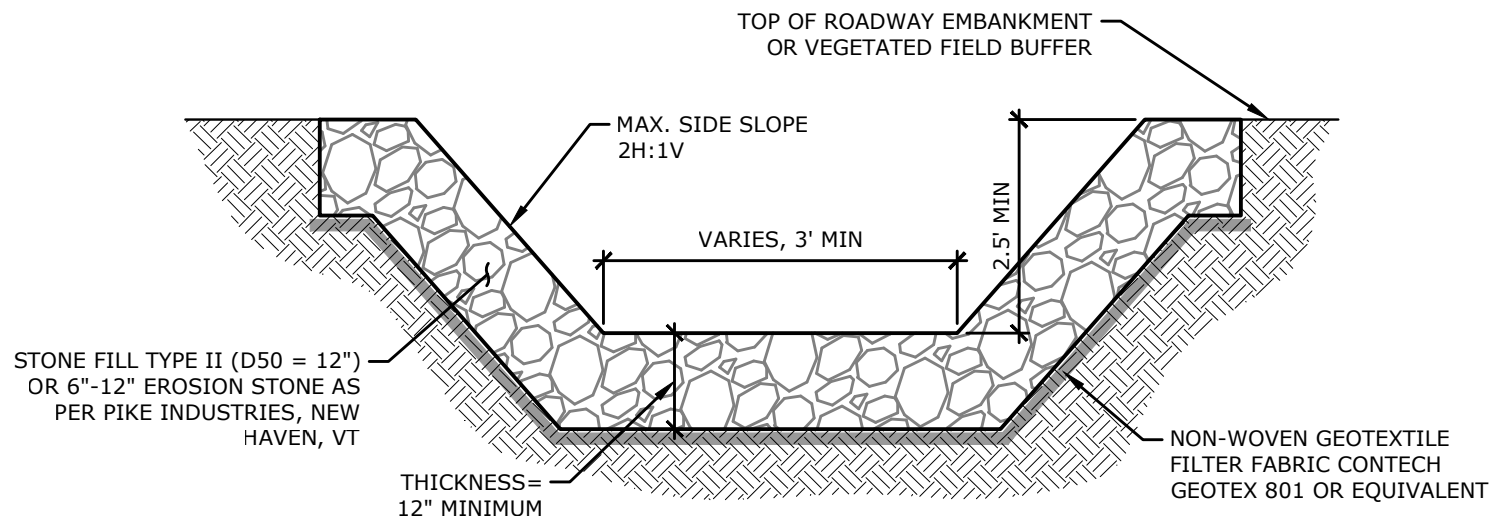
**STONE CHECK DAM**

NOT TO SCALE



**RESHAPED GRASS SWALE**

NOT TO SCALE



**STONE LINED SWALE**

NOT TO SCALE

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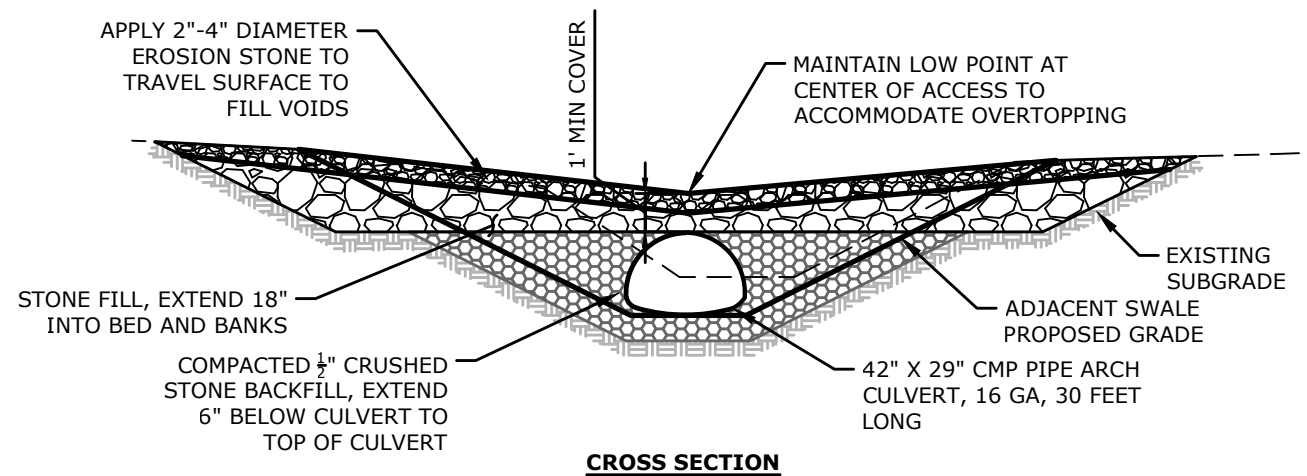
CONCEPT DESIGN

**DETAILS**  
 AHEAD OF THE STORM  
 THORP BROOK HEADWATER RESTORATION  
 EAST THOMPSON POINT ROAD  
 CHARLOTTE, VERMONT

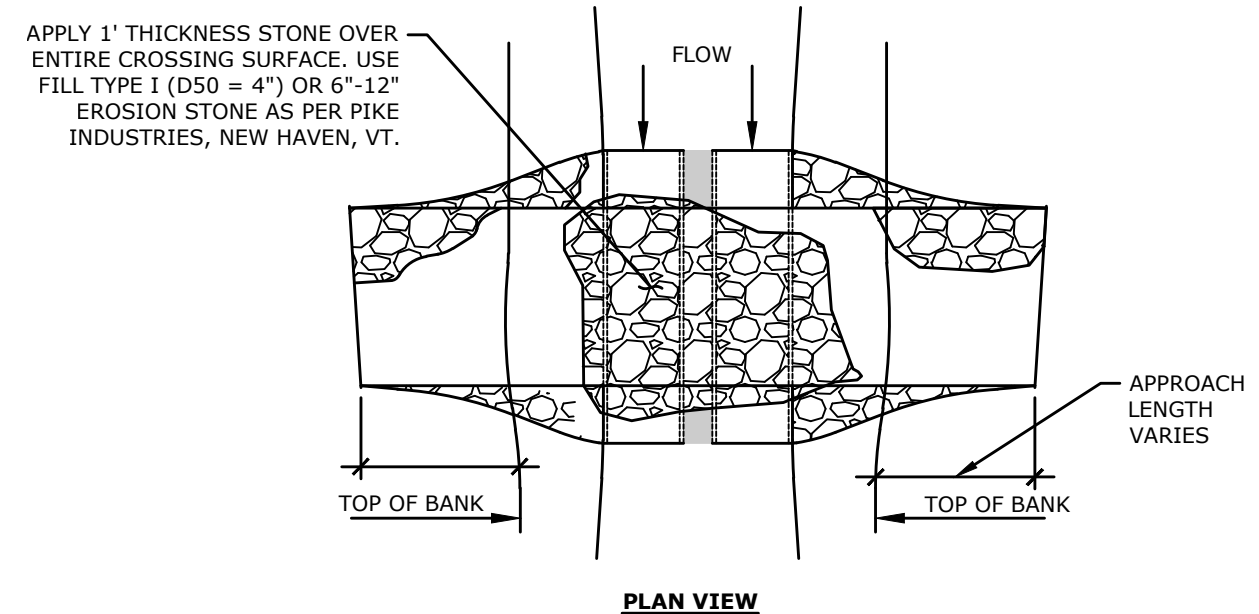
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PROJECT NO. 3452-22		

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**CROSS SECTION**



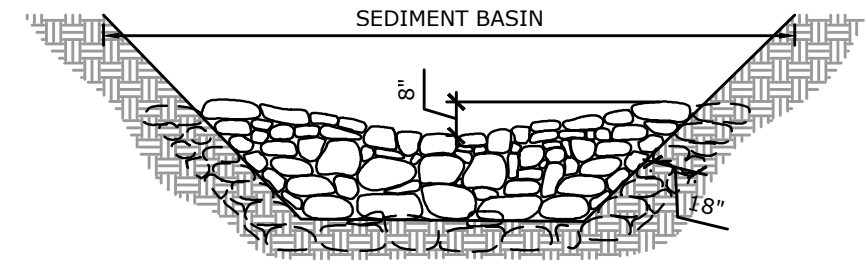
**PLAN VIEW**

**FIELD ACCESS CULVERT**

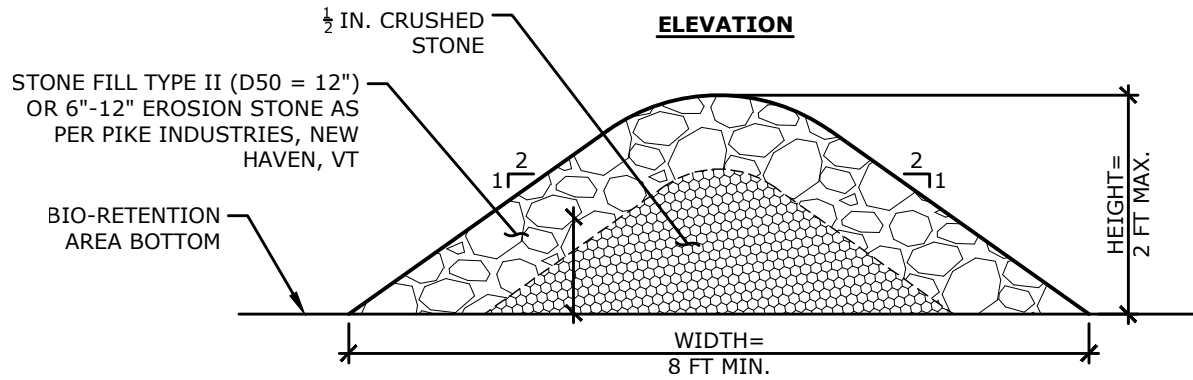
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**OPERATION AND MAINTENANCE NOTES**

1. THE CONCEPTUAL STORMWATER PLAN HAS BEEN DESIGNED TO MINIMIZE MAINTENANCE TO THE SYSTEM AND ONLY REQUIRE MAINTENANCE THAT CAN EASILY BE COMPLETED.
2. PERIODICALLY, INCLUDING AFTER LARGE STORMS AND REGULARLY DURING THE FALL, REMOVE LEAVES AND DEBRIS ACCUMULATED AT THE CULVERT AND AT FILTER BERMS.
3. THE ACCUMULATION OF SEDIMENT WITHIN THE BIO-RETENTION AREA SHOULD BE MONITORED AND INSPECTED A MINIMUM OF ONCE ANNUALLY. REMOVE SEDIMENT AFTER APPROXIMATELY 12 INCHES OF SEDIMENT HAS ACCUMULATED.
4. SWALES ARE EXPECTED TO REQUIRE RESHAPING AND REMOVAL OF SEDIMENT APPROXIMATELY EVERY 5 TO 10 YEARS.
5. THE BIO-RETENTION AREA, FILTER BERMS, AND SWALES CAN BE MOWED OR BRUSH-HOGGED AT THE END OF EACH GROWING SEASON.
6. MAINTENANCE OF THE SYSTEM SHOULD ONLY OCCUR DURING LOW FLOW AND IN THE GROWING SEASON AFTER SPRING RUNOFF.
7. RESEEDING OF THE SPECIFIED SEED MIX SHOULD OCCUR AFTER REMOVAL OF SEDIMENT FROM THE BIO-RETENTION AREA OR RESHAPING OF SWALES.



**ELEVATION**



**CROSS SECTION**

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

**STONE FILTER BERM**

NOT TO SCALE

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**DETAILS**  
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 THORP BROOK HEADWATER RESTORATION  
 EAST THOMPSON POINT ROAD  
 CHARLOTTE, VERMONT

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SHEET NO.  
**06**

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**BALLPARK OPINION OF PROBABLE CONSTRUCTION COST**  
**THORP BROOK HEADWATER RESTORATION**  
**EAST THOMPSON POINT ROAD**  
**SWALE IMPROVEMENTS**  
**Charlotte, Vermont**  
MMI #3452-22  
April 8, 2016



Item	ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
	<b>LABOR</b>				
	Labor to Restore Site	HR	18	\$35	\$630
	<b>EQUIPMENT</b>				
	Grade Edge of Field (Assume by Landowner)	LS	0	\$0	\$0
	Excavator for 575' Grass Swale, Realign at Corner	HR	15	\$110	\$1,650
	Truck for 575' Grass Swale and Realign at Corner	HR	10	\$80	\$800
	Excavator for 210' Stone Lined Swale, Check Dams	HR	21	\$110	\$2,310
	Truck for 210' Stone Lined Swale, Check Dams	HR	16	\$80	\$1,280
	Excavator to Install Access	HR	4	\$110	\$440
	Truck to Install Access	HR	4	\$80	\$320
	Haul Materials to Site (Pike Industries, 1.5 hr round trip)	HR	38	\$80	\$3,040
	<b>MATERIALS</b>				
	Stone for Stone Lined Swale	TN	256	\$10	\$2,560
	Stone for Stone Check Dams	TN	56	\$10	\$560
	Stone for Access	TN	56	\$10	\$560
	Gravel for Access	TN	32	\$19	\$608
	Pipe Arch Culvert	LS	1	\$1,749	\$1,749
	Seed for Bio-Retention Area and Swale	LS	1	\$75	\$75
	Temporary Erosion Matting	ROLL	16	\$95	\$1,520
	Staples to Install Temporary Erosion Matting	BOX	3	\$66	\$198
	<b>MISCELLANEOUS</b>				
	Engineering Oversight	LS	1	\$1,700	\$1,700
	<b>TOTAL</b>				<b>\$20,000</b>

**BALLPARK OPINION OF PROBABLE CONSTRUCTION COST**  
**THORP BROOK HEADWATER RESTORATION**  
**EAST THOMPSON POINT ROAD**  
**BIO-RETENTION AREA**  
**Charlotte, Vermont**  
MMI #3452-22  
April 8, 2016



Item	ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
	LABOR				
	Labor to Restore Site	HR	6	\$35	\$210
	EQUIPMENT				
	Excavator for 3 Stone Filter Berms	HR	24	\$110	\$2,640
	Truck for 3 Stone Filter Berms	HR	16	\$80	\$1,280
	Haul Materials to Site (Pike Industries, 1.5 hr round trip)	HR	35	\$80	\$2,800
	MATERIALS				
	Stone for Stone Filter Berm	TN	160	\$10	\$1,600
	Gravel for Stone Filter Berm	TN	205	\$19	\$3,895
	Seed for Bio-Retention Area and Swale	LS	1	\$25	\$25
	Temporary Erosion Matting	ROLL	4	\$95	\$380
	Staples to Install Temporary Erosion Matting	BOX	1	\$66	\$66
	MISCELLANEOUS				
	Engineering Oversight	LS	1	\$1,300	\$1,300
	<b>TOTAL</b>				<b>\$14,196</b>