Appendix A

Section 1: MUNICIPAL ROAD STANDARDS

The following standards constitute the minimum required Best Management Practices (BMPs) for municipal roads. These standards shall apply to the construction, repair, and maintenance of all town roads and bridges.

It is the municipality's responsibility to maintain all practices after installation. Roads not meeting these standards must implement the BMPs listed below in order to meet the required town's standards.

Feasibility

Municipalities shall implement these standards to the extent feasible. In determining feasibility, municipalities may consider the following criteria: The implementation of a standard listed in of this documentation does not require the acquisition of additional state of federal permits or noncompliance with such permits, or noncompliance with any other state or federal law. The implementation of a standard does not require the condemnation of private property; impacts to significant environmental and historic resources, including historic stone walls, historic structures, historic landscapes, or vegetation within 250 feet of a lakeshore; impacts to buried utilities; and excessive hydraulic hammering of ledge.

Standards for All Construction and Soil Disturbing Activities

Following construction and soil disturbance on a road, all bare or unvegetated areas shall be revegetated with see and mulch, hydroseeded, or stone lined within 5 days of disturbance of soils, or, if precipitations is forecast, sooner.

Standards for Gravel and Paved Roads with Ditches

Baseline Standards for Gravel and Paved Roads with Ditches

The following are the standards for all gravel and paved municipal roads with drainage ditches, whether or not erosion is present. These standards also apply to all new construction and significant upgrades of stormwater treatment practices.

A. Roadway/Travel Lane Standards
   1. Roadway Crown
      a. Gravel roads shall be crowned, in or out-sloped:
         Minimum: ¼ inch per foot
         Recommended: ¼ inch to ½ inch per foot or 2% - 4%
      b. Paved/ditched roads shall be crowned during new construction, redevelopment, or repaving where repaving involves removal of the existing paving.
         Minimum: 1/8 inch per foot or 1%
         Recommended: 1% - 2%
   2. Shoulder berms (also called Grader/Plow Berm/Windrows)
      Shoulder berms shall be removed to allow precipitation to shed from the travel lane into the road drainage system. Roadway runoff shall flow in a distributed manner to the drainage ditch or filter area and there shall be no shoulder berms or evidence of a "secondary ditch". Shoulder berms may remain in place if the road crown is in-sloped or out-sloped to the opposite side of the road from berm side of road. The shoulder berm standard only applies to gravel roads with drainage ditches.

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B. Road Drainage Standards

Roadway runoff shall flow in a distributed manner to grass or a forested area by lowering road shoulders or conversely by elevating the travel lane level above the shoulder. Road shoulders shall be lower than travel lane elevation. If distributed flow is not possible, roadway runoff may enter a drainage ditch, stabilized as follows:

1. For roads with slopes between 0% and 5%: At a minimum, grass-lined ditch, no bare soil. Geotextile and erosion matting may be used instead of seed and mulch. Alternatively, ditches may be stabilized using any of the practices identified for roads with slopes 5% or greater included in subpart B.2 below.

   Recommended shape: trapezoidal or parabolic cross section with mild side slopes; 2 foot horizontal per 1 foot vertical or flatter and 2-foot ditch depth.

2. For roads with slopes 5% or greater but less than 8%:
   a. Stone-lined ditch: minimum 6 to 8-inch minus stone or the equivalent for new practice construction. Recommended 2-foot ditch depth from top of stone-lined bottom,
   b. Grass-lined ditch with stone check dams[1], or
   c. Grass-lined ditch if installed with disconnection practices such as cross culverts and/or turnouts to reduce road stormwater runoff volume. There shall be at least <u>two</u> cross culverts or turnouts per segment disconnecting road stormwater out of the road drainage network into vegetated areas or spaced every 160 feet.

3. For roads with slopes of 8% or greater: Stone-lined ditch.
   a. For slopes greater than or equal to 8% but less than 10%: minimum 6 to 8-inch minus stone or the equivalent for new construction. Recommended 2-foot ditch depth from top of stone-lined bottom.
   b. For slopes greater than 10%: minimum 6 to 8-inch minus stone. Recommended 12-inch minus stone or the equivalent. Recommended 2-foot ditch depth from top of stone-lined bottom.

4. If appropriate, bioretention areas, level spreaders, armored shoulders, and sub-surface drainage practices may be substituted for the above road drainage standards.

C. Drainage Outlets to Waters & Turnouts

Roadway drainage shall be disconnected from waterbodies and defined channels, since the latter can act as a stormwater conveyance, and roadway drainage shall flow in a distributed manner to a grass or forested filter area. Drainage outlets and conveyance areas shall be stabilized as follows:

1. Turn-outs – all drainage ditches shall be turned out to avoid direct outlet to surface waters.

2. There must be adequate outlet protection at the end of the turnout, based upon slope ranges below. Turnout slopes shall be measured on the bank where the practice is located and not based on the road slope.
   a. For turnouts with slopes of 0% or greater but less than 5%: stabilize with grass at minimum. Alternatively, stabilize using the practices identified in subpart b – c below, when possible.
   b. For turnouts with slopes 5% or greater: stabilize with stone.
   c. For slopes greater than 5% but less than 10%: minimum 6-inch to 8-inch minus stone or the equivalent for new construction.
   d. For slopes greater than 10%: minimum 6 to 8-inch minus stone or equivalent for new construction. Recommend 12-inch minus stone or the equivalent.

[1] See check dam installation specifications.

Drainage and Intermittent Stream Culvert Standards

The following are the required culvert standards for all gravel and paved roads with ditches where rill or gully erosion is present. These standards also apply to new construction and significant upgrades of stormwater treatment practices.

1. Municipal Culverts (Drainage and Intermittent Streams)
    1. Culvert end treatment or headwall required for areas with road slopes 5% or greater if erosion is due to absence of these structures. End treatment or headwall is required for new construction on slopes 5% or greater.

    2. Stabilize outlet such that there will be no scour erosion, if erosion is due to absence or inadequacy of outlet stabilization. Stone aprons or plunge pools required for new construction on road slopes 5% or greater.

    3. Upgrade to 18-inch culvert (minimum), if erosion is due to inadequate size or absence of structure.

    4. A French Drain (also called an Underdrain) or French Mattress (also called a Rock Sandwich) sub-surface drainage practice may be substituted for a cross culvert.

2. Driveway Culverts within the municipal ROW
    1. Culvert end treatment or headwall required for areas with road slopes of 5% or greater, if erosion is due to absence of these structures. End treatment or headwall is required for new construction.

    2. Stabilize outlet such that there will be no scour erosion, if erosion is due to absence or inadequacy of outlet stabilization. Stone aprons or plunge pools required for new construction.

    3. Upgrade to minimum 15-inch culvert, 18-inch recommended, if erosion is due to inadequate size or absence of structure.

Standards for Paved Roads with Catch Basins

Catch Basin Outlet Stabilization: All catch basin outlets shall be stabilized to eliminate all rill and gully erosion. Catch basin outfall stabilization practices include: stone-lined ditch, stone apron, check dams and culvert header/headwall.

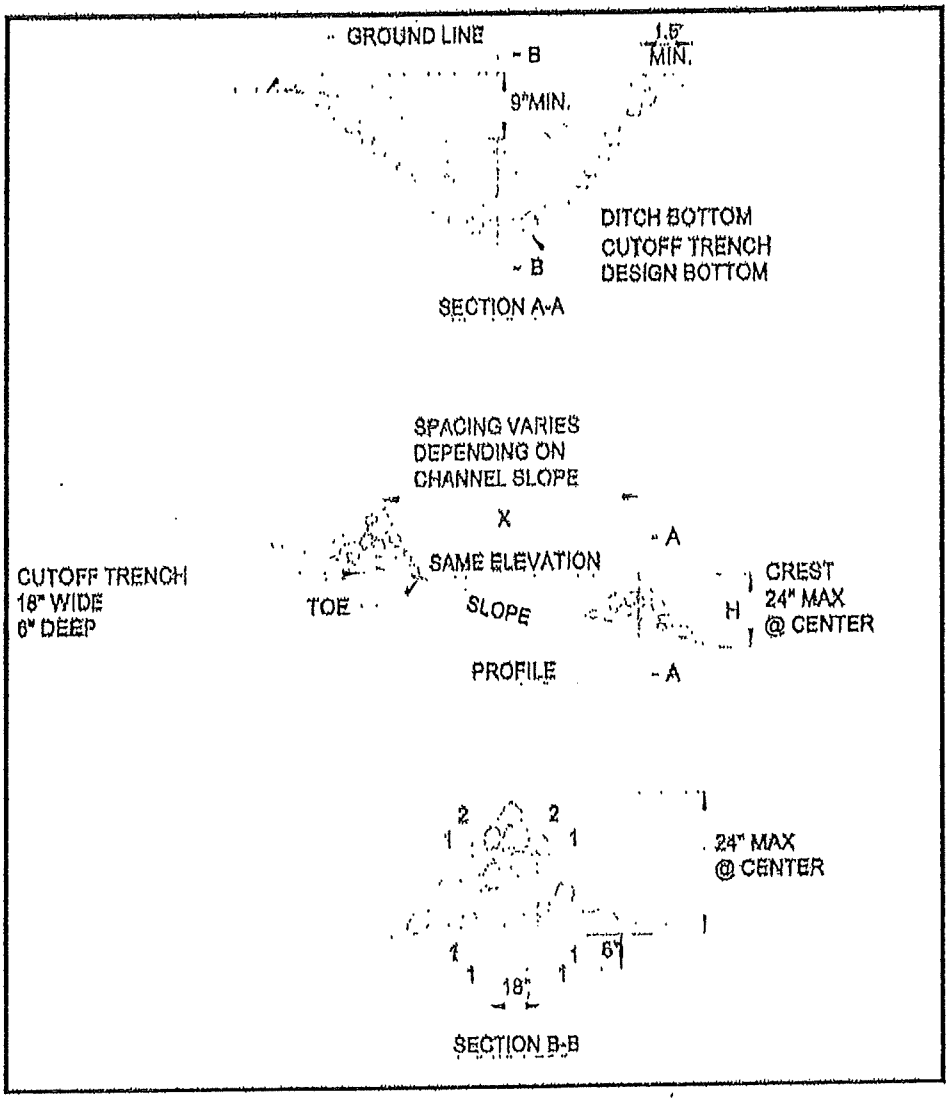
Stone Check Dam Specification

- Height: No greater than 2 feet. Center of dam should be 9 inches lower than the side elevation
- Side slopes: 2:1 or flatter
- Stone size: Use a mixture of 2 to 9-inch stone
- Width: Dams should span the width of the channel and extend up the sides of the banks
- Spacing: Space the dams so that the bottom (toe) of the upstream dam is at the elevation of the top (crest) of the downstream dam. This spacing is equal to the height of the check dam divided by the channel slope.

$$\text{Spacing (in feet)} = \frac{\text{Height of check dam (in feet)}}{\text{Slope in channel (ft/ft)}}$$

- Maintenance: Remove sediment accumulated behind the dam as needed to allow channel to drain through the stone check dam and prevent large flows from carrying sediment over the dam. If significant erosion occurs between check dams, a liner of stone should be installed.

Check Dam Specification:



Section 2: STANDARDS FOR CLASS 4 ROADS

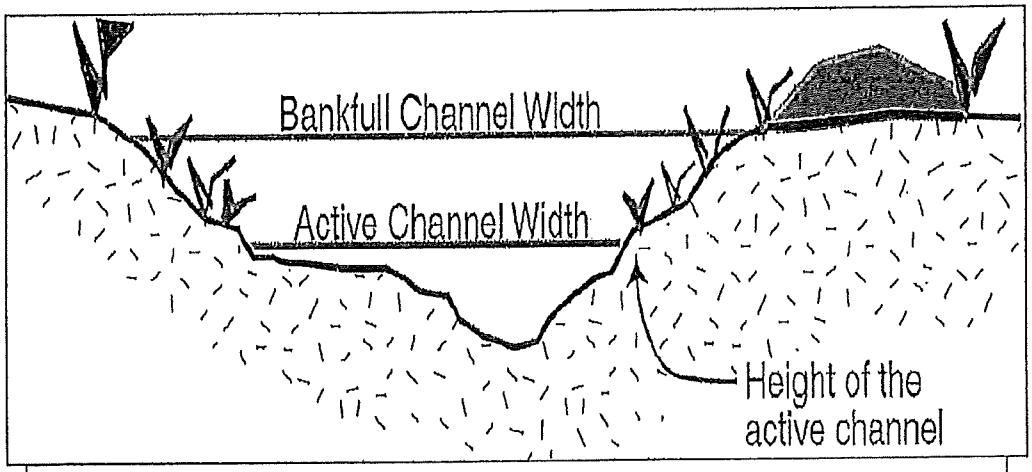
Stabilize any areas of gully erosion with the practices described above or equivalent practices. Disconnection practices such as broad-based dips and water bars may replace cross culverts and turnouts.

Appendix B
Active Channel Culvert Sizing for Intermittent Stream Crossings

Choose the drainage area closest to your crossing site drainage area

Drainage Area *(Acres)*	Minimum Diameter for Culverts on Intermittent Streams *(Inches)*
4	15
8	18
16	24
20	30
40	36
50	42
80	48
120	60
160	66
200	*Streams with drainage areas of 160 acres or greater are likely to be perennial. Adhere to the VTDEC Technical Guidance for Identification of Perennial Streams*
320	
350	
450	
640	

Active Channel Width



Active Channel Width means the limits of the streambed scour formed by prevailing stream discharges, measured perpendicular to streamflow. The active channel is narrower than the bankfull width (approximately 75%) and is defined by the break in bank slope and typically extends to the edge of permanent vegetation.

Culvert sizing for crossings on intermittent streams: Determine the Active Channel Width by field measurements, ***the culvert size should meet or exceed the Active Channel Width.*** To obtain the measurements go to the crossing location and obtain several upstream Active Channel Width measurements in riffle (fast moving water) narrower channel locations. The selected channel width should be a representative average of the field measurements. In the absence of field measurements, the drainage areas in the table can be used.

TOWN OF PLYMOUTH

SPECIFICATIONS FOR

CONSTRUCTION OF

TOWN HIGHWAYS

TOWN OF PLYMOUTH STANDARDS AND SPECIFICATIONS FOR CONSTRUCTION OF TOWN HIGHWAYS ARE IN EFFECT AS OF OCTOBER 18, 1993

1. Clear title of a minumum of four (4) rods right of way should be deeded to the Town or Municipality with a description of the limits of the right of way. Road must be 24 ft. in width.

2. Water courses and inlet and outlet ditches and other channels to meet legal requirements set forth by Vermont Statutes. Ditch stone where deemed necessary by Selectmen.

3. All materials (culverts, steel, cement, gravel, etc.) to meet State of Vermont, Department of Highways, Standard Specifications for Highway and Bridge Construction.

4. All culverts, minimum 18" or larger where water flow deems it necessary, with inlet and outlet ditches, will be installed during the construction of the highway before acceptance by the town. Culverts shall have headers where Selectmen deem necessary. Ditch stone shall be required where deemed necessary by Selectmen.

5. The construction of the highway to conform with attached sheet showing standard for town highways.

6. The grades relative to steepness of new roads will not exceed 14%.

7. All roads to be dedicated as town roads shall be paved with a minimum of three (3) inches of bituminous concrete, 20 feet in width.

8. Alternations in standards due to soil, water and other conditions may be required as stipulated by the Board of Selectmen or Trustees.

9. All agreements relative to sewer lines, water pipes, sidewalks, and surfaces should conform to the requirements of the Board of Selectmen or Trustees.

10. The abutting property owners to be notified that no installations will be allowed within the highway right of way without wirtten permit of the Board of Selectmen or Trustees.

11. Any curve shall have a minimum radius of 100 feet.

12. Guardrails to be installed where selectmen deem necessary because of exhisting terraine. Marker post to be installed at each end of culvert.

13. If the road is to be a Dead End, there will have to be a turn around place with a minimum 70 ft. radius. This will meet road specs.

14. Any driveway or road leading off town road shall have a culvert installed by owner. No culvert smaller than 15" will be accepted or larger if deemed necessary.

15. Driveway or private road leading from proposed town highway shall remain at the same level or go down for first 8 ft. from ditch line.

16. First 8 ft. of drive will have 1 ft. of gravel.

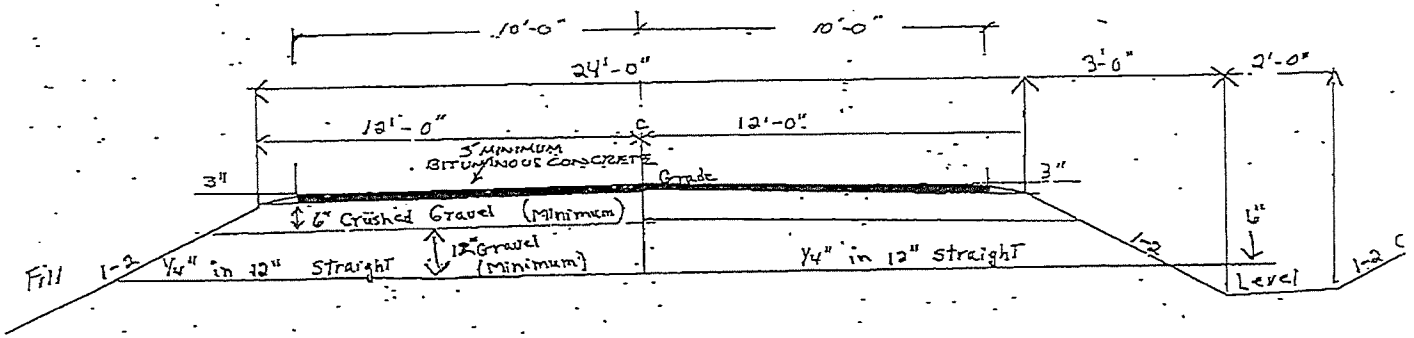
17. Balance of drive will be constructed in manner to shed water toward ditches and be maintained in this manner at all times.

18. The first 12" of bank run gravel shall have no stone larger than 6". The top 6" of crushed gravel shall be no larger than 1½".

19. All excavation of ditches across town roads shall be backfilled with crushed gravel and tamped.

STANDARDS FOR TOWN HIGHWAYS

TOWN HIGHWAYS. NEW CONSTRUCTION SHALL PROVIDE A 24-FOOT ROADBED. THE GRAVEL SHALL HAVE A MINIMUM DEPTH OF 18" AND CRUSHED GRAVEL ON TOP, MINIMUM DEPTH OF 6". THE TERRAIN, TO PROVIDE ADEQUATE DRAINAGE AND PERMIT EASIER SNOW REMOVAL. ALIGNMNET AND GRADES SHOULD BE THE BEST OBTAINABLE AT REASONABLE COST, AND ADEQUATE TO PROVIDE SAFE TRAVEL AT REASONABLE SPEEDS.



TOWN ROAD AND BRIDGE STANDARDS of the TOWN OF Plymouth, VERMONT

The town of Plymouth hereby adopts the following Town Road and Bridge Standards which shall apply to all future road and bridge construction within the Town (unless State or federal funding regulations supersede this document).

The standards listed here are considered minimum and are presented for purposes of guiding construction and maintenance personnel. The selectboard reserves the right to modify the standards for a particular project, where, because of unique physical circumstances or conditions, there is no possibility that the project can be completed in strict conformance with these provisions. Fiscal reasons are not a basis for modification of the standards.

Any new road, whether or not that road is proposed to be conveyed to the town, shall be constructed according to the minimums of these standards. If any federal and/or state funding is involved in a project, the VTrans district office will be notified prior to any field changes taking place that would alter the original scope of work.

Roadways

All gravel roads will have at least a 15-inch thick processed gravel subbase, with the top 3 inches being crushed gravel. Material will be graded so that water does not remain on the road surface, and have adequate space for proper ditching.

Ditches

Soil exposed during ditch and slope construction or maintenance will be treated immediately following the operation as follows:

- Seed and mulch slopes less than 2.5%
- Placing biodegradable matting and seed on slopes between 2.5% and 5%
- Stone lining ditches with angular material on slopes greater than 5%

Culverts and Bridges

- All new driveway culverts will have a minimum diameter of 15 inches.
- All new roadway culverts will have a minimum diameter of 18 inches.
- Any culvert greater than or equal to 36 inches in diameter will be designed according to the latest VTrans Hydraulics Manual. End treatment (inlet or outlet) will also be evaluated in accordance with this manual.
- All bridges (structures with spans greater than 6 feet) will have waterway openings designed in accordance to the latest VTrans Hydraulics Manual.

Guardrail

When new road or culvert construction creates side slopes steeper than 1 on 3, guardrail will be installed according to AASHTO Roadside Design Guide.

Passed and adopted by the Selectboard of the Town of Plymouth, State of Vermont on April 19, 2010.

Select Board

Certification of Compliance
for
Town Road and Bridge Standards
and
Network Inventory

We, the Legislative Body of the Municipality of Plymouth, certify that we have reviewed, understand and comply with the Town Road and Bridge Standards / Public Works Specifications and Standards passed and adopted by the Selectboard / City Council / Village Board of Trustees on 4-19, 2020.

We further certify that our adopted standards ☑do ☐do not meet or exceed the minimum requirements included in the June 5, 2019 State-approved template.

We further certify that we ☑do ☐do not have an up-to-date highway network inventory which identifies location, size, deficiencies/condition of roads, bridges, causeways, culverts and highway-related retaining walls on class 1, 2, and 3 town highways, and estimated cost of repair.

x _____ Date: 4-20-20

x _____

x _____

_____

_____
(Duly Authorized Administrator)

For a summary of your community's road and bridge information please visit: tinyurl.com/rdsinfo