

AHEAD OF THE STORM

Site: Du Brul Residence

Location: 845 Greenbush Road, Charlotte, Vermont



Primary Problem

The Du Brul residence on Greenbush Road in Charlotte experiences water damage at their garage and front house entrance. Currently runoff from the road, adjacent property, driveway, and front yard collect near the house. Stormwater then travels South and discharges to Holmes Creek. The property owner has previously taken initial steps toward implementing stormwater treatment in front of the home. This project has advanced a concept design prepared by Landscape Design Inc. to final design with the goal to capture and treat stormwater runoff, protect water quality, and reduce the potential for flood damage at the house. The landowner is choosing to treat roadside and local runoff using green infrastructure techniques instead of increasing swale capacity and passing the water further down the road. *(See existing conditions site summary and plan.)*

Two Optimal Conservation Practices (OCPs) are recommended to treat runoff from a portion of the existing impervious cover. The primary goal is to improve water quality protection by slowing runoff, reducing erosion, and enhancing vegetation. This project will begin to reverse the cumulative impacts from incremental development within the Holmes Creek watershed where past water quality sampling results show high turbidity, nitrogen, and phosphorus levels in the stream.

Final Treatment Recommendations

1. Create a bio-retention area in the front lawn to treat existing impervious surfaces to slow runoff, increase storage, retain sediment, promote infiltration, and redirect flow away from the house and garage.
2. Reshape the roadside swale to pre-treat stormwater prior to entering the bio-retention area, slow runoff, improve vegetation, and increase available storage.

Site Constraints and Design Basis

The design maximizes treatment while largely maintaining mature fruit trees, avoiding underground utilities, and reducing maintenance needs. A simple percolation test indicated an estimated infiltration rate of 1-2 inches per hour, eliminating the need for an underdrain. Runoff calculations indicate that the bio-retention area in the entrance island will treat the 1-inch rain storm (i.e., the Water Quality Volume – WQv) produced from impervious surface at the residence (Table 1). The system has been designed to accommodate roadside runoff from a portion of Greenbush Road and the adjacent property. The outlet of the bio-retention will safely pass larger storm events and dissipate water beyond the house. The design minimizes long-term maintenance needs and costs. *(See attached concept design plans, including operation and maintenance notes.)*

Table 1: Summary of Hydrology Calculations

Drainage Location	Total Drainage Area (Acres)	Drainage Area on the Site (Acres)	Impervious Area on the Site (%)	WQv Generated on the Site (Cubic Feet)	Treatment Volume (Cubic Feet)	Treatment Volume (%)
Du Brul Property	5.0	1.0	9	476	630	130% of WQv

Cost

Construction costs for the recommended OCPs are estimated to be \$16,800. *(See attached cost estimate.)*

AHEAD OF THE STORM

Existing Conditions Site Summary

Site: Du Brul Residence

Site Description

The Du Brul residence on Greenbush Road in Charlotte experiences water damage at their garage and front house entrance. Currently runoff from the road, adjacent property, driveway, and front yard collect near the house (Figure 1). The property owner has already taken initial steps toward implementing stormwater treatment in front of the home. A survey and concept sketch have been completed for a raingarden at the north side of the driveway (See the attached plan “Existing Conditions Plan, Du Brul Property” by Krebs & Lansing, 8/27/2015). This project will advance the concept design to with the goal to capture and treat stormwater runoff, protect water quality, and improve flood resiliency.

Drainage Patterns

The property is graded so that runoff flows to a low spot in front of the garage and then travels to the east around the north side of the garage. The grades are mild such that drainage patterns change when snow and ice buildup reduces drainage to the east temporarily threatening the home while water ponds in front of the garage. Water leaving this property drains east to Holmes Brook.

A mowed grass swale exists along the east side of Greenbush Road that collects runoff from the north and directs some water into the driveway for a total drainage area of 0.6 acres. A shallow swale also exists along the northern edge of the subject property near the treeline.

Site Constraints

The site is flat (slope $\sim 0.5\%$). The garage and area in front of the home are lower than the elevation of the road, likely due to plowing and settling from car traffic.

The soil in front of the home is a fine sandy loam. The Hydrologic Soil Group is C, with limited infiltration potential. Soils may contract and expand during freeze and thaw that could direct water towards the house. Soils are potentially highly erodible.

The property owner would like to keep the mature apple trees along the north side of the property. The property owner maintains a play area at the north side of the garage that they would like to maintain.

An underground power line runs from the pole at the north side of the property to the house that may conflict with the potential rain garden location.

Possible Treatment Options Identified

1. Create a bio-retention area on the north side of the driveway to capture runoff and direct the overflow due east into the backyard, away from the house and garage. Complete stormwater calculations to complete the concept design by others.
2. Elevate and grade the driveway to drain into the new bio-retention area and away from the house.

Ahead of the Storm
Existing Conditions Photo Documentation Summary
Du Brul Residence



Figure 1: Runoff from road and adjacent property flows toward the Du Brul property along the road.



Figure 3: The driveway is low and sloped toward the house, so some water flows towards the house and garage.



Figure 2: In front of the Du Brul residence, some water continues down swale along the road.



Figure 4: The driveway slopes toward the house.

Ahead of the Storm
Existing Conditions Photo Documentation Summary
Du Brul Residence



Figure 5: A low spot is located in front of the house and garage.



Figure 7: Water puddles in front of the home.



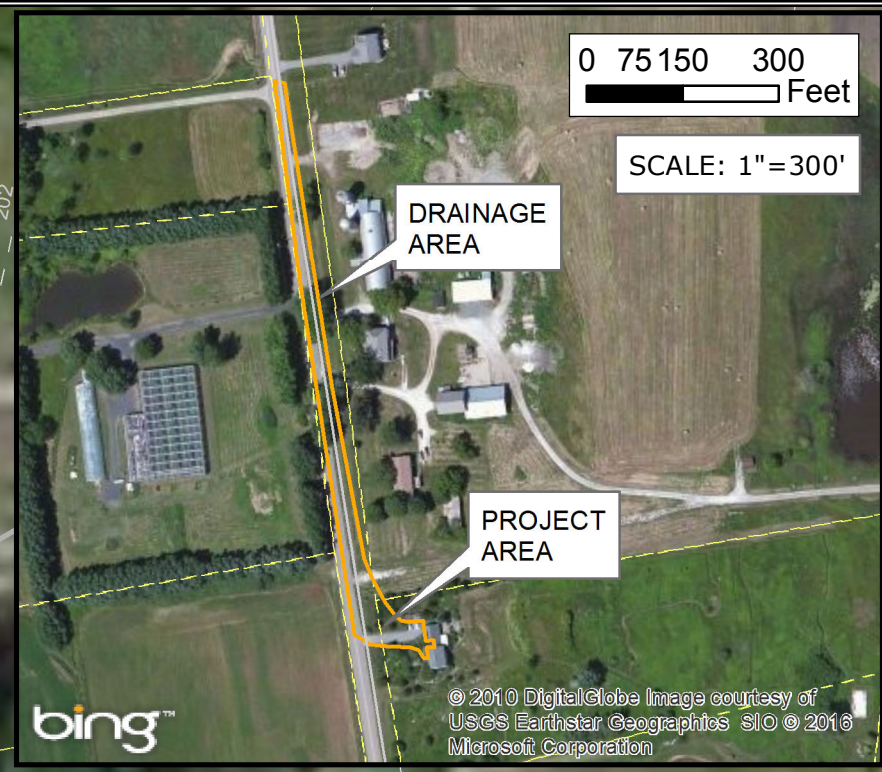
Figure 6: The ground in front of the entryway is low.



Figure 8: A possible bio-retention area has been identified for the area adjacent to the driveway.

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	2'-Elevation Contour, 2009 Lidar		Stormwater Flow
	Drainage Area Boundary		Overland
	NRCS Soil Area Boundary		Swale
	Parcel Boundary, Approximate		Culvert
			Pipe



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

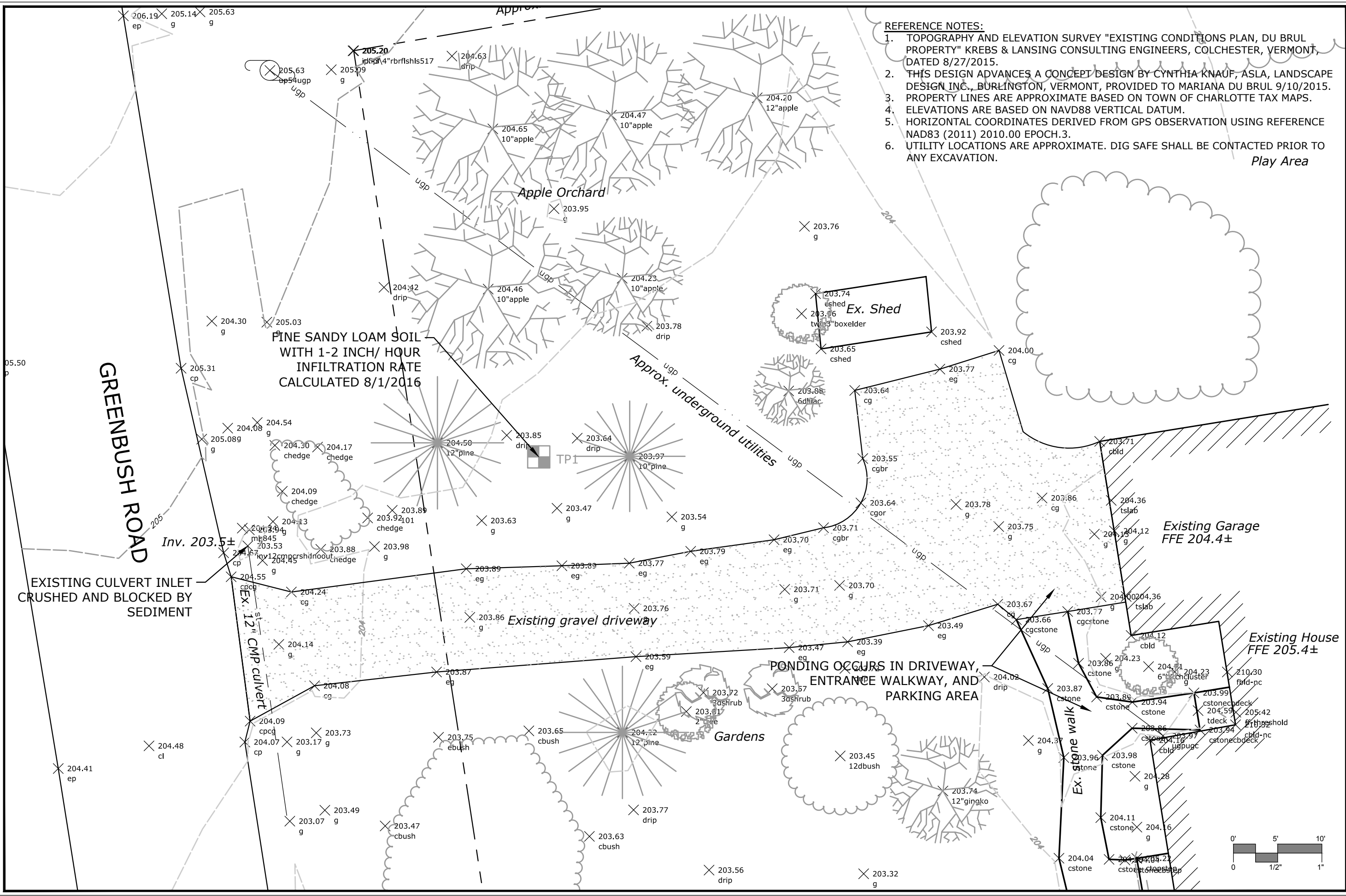
EXISTING CONDITIONS
DU BRUL RESIDENCE
AHEAD OF THE STORM
845 GREENBUSH ROAD
CHARLOTTE, VERMONT

FINAL DESIGN

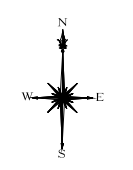
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MMI#: 3452-22
MXD:
1st Version: 3/31/2016
Revision: 9/26/2016
Scale: 1"=40'

01

Plotting by: JESSICA L. On this date: Mon, 26 Sep 2016 3:26pm



- REFERENCE NOTES:**
1. TOPOGRAPHY AND ELEVATION SURVEY "EXISTING CONDITIONS PLAN, DU BRUL PROPERTY" KREBS & LANSING CONSULTING ENGINEERS, COLCHESTER, VERMONT, DATED 8/27/2015.
 2. THIS DESIGN ADVANCES A CONCEPT DESIGN BY CYNTHIA KNAUF, ASLA, LANDSCAPE DESIGN INC., BURLINGTON, VERMONT, PROVIDED TO MARIANA DU BRUL 9/10/2015.
 3. PROPERTY LINES ARE APPROXIMATE BASED ON TOWN OF CHARLOTTE TAX MAPS.
 4. ELEVATIONS ARE BASED ON NAVD88 VERTICAL DATUM.
 5. HORIZONTAL COORDINATES DERIVED FROM GPS OBSERVATION USING REFERENCE NAD83 (2011) 2010.00 EPOCH.3.
 6. UTILITY LOCATIONS ARE APPROXIMATE. DIG SAFE SHALL BE CONTACTED PRIOR TO ANY EXCAVATION.



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FINAL DESIGN

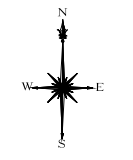
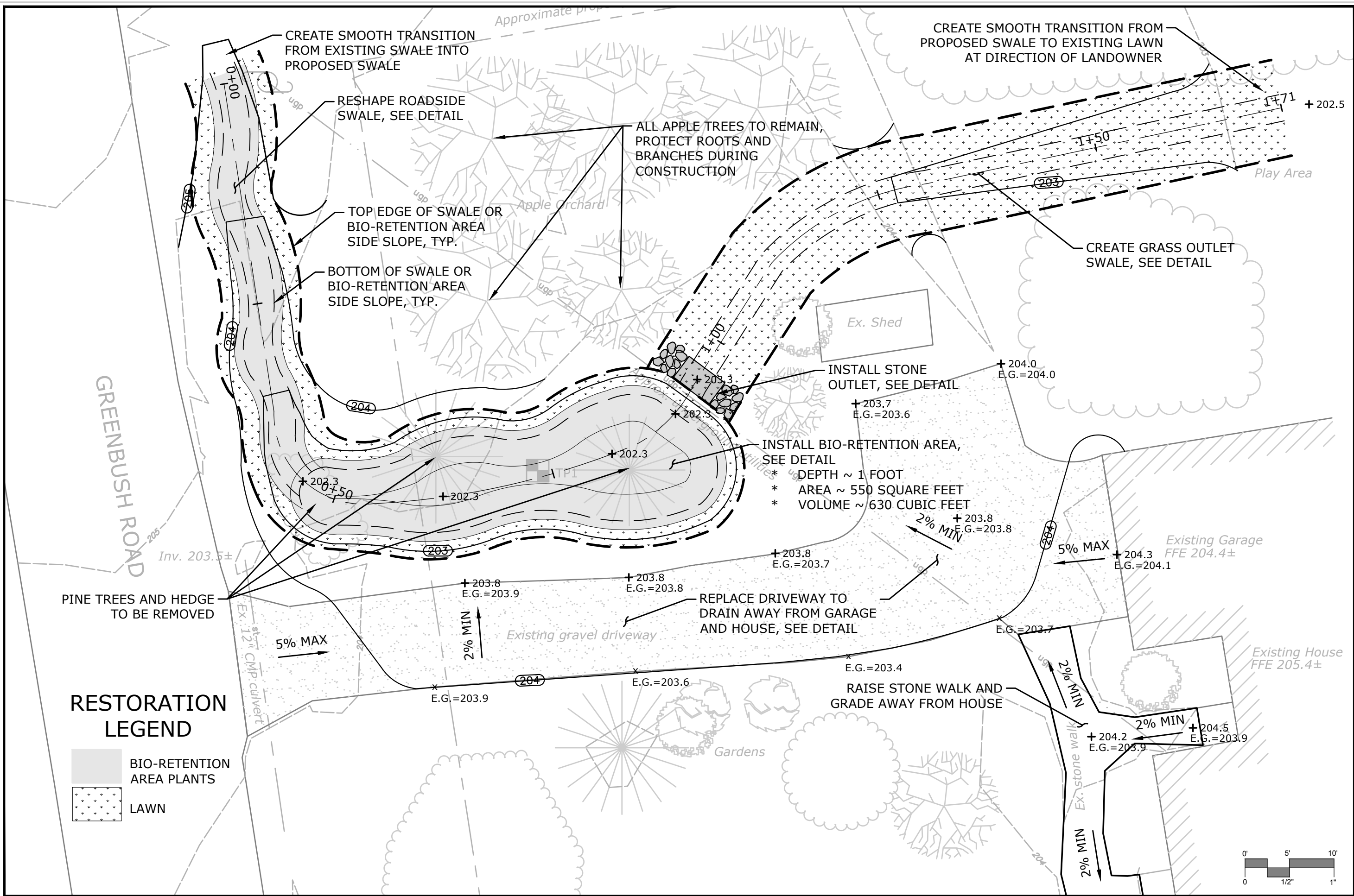
SITE PLAN - EXISTING CONDITIONS
DU BRUL RESIDENCE
AHEAD OF THE STORM
 845 GREENBUSH ROAD
 CHARLOTTE, VT

JCL DESIGNED	JCL DRAWN	RKS CHECKED
SCALE 1"=10'		
DATE 9/26/2016		
PROJECT NO. 3452-22		

02

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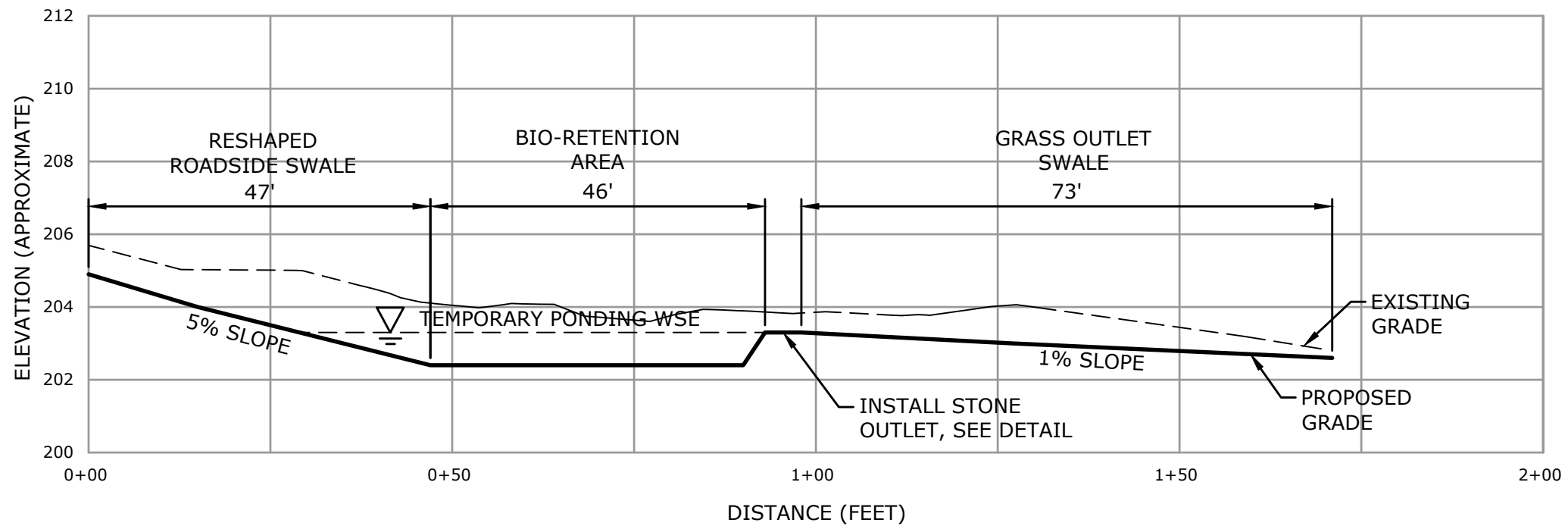
FINAL DESIGN

SITE PLAN - PROPOSED CONDITIONS
 DU BRUL RESIDENCE
 AHEAD OF THE STORM
 845 GREENBUSH ROAD
 CHARLOTTE, VT

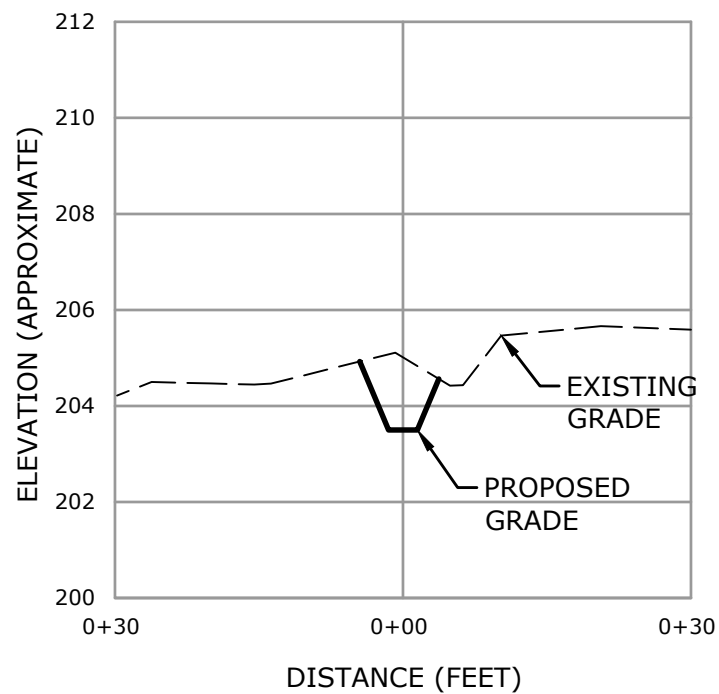
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PROJECT NO. 3452-22		

SHEET NO. **03**

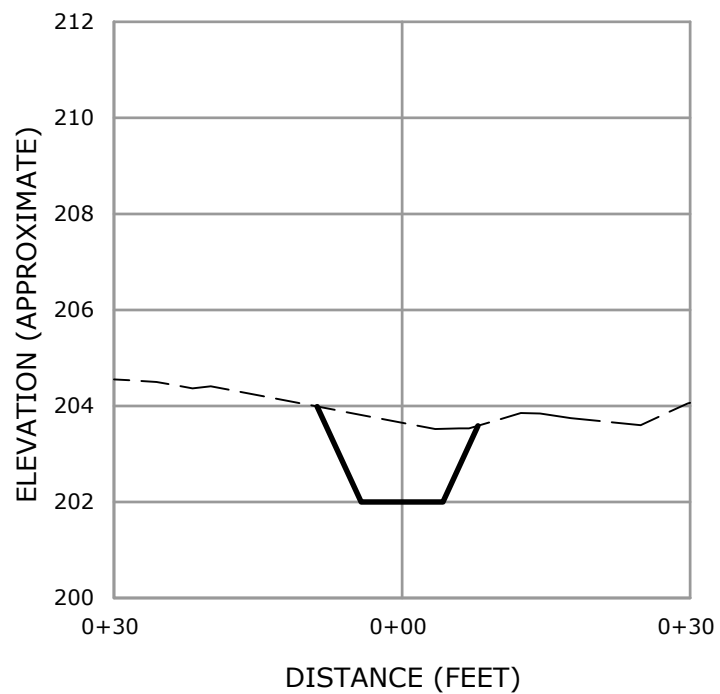
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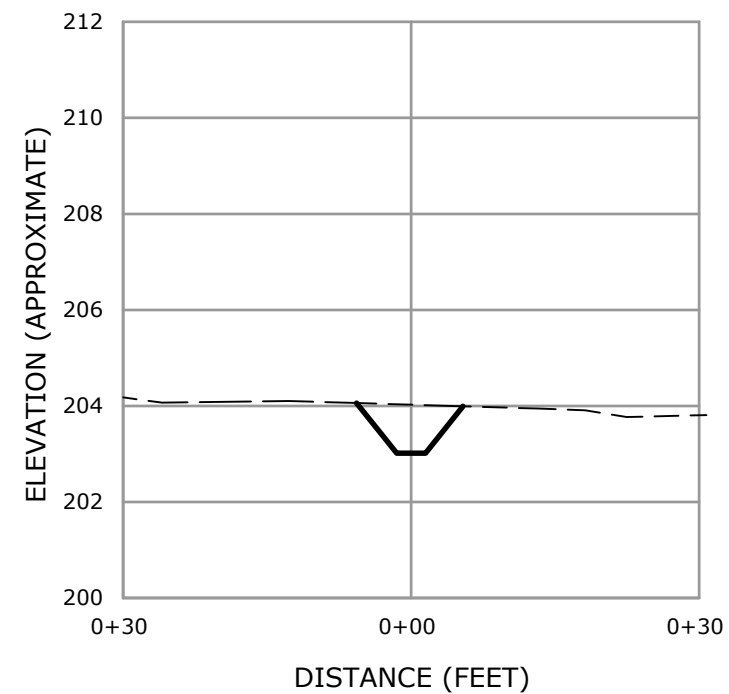
PROFILE



SECTION 0+25



SECTION 0+75



SECTION 1+25

REVISIONS

PROFILE AND CROSS SECTIONS
 DU BRUL RESIDENCE
 AHEAD OF THE STORM
 845 GREENBUSH ROAD
 CHARLOTTE, VERMONT

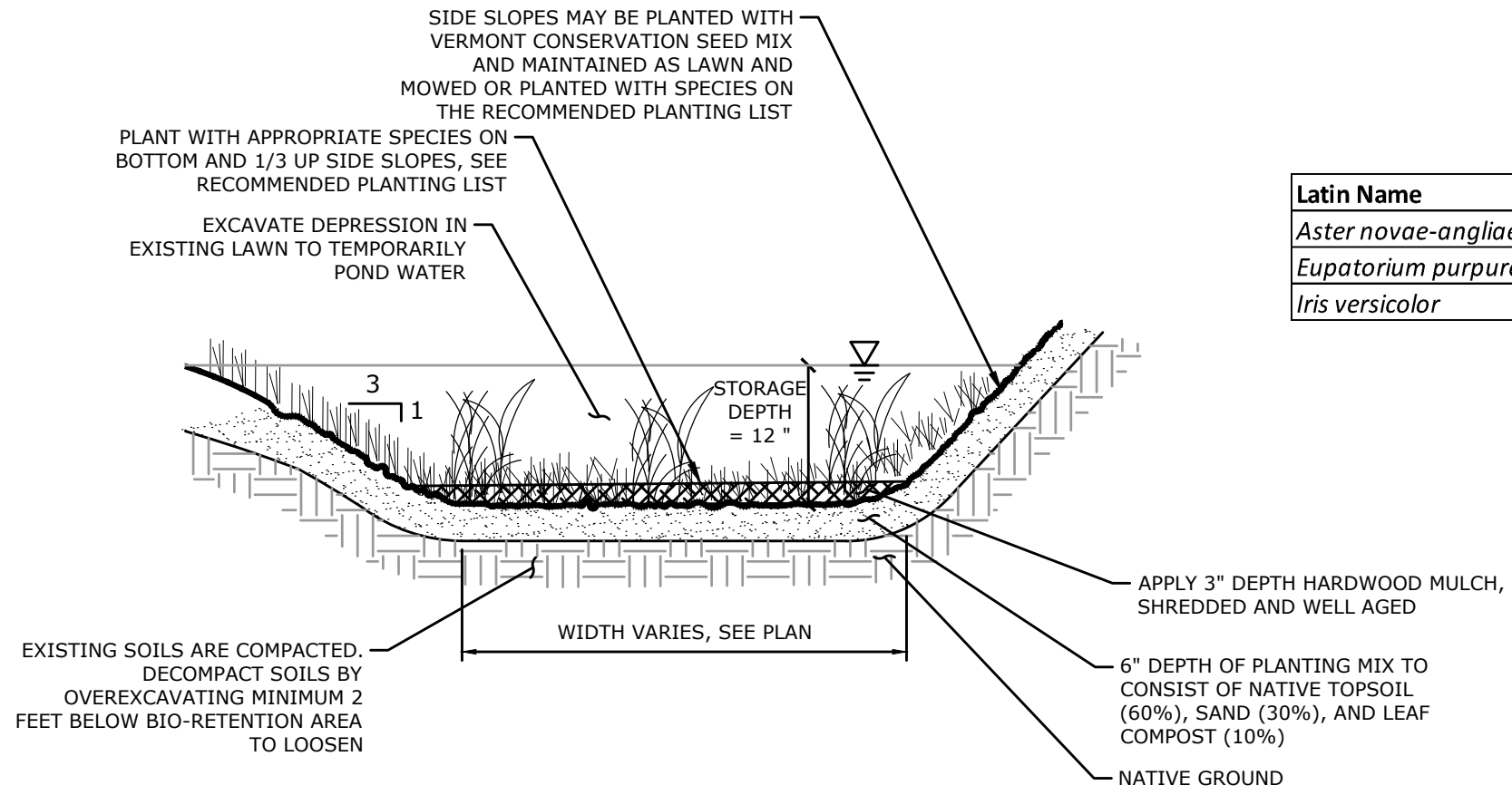
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PROJECT NO. 3452-22		

SHEET NO.
04

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FINAL DESIGN

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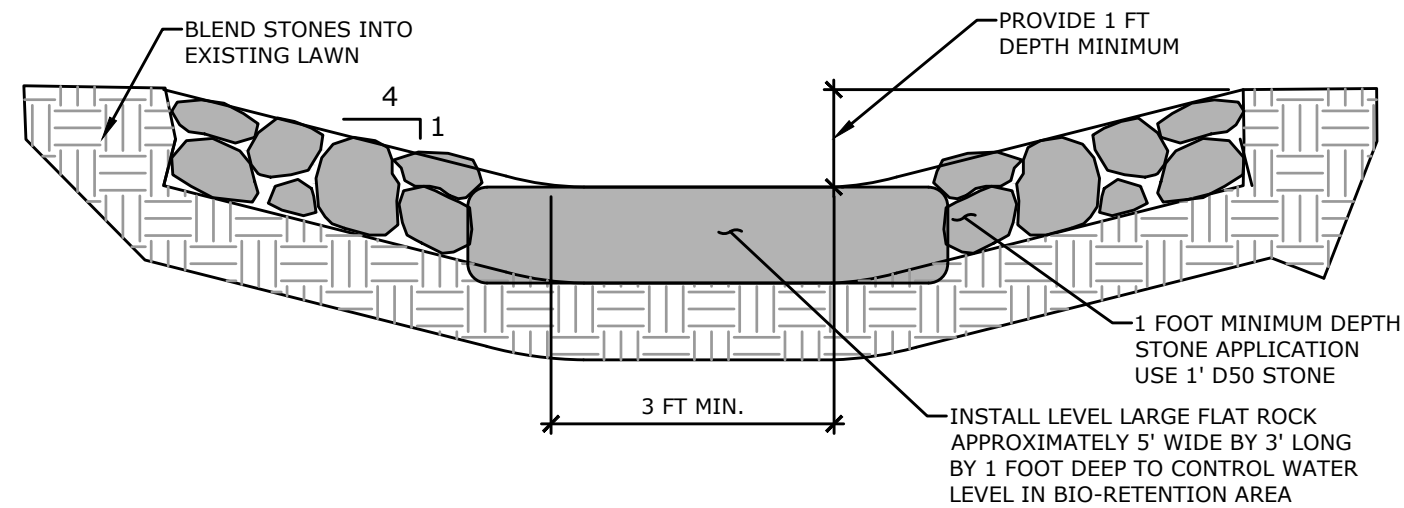
BIO-RETENTION AREA
NOT TO SCALE

Latin Name	Common Name	Mature Height	Comments
<i>Aster novae-angliae</i>	New England Aster	2-6'	Pink-purple flowers
<i>Eupatorium purpureum</i>	Joe-Pye Weed	4-6'	Pink flowers, deer-resistant
<i>Iris versicolor</i>	Blue Flag Iris	2-3'	Blue-violet flowers

RECOMMENDED PLANTING LIST
NOT TO SCALE

- BIO-RETENTION AREA INSTALLATION NOTES:**
1. THE VERMONT RAINGARDEN MANUAL IS A DESIGN GUIDE TO ACCOMPANY THIS PROJECT. ALTERNATIVES TO THE DETAILS PRESCRIBED IN THIS PLAN ARE AVAILABLE IN THAT MANUAL INCLUDING ADDITIONAL APPROPRIATE PLANT SPECIES. THE BIO-RETENTION AREA SHOULD BE PLANTED WITH A MIX OF PERENNIAL VEGETATION.
 2. ENSURE THAT THE FINAL GRADES OF THE BIO-RETENTION AREA DO NOT DIRECT WATER TOWARD THE BUILDINGS OR DRIVEWAY.
 3. PLANTING DENSITIES ARE RECOMMENDED TO BE ONE PERENNIAL EVERY 2.5 FEET ON CENTER OR ONE SHRUB EVERY 5 FEET ON CENTER. PLANT IN GROUPINGS OF SAME SPECIES BY HAND.

- BIO-RETENTION AREA OPERATION AND MAINTENANCE NOTES:**
1. MAINTENANCE OF THE BIO-RETENTION AREA IS SIMILAR TO OTHER PLANTED LANDSCAPED BEDS. REPLACEMENT OF SOME MULCH MAY BE REQUIRED IN THE SPRING. OCCASIONAL WEEDING WILL BE REQUIRED TO ALLOW THE SELECTED PLANTS TO CREATE AN AESTHETICALLY PLEASING GARDEN.
 2. DURING THE FIRST YEAR OF OPERATION, WATERING, WEEDING, AND REPLACEMENT OF DEAD PLANTS IS IMPORTANT FOR PROPER ESTABLISHMENT.
 3. PERIODICALLY, INCLUDING AFTER LARGE STORMS AND REGULARLY DURING THE FALL, REMOVE LEAVES AND DEBRIS ACCUMULATED AT ENTRANCE AND OUTLET.
 4. THE ACCUMULATION OF SEDIMENT WITHIN THE BIO-RETENTION AREA SHOULD BE MONITORED AND INSPECTED A MINIMUM OF ONCE ANNUALLY. REMOVE SEDIMENT AFTER APPROXIMATELY 3 INCHES OF SEDIMENT HAS ACCUMULATED OR RAKE WHEN WATER DOES NOT DRAIN WITHIN 1 DAY.
 5. ANNUALLY INSPECT TO MAKE SURE NO INVASIVE SPECIES ARE PRESENT.
 6. IN THE FALL, BRUSHHOG OR MOW BIO-RETENTION AREA AND RAKE AND REMOVE DEAD PLANT MATERIAL.



STONE OUTLET
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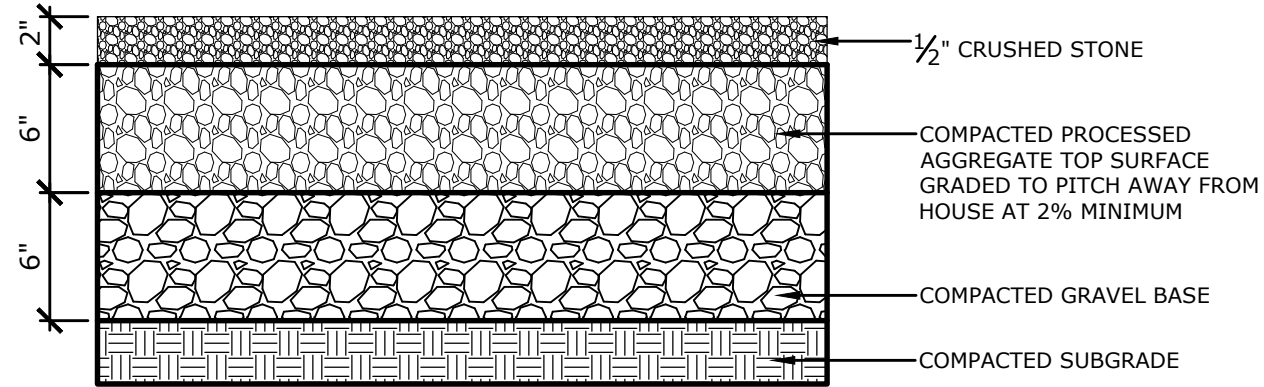
FINAL DESIGN

DETAILS
 DU BRUL RESIDENCE
 AHEAD OF THE STORM
 845 GREENBUSH ROAD
 CHARLOTTE, VERMONT

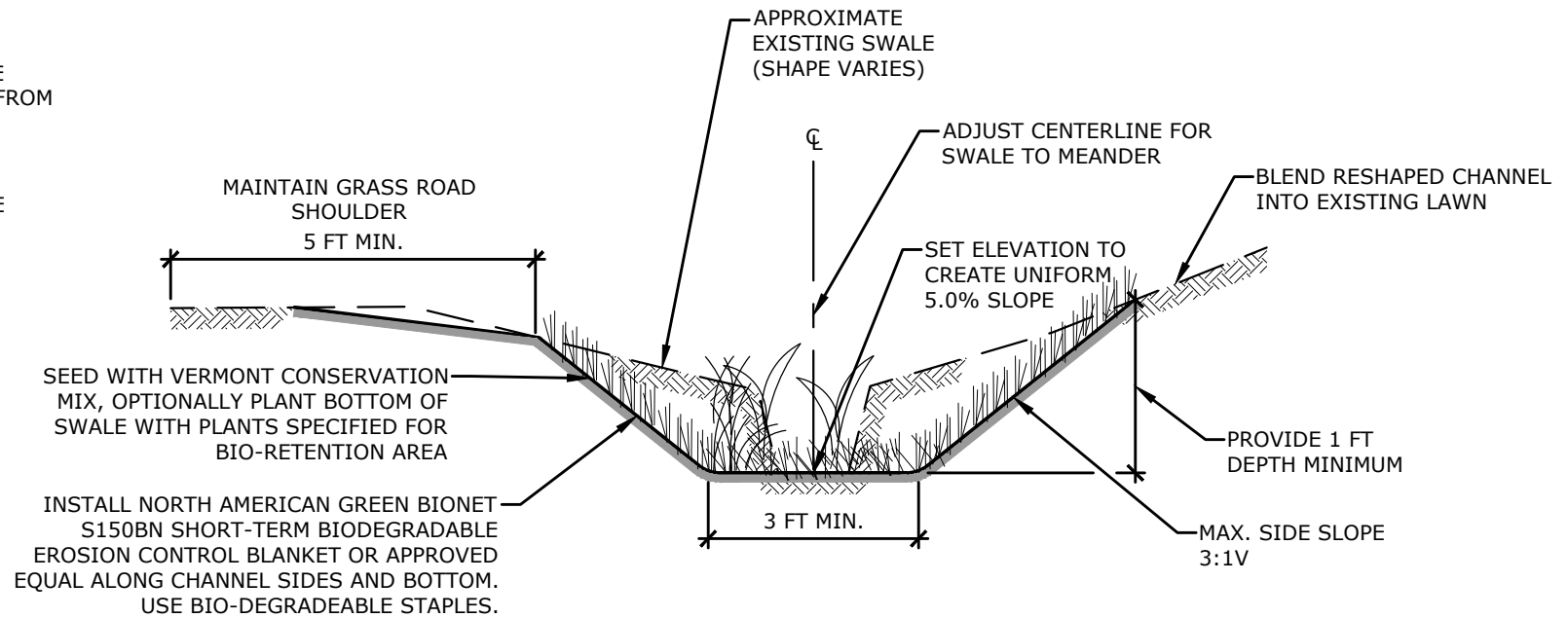
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GRAVEL DRIVEWAY SURFACE
NOT TO SCALE



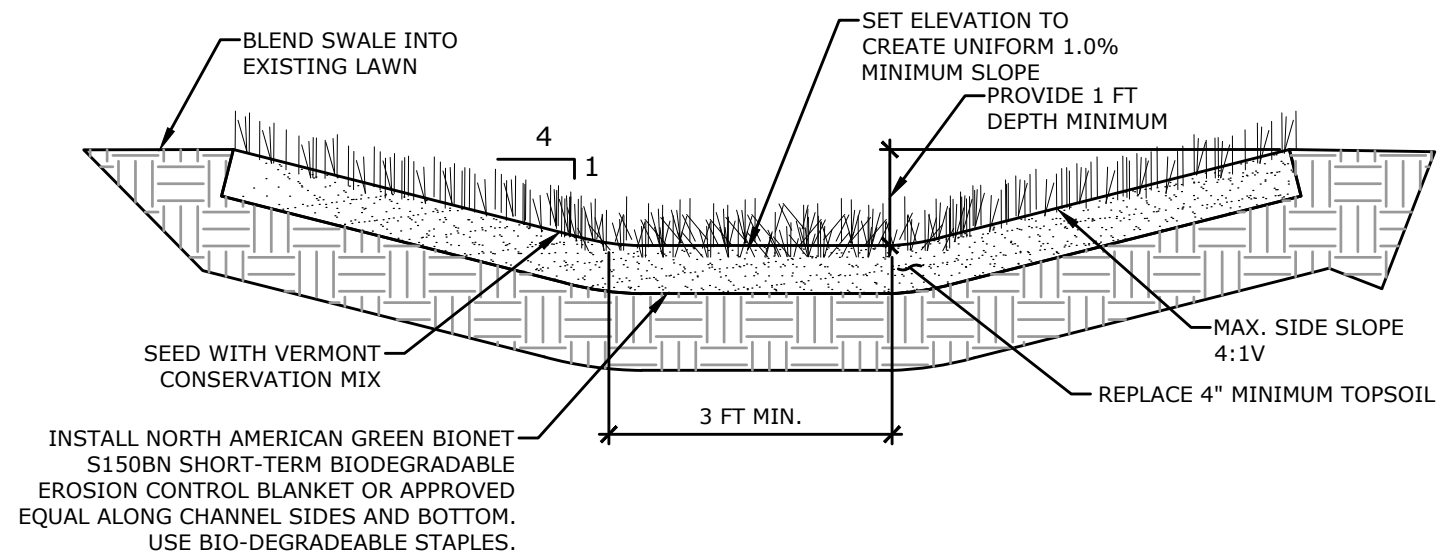
RESHAPED ROADSIDE SWALE
NOT TO SCALE

SWALE INSTALLATION NOTES:

- DO NOT COMPACT THE GROUND WHEN GRADING SWALES.
- REPLACE TOPSOIL.

SWALE OPERATION AND MAINTENANCE NOTES:

- DURING THE FIRST YEAR OR UNTIL VEGETATION HAS BEEN ESTABLISHED, INSPECT THE SWALES AFTER ALL STORMS GREATER THAN 0.5 INCHES. REPAIR ANY EROSION THAT HAS OCCURRED AND SPOT SEED ANY BARE PATCHES.
- SWALES ARE EXPECTED TO REQUIRE RESHAPING AND REMOVAL OF SEDIMENT EVERY 10-15 YEARS.
- SWALES CAN BE MAINTAINED AS LAWN AND REGULARLY MOWED OR ALLOWED TO GROW TALL PERENNIAL VEGETATION.
- AT LEAST ONCE PER YEAR BRUSHHOG OR MOW SWALES AND RAKE AND REMOVE DEAD VEGETATION.



GRASS OUTLET SWALE
NOT TO SCALE

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NOT TO SCALE										
DATE: 9/26/2016										
PROJECT NO: 3452-22										
06										

BALLPARK OPINION OF PROBABLE COST
DU BRUL RESIDENCE - 845 GREENBUSH ROAD
AHEAD OF THE STORM
Charlotte, Vermont
MMI #3452-22
October 25, 2016



Item	ITEM/DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
	CONSTRUCTION LABOR				
	Labor to Install Plants	HR	16	\$35	\$560
	Labor to Install Stone Outlet	HR	8	\$35	\$280
	Labor to Remove Trees and Hedge	HR	16	\$35	\$560
	Labor to Restore Site	HR	4	\$35	\$140
	CONSTRUCTION EQUIPMENT				
	Excavator Rental / Operator	HR	24	\$110	\$2,640
	Haul Fill Off Site (1 hr round trip)	HR	12	\$80	\$960
	Haul Materials to Site (Hinesburg, 1 hr round trip)	HR	4	\$80	\$320
	CONSTRUCTION MATERIALS				
	Sand Soil Ammendment (Hinesburg S &G)	TN	7	\$15	\$105
	Compost Soil Ammendment (Green Mt C., Delivered)	CY	2	\$85	\$170
	Hardwood Mulch	CY	8	\$45	\$360
	Stones for Outlet (Livingston Farm, Bristol, Delivered)	LS	1	\$800	\$800
	Seed for Restoring Disturbed Areas	LS	1	\$25	\$25
	Plants	LS	1	\$1,000	\$1,000
	Temporary Erosion Matting	ROLL	3	\$95	\$285
	Staples to Install Temporary Erosion Matting	BOX	1	\$66	\$66
	CONSTRUCTION MISCELLANEOUS				
	Mobilization/ Demobilization	LS	1	\$500	\$500
	Gravel Driveway Replacement	LS	1	\$3,500	\$3,500
	ENGINEERING SERVICES				
	Contractor Selection				\$1,000
	Construction Oversight (Part-time)				\$3,500
	Construction Subtotal				\$12,271
	Engineering Services Subtotal				\$4,500
	TOTAL (ROUNDED)				\$16,800