APPENDIX B

Problem Area Prioritization Matrix and Culvert Modeling Summary Table (11”x17”)

Additional Benefits Codes	CPA	SF	E	IC	SW	BMP	HV	TH	PF
	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

				Maximum Score:	**4**	**4**	**1**	**3**	**3**	**2**	**2**	**6**		**5**	**30**
Project	**Project Type**	**Location**	**Problem Area Description**	**BMP Type/Description**	**Water Quality Mitigation**					**Landowner Support**	**Operation & Maintenance Requirements**	**Cost and Constructability**	**Additional Benefits**	**Additional Benefits Score**	**Total Score**
					Nutrient Reduction	**Sediment Reduction**	**Drainage Area**	**Impervious Drainage**	**Connectivity to Surface Waters**						
SW-1	Stormwater Repair/ Retrofit	Paulin Inc. / Green Mountain Power Parking Lot	Stormwater infrastructure from Route 7A, Green Mountain Power infrastructure, and the gas station parking lot drain to the adjacent stream. The outfall pipe is corroded and collapsing.	Repair the existing outfall pipe. Evaluate SHGWT and consider installing an underground sand filter with a capacity of 75% of WQv. Special considerations may be needed for hydrocarbons associated with the gas station runoff.	2	3	0	2	3	1	0	1	SW, HV, TH, PF	4	16
SW-2	Stormwater Retrofit	Hawks Ave & Bank Road Intersection	Runoff from the southwest portion of Hawks Avenue neighborhood and approximately 225 feet of Bank Street enters a catch basin on the south side of the road near the intersection with bank street.	Evaluate SHGWT and infiltration rates. Soils mapping suggests the soils are very suitable for infiltration treatment. Consider installing off-line underground infiltration features with appropriate pretreatment.	2	2	1	2	2	1	0	2	SW, HV, TH, PF	4	16
SW-3	Stormwater Retrofit	Twitchell Hill Rd	A steep section of the Twitchell Hill Road neighborhood drains via a paved ditch to a grass-lined swale. Runoff drains to a stream channel approximately 300 feet to the east.	Widen the swale and install outlet control. Install check dams in the swale to slow and infiltrate water.	2	2	1	2	2	0	1	3	BMP, PF	2	15
SW-4	Stormwater BMP/ Retrofit	VT Route 67 at Bernstein Display	Runoff from VT 67, the industrial area where Bernstein Display is located, and associated driveways/parking lots drains to stormwater infrastructure and the adjacent stream.	Install a treatment feature, such as an infiltration basin or gravel wetland, in green space east of the parking lot or north of 67. Evaluate soils and SHGWT to determine whether an infiltration feature is possible. Consider diverting stormwater from the storm drains to treat runoff before reaching the stream channel.	2	2	1	3	2	0	0	1	SW, HV, TH, PF	4	15
SW-5	Stormwater Retrofit	Route 7A & Trailer Park Rd	This is the location of a priority drainage area retrofit identified by VTDEC in the 2018 Shaftsbury Stormwater Report. The existing swale receives runoff from Route 7A, Trailer Park Road, and the Phil Harrington Construction Co.	Install check dams in the swale to slow and infiltrate water. Grade construction company parking lot to send more runoff to the swale for treatment. Explore option for a first-flush treatment feature.	1	2	1	3	1	0	1	5	BMP	1	15

				Maximum Score:	4	4	1	3	3	2	2	6		5	30
					Water Quality Mitigation										
Project	**Project Type**	**Location**	**Problem Area Description**	**BMP Type/Description**	**Nutrient Reduction**	**Sediment Reduction**	**Drainage Area**	**Impervious Drainage**	**Connectivity to Surface Waters**	**Landowner Support**	**Operation & Maintenance Requirements**	**Cost and Constructability**	**Additional Benefits**	**Additional Benefits Score**	**Total Score**
SW-6	Stormwater Repair	Church Street near Route 67	This is the location of a priority drainage area retrofit identified by VTDEC in the 2018 Shaftsbury Stormwater Report. **Based on FEA field observations, it appears the stormwater outfall is located in the northeast portion of the T & M Enterprises property rather than along the railroad as shown in the infrastructure mapping.**	While discussion with T & M Enterprises staff suggested that all stormwater infiltrates on site, infiltration could be enhanced by installing an infiltration basin at the pipe outlet.	1	2	1	2	1	1	0	1	SW	1	10
SW-7	Stormwater Retrofit	Bank of Bennington ATM (WM. E. Dailey Property) & VT Route 7A	Stormwater runoff from the west side Route 7A and the Bank of Bennington ATM drain to an adjacent wetland. Existing stormwater infrastructure draining the WM. E. Dailey Inc. entrance and east side of Route 7A drains to SW-1.	Disconnect a portion of the drainage area from VT 7A and the WM. E. Dailey parking lot that enters stormwater infrastructure to the south. Send combined drainage to a sand filter or gravel wetland to treat runoff.	2	3	0	2	2	0	0	2	SW, HV, TH, PF	4	15
SW-8	Stormwater Retrofit	Town Garage/Town Offices parking lot	A dry well receives a large portion of runoff from the existing Town Garage and Town Office properties. The remaining runoff runs west along Buck Hill Road toward Route 7A drainage infrastructure.	Install a pretreatment feature in front of the Town Office to treat runoff from the rooftops and gravel parking lots. Pipe pretreated runoff to existing dry well.	1	2	0	2	0	1	1	4	HV, E	2	13
SW-9	Stormwater BMP	Howard Park	Water from the artesian well overflow pools in a very shallow grassed swale south of the soccer field.	Install a meandering channel with native wetland plantings to slow and infiltrate runoff.	1	1	0	0	0	2	1	3	HV, E, BMP	3	11
SW-10	Stormwater BMP	Howard Park Road	Runoff from Howard Park Road and the gravel parking lot drains to a stream to the south and a grassy area to the north adjacent to the tennis court.	Grade parking lot so as much of the runoff as possible flows north. Install a treatment feature, such as an infiltration basin or gravel wetland, in green space east west of the tennis court. Evaluate soils and SHGWT to determine whether an infiltration feature is possible. Reduce mowing alongside the stream east of Howard Park Road to slow flow and allow treat runoff.	2	2	0	2	3	2	1	1	CPA, E, HV, PF	4	17
SW-11	Stormwater BMP	Shaftsbury State Park	Runoff from lawn, rooftops, and paved paths east of the lake drain to the shoreline. Runoff from the gravel parking lot east of the lawn also drains toward the lake.	Adopt lakeshore BMPs. Install treatment feature for parking lot runoff such as a rain garden/bioretention basin in the green space west of the lake. Consider installing pervious pavement where possible. Replace paved paths to the lake with infiltration step paths.	3	1	0	1	3	1	0	2	E, HV	2	13

				Maximum Score:	4	4	1	3	3	2	2	6		5	30
					Water Quality Mitigation										
Project	Project Type	Location	Problem Area Description	BMP Type/Description	Nutrient Reduction	Sediment Reduction	Drainage Area	Impervious Drainage	Connectivity to Surface Waters	Landowner Support	Operation & Maintenance Requirements	Cost and Constructability	Additional Benefits	Additional Benefits Score	Total Score
RD-1	Road Erosion and Drainage Improvement	Jack Cross Rd	Approximately 250 feet of road lacks ditches on both sides, causing erosion of the roadway. Gravel is deposited at the drop-inlet to a driveway culvert at #209 Jack Cross Road, which frequently clogs the culvert. The clogged culvert causes runoff to travel down the driveway toward the house. Stone walls on either side of the road may make it difficult to install ditches in some areas.	Install stone-lined ditches on both sides of the road where possible. Grade the road to direct water to a new ditch on the southwest side of the road opposite the house as much as possible. Install a cross culvert at the bottom of the bend (the bottom of the steep slope).	1	3	0	0	2	2	1	2	CPA, IC	2	13
RD-2	Road Erosion and Drainage Improvement	Cross Hill Rd (East)	A stretch of Cross Hill Road lacks adequate drainage for approximately 500 feet.	Install stone lined ditches on the north side of the road. Improve existing turnouts on the south side of the road and install a couple more up the hill to reduce the amount of runoff reaching this area. Install a cross culvert before the driveway of the proposed house to send flow into the forested area to the south.	1	2	1	1	3	2	1	2	CPA, SF	2	15
RD-3	Road Erosion, Conveyance, and Drainage Improvement	Potter Montgomery Rd	Approximately 300 feet of road lacks ditches on both sides, causing severe erosion of the roadway that drains directly to a stream.	Install stone-lined ditches on both sides of the road with a stone-lined conveyance to the stream.	2	4	0	0	3	1	1	3	CPA	1	15
RD-4	Road Erosion and Drainage Improvement	Trumbull Hill Rd	A 600-foot stretch of road has grader berms concentrating flow on the roadway. The existing ditches are eroded. This area includes two Very High Priority REI segments.	Remove grader berms and install stone in ditches. Install driveway culverts at 1856 and 1779 Trumbull Hill Road.	1	2	0	1	1	1	1	3		0	10
RD-5	Road Erosion and Drainage Improvement	Trumbull Hill Rd	A 400-foot stretch of road lacks stable drainage ditches. Eroded material is emptied via a drainage culvert into the lawn northeast of 1530 Trumbull Hill Road. Flow across the 1513 Trumbull Hill Road driveway is causing it to erode.	Install drainage ditches and stabilize them with stone. Reconfigure cross culvert and clear it out. Install a driveway culvert at 1513 Trumbull Hill Road.	1	2	0	1	1	1	1	3		0	10
RD-6	Road Erosion and Drainage Improvement	East Mountain Rd	This road area has unstable drainage ditches on the North side of the road for 300 feet, causing severe erosion of the roadway.	Install a stone-lined ditch. Consider installing a cross culvert to allow flow to drain north toward Furnace Brook if deemed appropriate for steep road embankment.	1	2	0	0	1	1	1	4	CPA	1	11

				Maximum Score:	4	4	1	3	3	2	2	6		5	30
					Water Quality Mitigation										
Project	Project Type	Location	Problem Area Description	BMP Type/Description	Nutrient Reduction	Sediment Reduction	Drainage Area	Impervious Drainage	Connectivity to Surface Waters	Landowner Support	Operation & Maintenance Requirements	Cost and Constructability	Additional Benefits	Additional Benefits Score	Total Score
RD-7	Road Erosion and Drainage Improvement	Airport Rd	Grader berms along approximately 250 feet of the roadway concentrate flow, causing severe erosion of the roadway and driveway.	Remove grader berms. Install a stone-lined turnout/conveyance before the driveway.	1	2	0	0	2	1	1	5	CPA	1	13
RD-8	Road Erosion and Drainage Improvement	Trumbull Hill Rd	An approximately 1200-foot stretch of road lacks adequate drainage, causing the formation of a secondary ditch on the north side of the road that extends west to Paran Creek.	Install turnouts on the south side of the road and on the north side of the road at the intersection with Oak Hill Road to enhance drainage. Install approximately 450' of ditch on the north side of the road with cross culverts east of each driveway and 400' of ditch on the south side of the road draining to a sediment trap in the forest.	2	3	1	2	3	2	1	2	CPA	1	17
RD-9	Road Erosion, Conveyance, and Drainage Improvement	North Rd	Unstable drainage ditches are eroding, depositing large quantities of road material in the wetland.	Deepen approximately 300' of ditch and stabilize with stone. Install a sediment trap on the north side of the road, east of the wetland to prevent road materials from entering wetland.	2	3	0	0	2	1	1	4		0	13
RD-10	Road Erosion, Conveyance, and Drainage Improvement	Cross Hill Rd (West)	Approximately 3,000 feet of road has drainage issues, including a severely eroded stretch of road and ditch approximately 800 feet long that drains directly to a stream. This area includes two Very High Priority REI segments.	Remove grader berms and stabilize ditches with stone and vegetation. Install cross-culverts and turnouts to reduce the amount of flow in the existing ditch.	3	4	1	2	3	2	1	1	CPA, SF	2	19
RD-11	Road Erosion, Conveyance, and Drainage Improvement	Cold Spring Rd	Approximately 240 feet of road has unstable drainage ditches on both sides. These extend directly into the downslope stream, which crosses the road to the east of the ditch.	Stabilize the drainage ditches with stone. Install turnouts to field and forest to the north and south of the road respectively to filter flow before it reaches the stream.	2	3	0	0	3	1	1	3		0	13
RD-12	Road Erosion and Drainage Improvement	Bennett Hill Rd	An approximately 100-foot stretch of road is severely eroded. Grader berms concentrate flow along the roadway and an existing ditch/swale is located too far back from the road to handle the runoff.	Remove grader berms and install a vegetated ditch starting south of the Meadows Farm driveway (396 Bennet Hill Road) alongside the road. Connect to the existing ditch or install a cross culvert conveying flow to the west.	1	2	0	0	1	1	1	5		0	11
RD-13	Road Erosion and Drainage Improvement	Bennett Hill Rd	Grader berms along approximately 300 feet of road concentrate flow, are causing severe erosion of the roadway.	Remove grader berms and lower shoulders as needed to allow water to sheet flow off the road.	1	2	0	0	0	1	1	5		0	10

				Maximum Score:	4	4	1	3	3	2	2	6		5	30
					Water Quality Mitigation										
Project	Project Type	Location	Problem Area Description	BMP Type/Description	Nutrient Reduction	Sediment Reduction	Drainage Area	Impervious Drainage	Connectivity to Surface Waters	Landowner Support	Operation & Maintenance Requirements	Cost and Constructability	Additional Benefits	Additional Benefits Score	Total Score
RD-14	Road Erosion and Drainage Improvement	Blueberry Hill Rd	Approximately 600 feet of road lacks stone in drainage ditches and the roadway is eroding due to grader berms. Some of the road materials are deposited directly into the yard of 505 Blueberry Hill Road. This area includes a very high priority REI segment.	Stabilize the drainage ditch with stone. Install stone-lined turnout in forest north of 505 Blueberry Hill Road to reduce flow along the roadway. Remove grader berms to establish sheet flow west of the road.	1	2	0	1	1	1	1	3		0	10
RD-15	Road Erosion, Conveyance, and Drainage Improvement	Laclair Rd	Approximately 200 feet of ditch on the north side of the road is unstable. The unstable ditch extends east where it enters a stream via poor eroding conveyance. This area includes a very high priority REI segment.	Install a cross culvert so that water drains to the field south of the road. Install stone in existing ditch and grade road to direct water into ditch. Line the existing conveyance with stone.	2	3	0	0	3	1	1	4		0	14
RD-16	Road Erosion and Drainage Improvement	Sally Gannon and Murphy Hill Road	The two-entrance intersection at Sally Gannon Road and approximately 800 feet of Murphy Hill Road to the north have inadequate road drainage, causing water to pool on the roadway and erosion of the roadside ditch.	Install single entrance to Sally Gannon Road, removing the second entrance. Reduce amount of water making it to the intersection by improving the ditch to the east and west. Add cross culvert west of the intersection and a sediment trap near the intersection.	1	2	0	2	3	2	1	6	CPA, SF	2	19
RD-17	Conveyance Improvement	Shaftsbury Hollow Rd	This road area has two poor conveyances to Little White Creek. One is located where Shaftsbury Hollow Road becomes Class 4 and is turned out toward the stream causing sediment to build up on the bank and enter the stream. The second is approximately 50 feet to the east where a culvert conveys a tributary under Shaftsbury Hollow Road. The culvert headers are severely eroded.	Install a sediment trap between the Class 4 road and stream and stabilize the conveyance with stone. Stabilize the culvert headers with stone.	2	3	0	0	3	1	1	5		0	15
RD-18	Conveyance Improvement	Granger Hollow Rd	Water runs down approximately 100' of road, entering Little White Creek at the culvert outlet and causing severe erosion of the header and roadway.	Remove grader berm and deepen ditch so water can exit roadway before culvert. Stabilize conveyance with stone.	1	2	0	0	3	1	1	5		0	13
RD-19	Road Drainage Improvement	Cider Mill Road	A section of road between a steep valley wall and pond/wetland had drainage problems, including water pooling on the road.	Deepen ditch and vegetate. Crown road to shed water. Install a new cross-culvert at a lower elevation to help drain roadway.	0	1	0	0	2	2	1	4	CPA, SF	2	12

			Maximum Score:	4	4	1	3	3	2	2	6		5	30
				Water Quality Mitigation										
Project	Project Type	Location	Problem Area Description	BMP Type/Description	Nutrient Reduction	Sediment Reduction	Drainage Area	Impervious Drainage	Connectivity to Surface Waters	Landowner Support	Operation & Maintenance Requirements	Cost and Constructability	Additional Benefits	Additional Benefits Score	Total Score
RD-20	Road Erosion and Drainage Improvement	Daniels Road, Mountainview Road, Glastenview Road	Grader berms along approximately 600 feet of Glastenview Road are causing erosion of the roadway. Road gravel is accumulating in the ditch at the intersection with Daniels Road and the Daniels Road ditch is eroded for approximately 300 feet.	Remove grader berms. Install stone in eroded ditches. Consider installing a sediment trap with a level spreader at the ditch outlet to settle out particulates and send sheet flow into the wetland.	2	3	1	2	2	2	1	2	CPA	1	16
DC-1	Drainage Improvement	East Rd	This culvert is partially blocked by debris.	Unclog the culvert.	0	0	1	0	2	1	2	6		0	12
DC-2	Erosion Stabilization and Drainage Improvement	Glastenbury Rd	This culvert inlet header is severely eroded and the culvert is partially blocked by sediment and debris. The ditch above the inlet is somewhat eroded between the driveway and road.	Unclog the culvert and stabilize the header with stone.	1	1	0	0	2	1	1	6		0	12
DC-3	Culvert Replacement	Potter Montgomery Rd	The drainage culvert is completely crushed at the inlet.	Replace the culvert.	0	0	0	0	2	1	1	5		0	9
DC-4	Drainage Improvement	Simeon Dean Rd	Two culverts parallel to the train tracks on either side are blocked by sediment from erosion of the roadway.	Unclog the culverts. Install vegetated ditches where absent.	0	1	0	0	2	1	1	5		0	10
DC-5	Erosion Stabilization	Airport Rd	The downstream culvert header is unstable and severely eroded.	Stabilize the header with stone.	1	1	0	0	2	1	1	6		0	12
DC-6	Erosion Stabilization	Myers Rd	Approximately 300' of eroding ditch extends directly to the stream via a poor conveyance. The stream culvert headers are unstable and eroding.	Stabilize the culvert headers, conveyance, and ditch with stone.	2	2	0	0	3	1	1	4		0	13
DC-7	Erosion Stabilization	Rollin Rd	This culvert has severe header and outlet erosion. This erosion continues for 85' to a nearby stream.	Stabilize the culvert headers, outlet, and conveyance with stone. Consider installing check dams and a level spreader in the conveyance to slow and disperse flow.	2	2	1	1	3	1	1	4		0	15
DC-8	Erosion Stabilization	White Creek Rd	The culvert outlet header is severely eroded. The erosion may cause undermining of the paved roadway.	Stabilize the culvert header and road embankment with stone.	1	1	0	0	2	1	1	6	IC	1	13
C-1	Culvert Replacement	Jack Cross Rd	This culvert is prone to clogging with leaves and gravel from the eroding ditch and road embankment.	Unclog the structure and consider installing a larger structure to convey debris. Stabilize the headers and the lower portion of the ditch with stone.	0	1	1	0	2	1	1	5		0	11
C-2	Culvert Replacement	Harrison Road	The culvert headers are eroding, with severe erosion of the road embankment around the culvert outlet. The culvert is undersized.	Install stone headers. Install a larger structure.	1	2	1	1	3	1	1	4		0	14

				Maximum Score:	4	4	1	3	3	2	2	6		5	30
					Water Quality Mitigation										
Project	Project Type	Location	Problem Area Description	BMP Type/Description	Nutrient Reduction	Sediment Reduction	Drainage Area	Impervious Drainage	Connectivity to Surface Waters	Landowner Support	Operation & Maintenance Requirements	Cost and Constructability	Additional Benefits	Additional Benefits Score	Total Score
C-3	Culvert Replacement	Glastenbury Rd	This culvert is in poor condition and undersized. The upstream header is eroding and the inlet is collapsing.	Install a larger structure with stone headers.	1	2	1	3	3	1	1	4		0	16
C-4	Culvert Replacement	Potter Montgomery Rd	The culvert headers are eroding, with severe erosion of the road embankment around the culvert outlet. The culvert is undersized.	Install stone headers. Consider installing a larger structure.	1	2	1	0	3	1	1	4		0	13
C-5	Culvert Replacement	East Rd	The culvert is undersized with erosion at the header and in the downstream channel.	Install a larger structure with stone headers and stabilize the channel at the outlet with stone as needed. This likely will require VT ANR permitting.	1	2	1	3	3	1	1	2		0	14
C-6	Culvert Replacement	Murphy Hill Rd	The culvert headers are eroding, with severe erosion of the road embankment and downstream channel at the culvert outlet. The culvert is undersized.	Install a larger structure with stone headers and stabilize the channel at the outlet with stone as needed.	1	2	1	2	3	1	1	4		0	15
C-7	Culvert Replacement	Granger Hollow Rd	The culvert headers are eroding, with severe erosion of the road embankment and downstream channel at the culvert outlet. The culvert is undersized.	Install a larger structure with stone headers and stabilize the channel at the outlet with stone as needed. This likely will require VT ANR permitting.	1	2	1	3	3	1	1	2		0	14
C-8	Culvert Replacement	Murphy Hill Rd	This culvert is undersized. There is some erosion of the road embankment at the inlet and outlet.	Install a larger structure with stone headers.	1	2	1	3	3	1	1	4		0	16
C-9	Culvert Replacement	Elm Street	This culvert is undersized. There is some erosion of the road embankment at the inlet and outlet.	Install a larger structure with stone headers. This likely will require VT ANR permitting.	1	2	1	3	3	1	1	2		0	14
C-10	Culvert Replacement	Howard Park Rd (Shaftsbury Recreation Park)	This culvert is undersized.	Install a larger structure. This likely will require VT ANR permitting.	0	1	1	3	3	1	1	2		0	12

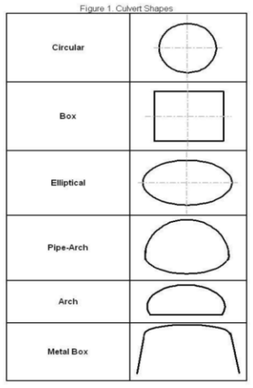
Shaftsbury Stormwater
Master Plan
Culvert Modeling

		Drainage Area														Discharge (cfs)									
Structure	Site ID	Acres	Square Miles	Bankfull Width (ft)[1]	Road Crown Elevation (ft)	Roadway Width (ft)	Crest Length (ft)	Current Culvert Type	Culvert Length (ft)	Culvert Inlet (ft)	Culvert Outlet (ft)	Outlet Drop (ft)	Slope	Diameter (ft)	Mannings Roughness	Q10	Q25 (design)	Q100 (extreme)	Culvert Capacity[2]	Q10 WSE (ft)[3]	Q10 Free-board (ft)	Q25 WSE (ft)[3]	Q25 Free-board (ft)	HydroCAD Peak Capacity (cfs)	Recommended Size (inches)[4]
Jack Cross Rd (4" Embedded)	C-1	3.3	0.01	1.3	95.9	14	50	CMP	18	93.9	92.8	0.0	0.06	1.25	0.035	1.9	3.5	6.5	5.3	94.7	1.14	95.0	0.86	5.8	15
Harrison Road	C-2	16.5	0.03	2.6	95.1	19	80	Smooth HDPE	30	91.9	91.5	0.0	0.01	1.5	0.035	17.0	26.3	34.1	13.2	95.2	-0.10	95.3	-0.18	6.3	30
Glastenbury Rd	C-3	71.2	0.11	5.0	96.2	20	100	CMP	30	91.0	88.7	1.5	0.08	2.2	0.04	31.4	46.2	70.7	37.8	95.0	1.15	96.3	-0.12	42.0	42
Potter Montgomery Rd	C-4	37.0	0.06	3.7	96.3	16	70	CMP	20	93.2	93.1	0.0	0.01	2	0.035	19.4	29.2	45.6	19.5	96.3	-0.02	96.4	-0.16	8.3	36
East Rd	C-5	121.0	0.19	6.3	95.5	22	80	CMP	25	90.4	88.1	0.4	0.09	2	0.04	65.8	100.7	158.4	31.4	95.8	-0.26	96.0	-0.43	35.7	60
Murphy Hill Rd	C-6	99.6	0.16	5.8	95.9	25	100	CMP	40	90.2	87.3	4.0	0.07	2.4	0.05	75.5	109.5	165.7	50.7	96.1	-0.19	96.3	-0.34	54.3	48
Granger Hollow Rd	C-7	280.1	0.44	9.1	95.0	15	90	CMP	20	91.5	89.4	4.0	0.10	2.4	0.04	149.1	234.5	381.2	32.5	95.6	-0.60	95.9	-0.86	62.0	72" round or 95"x67" elliptical - subject to Perrenial Stream Regulations
Murphy Hill Rd	C-8	67.9	0.11	4.9	95.4	22	80	CMP	30	90.7	88.8	2.5	0.06	2	0.04	51.6	76.6	118.4	29.6	95.6	-0.27	95.9	-0.59	29.6	42-48
Elm Street	C-9	179.1	0.28	7.5	95.3	22	70	CMP	30	90.6	89.5	0.0	0.04	3	0.04	123.0	174.9	260.0	59.4	95.8	-0.44	96.0	-0.66	66.4	66
Howard Park Rd (Shaftsbury Recreation Park)	C-10	497.3	0.78	11.7	95.9	18	90	CMP	30	92.3	91.1	0.0	0.04	2	0.04	174.8	283.6	474.8	24.2	96.6	-0.68	96.9	-0.97	23.5	72" round or 84"x60" elliptical - subject to Perrenial Stream Regulations

1 - Calculated using VTANR Hydraulic Geometry Regressions, drainage areas <1sqmi not applicable
2 - Culvert capacity before road overtops using HY-8 model
3 - WSE = Water Surface Elevation. All elevations are relative to the laser level used for field data collection.
4 - Recommended size based on VT ANR sizing guidelines verified or modified by hydraulic modeling using HY-8 model.

HY-8 User Manual

Figure 1. Culvert Shapes



Active Channel Culvert Sizing for Intermittent Stream Crossings

Drainage Area (acres)	Culvert Size (inches)
4	15
8	18
16	24
20	30
40	36
50	42
80	48
120	60
160	66
200	Likely Perennial - Refer to VTDEC Technica
320	
350	
450	
640	

Source: https://dec.vermont.gov/sites/dec/files/wsm/stormwater/docs/Permitinformation/MunicipalRoads/sw_MRGP_IntermittentStreamCulvertSizingGuidance.pdf