



**VERMONT AGENCY OF TRANSPORTATION
CULVERT & DITCH PROCEDURES
Revised _____, 2010**

PURPOSE & NEED

The Vermont Agency of Transportation (VTTrans) first developed statewide Culvert and Ditch Procedures in 1997 to address the problem of rapidly deteriorating culverts and plugged ditches. VTTrans developed these procedures to ensure the proper design and maintenance of existing transportation infrastructure to provide an adequate drainage system, while at the same time respecting the natural environs that abut our transportation networks. Originally, this program focused primarily on maintaining existing drainage systems. However, this program now extends to new projects as well.

Throughout the state, many metal culverts are reaching the end of their useful life and must be replaced. Many of these culverts are now failing due to corrosion, erosion, and insufficient maintenance. Roadside ditches are also a vital component to the state's transportation system. In addition, to conveying runoff away from a highway or railbed, ditches which contain herbaceous vegetation are a particularly effective means of trapping sands and filtering pollutants to prevent them from entering the state's waterways. Ditches can work so well that over time they fill in and must receive maintenance to restore their functionality.

A lack of functional ditches and culverts can result in unsafe traveling conditions from ice and water on the traveling surface and cause degradation of the roadway due to high water tables allowing moisture and frost into the sub-base. Neglecting to maintain culverts and ditches or designing or constructing them improperly can result in surface failure and costly reconstruction projects. Neglect or poor design or construction can also result in plugged systems that create localized flooding conditions that have the potential to erode away sections of the highway or railbed and create unsafe traveling conditions.

Keeping ditches and culverts in optimum condition is an on-going maintenance operation of VTTrans. This maintenance must be done in an environmentally responsible manner that includes proper disposal of the surplus materials generated by the ditching operations and control of erosion by seeding and mulching exposed earth in ditch swales and at culvert replacements. In addition, construction and maintenance activities must protect the ability of aquatic organisms to move along water courses.

BACKGROUND

In response to changes in the availability of federal funding for maintenance operations, the VTrans Operations Division conducted a statewide survey of the condition of culverts and ditches throughout VTrans' Districts during 1996. Following that initial survey, VTrans developed a program to address its culvert and ditch maintenance needs statewide.

Shortly after the initial survey in 1996, and the development of a prioritized list, VTrans and the FHWA discussed the development of a procedure to expedite procurement of state and federal permits, relative to the expanded statewide culvert and ditch program. VTrans developed a draft procedure that VTrans initially discussed at a September 1996 Resource Coordination Meeting with officials from the ANR, COE, EPA, FHWA, and USFWS in order to obtain preliminary comments. On March 17, 1997 Glenn Gershaneck, former Secretary of Transportation, approved and signed a document reflecting recommendations from that meeting. This document subsequently served as the guidance document for all VTrans culvert and ditch maintenance operations within the state of Vermont.

VTrans completed a five-year review of the 1997 Procedures on March 27, 2002 with the issuance of an update reflecting current program needs. VTrans produced this document using comments received from VTrans Environmental, Hydraulics, and District staff, as well as officials from the ANR, COE, EPA, FHWA and USFWS.

Since the adoption of the 2002 update, annual culvert and ditch inspections continue to be conducted under the VTrans Asset Management Program and under the VTrans Operations Infrastructure Inspection Program. A list of Large "Critical Culverts" in need of repair or replacement is prepared by VTrans Operations and forwarded annually to VDFW fisheries biologists by VTrans Environmental Section biologists to solicit comments on the need for aquatic organism passage requirements in advance of initiating design development, permitting, or construction.

More recently, VTrans initiated a five-year review of the 2002 Procedures in 2007 but subsequently postponed any revisions pending the re-write of the COE Vermont General Permit. Upon issuance of the new COE GP, effective December 5, 2007, VTrans resumed its work on updating the Culvert and Ditch Procedures. Numerous changes have taken place since VTrans introduced the first Procedures in 1997, and VTrans completed updates to reflect the current COE GP requirements as well as other procedural and regulatory requirements in 2009. One of the most notable changes was in the recognition that the maintenance costs associated with undersized structures are high and continual, as many are associated with stream instability due to the undersized or geomorphically incompatible culverts causing sediment/debris deposition upstream of the structure, scour at the structure outlets, and bank erosion. Changes in land use patterns and drainage characteristics adjacent to the transportation right-of-ways have also been noted as a major contributing factor to culvert maintenance.

The 2009 Procedures replaced the former emphasis on existing culvert size and provided review guidelines for culverts based upon the watershed size draining to the structure, as determined via the use of USGS StreamStats or other appropriate analytic tool. It is the responsibility of each DTA to provide the watershed size and map (based upon StreamStats or other appropriate method) to the VTrans Biologists at the time of the review. StreamStats may be found at the following website:

<http://water.usgs.gov/osw/streamstats/>

In 2010, VTrans again revised the Culvert & Ditch Procedures to explicitly extend them from maintenance work to entirely new projects. Further, VTrans and ANR entered into a Memorandum of Agreement to streamline the consultation process required by 19 V.S.A. § 10(12) and the certification process required by section 401 of the Clean Water Act, 33 U.S.C. § 1341. Under the MOA, consultation and certification take place categorically for VTrans culvert and ditch projects in watersheds draining less than one square mile, provided that VTrans complies with these Procedures. The MOA also covers municipal culvert and ditch projects that VTrans funds in whole or in part.

The objectives of to the MOA include the following:

- Achieve greater efficiency of ANR and VTrans operations by modifying unnecessary and/or inefficient processes; and
- Enhance the performance of the VTrans stream crossing structure projects in the areas of geomorphic compatibility (sediment transport), flood hazard avoidance, maintenance requirements, and aquatic organism passage (AOP); and
- Address a 33% statewide reduction in the ANR stream alteration engineering staff.

DEFINITIONS OF TERMS

ANR	Vermont Agency of Natural Resources
AOP	Aquatic Organism Passage
Backroads Manual	Vermont Better Backroads Manual
Bankfull Cross Section	
Bankfull Width (BFW)	For the purpose of this document, Bankfull Width shall be synonymous with Ordinary High Water - The point on a stream bank to which the action of surface water leaves a distinct mark by erosion; destruction or prevention of woody terrestrial vegetation; predominance of aquatic vegetation; or other easily recognized characteristic. BFW also refers to the natural channel width associated with the average annual high water discharge.
Biodegradable	Capable of decay through exposure and/or the action of living organisms
BMP	Best Management Practice
COE	U.S. Army Corps of Engineers
Culvert Length	The distance of a culvert as measured from the inlet to the outlet
Culvert Roughness	Refers to the friction caused by the inside configuration of the culvert
Culvert Size	Refers to the measurement of the structure opening
DHP	VTrans Historic Preservation and Archeological Officers
District	VTrans Maintenance District
DTA	District Transportation Administrator
EPSC	Erosion Prevention & Sedimentation Control
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
In-kind Replacement	Refers to same length, size and roughness, as well as horizontal and vertical alignment
Intermittent Streams	Streams which do not flow year-round, but at least 3 months of the year
Liner	Any retrofit method which may increase flow velocities by lessening the culvert internal opening. Liners include, but are not limited to: invert repairs, slip-liners, and cast-in-place pipes of any material type.
MOA	Memorandum of Agreement
Ordinary High Water	(OHW) See definition of <u>Bankfull Width</u> (above).
Perennial Streams	Watercourses that flow year-round
Photodegradable	Capable of being broken down by sunlight
Roadside Ditches	Man made drainage swales, which collect and convey runoff away from a transportation facility. Roadside ditches are not considered wetlands, if they were “constructed in the non-wetlands.”

SAE	ANR stream alteration engineer
StreamStats	StreamStats is a Web-based Geographic Information System (GIS) that provides users with access to an assortment of analytical tools that are useful for water-resources planning and management. StreamStats allows users to easily obtain stream flow statistics, drainage-basin characteristics, and other information for user-selected sites on streams.
Surplus Materials	Excess earthen matter generated during maintenance activities.
Type I Stone	Stone varying in size from 1" – 12", with at least 50% 4" or greater
Type II Stone	Stone varying in size from 2" – 36", with at least 50% 12" or greater
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Service
VDFW	Vermont Department of Fish and Wildlife
VTrans	Vermont Agency of Transportation

GENERAL GUIDELINES FOR PROTECTION OF THE ENVIRONMENT

Implementation and management of the statewide Culvert and Ditch Procedures is intended to provide uniform guidance for all types of transportation facilities. Project review and permitting responsibilities reside within the VTrans Environmental Section. The following basic conditions will be applied to all culvert activities and all ditching operations so as to ensure uniform resource regulatory permit compliance throughout the state:

1) Work from the road, rail bed, or fill slopes

Every effort will be made to work from the existing road surface or fill slopes. When it is necessary to have equipment and materials beyond the existing roadway slopes and/or toe-of-slope, the District must contact the Environmental Specialist covering that region to coordinate a review and clearance with regard to cultural and/or natural resources.

2) Waste & Borrow Sites

Each District is responsible for identifying locations where surplus materials can be placed throughout their respective District. Surplus materials will not be placed within 50' of any wetlands or their buffer zones, or 100' from the top of bank of any river, stream, lake or pond, and will not be disposed of in areas known to contain archeological sites, or areas that have been determined to be archeologically sensitive. It is the responsibility of each District to identify proposed waste and borrow areas and submit them to the VTrans Environmental Specialist covering that region for review and clearance of cultural and/or natural resources impacts prior to their use.

An Off-Site Construction Submittal Form must be submitted to the VTrans Environmental Section for review and approval. Certain waste, borrow, and staging sites are EXEMPT from review due to the inert nature of these activities. Both the Off-Site Construction Submittal Form and a list of waste, borrow, and staging exemptions is located on the following website link:

<http://www.aot.state.vt.us/TechServices/EnvPermit/erosionpreventionandsedimentcontrol.htm>

3) Minimum Culvert Size

It is VTrans policy to replace any culvert under a State or U.S. Route with a new culvert with a minimum dimension of eighteen inches (18") and any culvert under an access drive with a minimum dimension of fifteen inches (15").

4) Permitting

VTrans must obtain and comply with all applicable permits.

5) Erosion Control, Sedimentation Prevention, and Water Quality Protection

a) It is VTrans policy to permanently seed and mulch all disturbed soils upon completion of the maintenance operation. Temporary erosion control measures will be utilized until final control measures are established. Erosion control measures will be completed on each section by the end of each work week (or sooner) if weather conditions dictate. In the event of heavy rains, seeding and mulching will be repeated as necessary until vegetation is established. Furthermore, in the event that the previous year's disturbed areas have not established a healthy vegetative cover, it will be necessary to re-seed and mulch the areas so as to stabilize the sites.

b) For the side slopes of ditches, if the slope is steeper than 1:3 (1 vertical to 3 horizontal), erosion matting is recommended.

c) Every effort will be made to ensure that ditch maintenance projects are completed and stabilized before September 15th of each year, as seeding before September 15th provides enough growing season for vigorous growth to occur. If seeding cannot be done prior to September 15th the use of non-vegetative protection measures (i.e. erosion control matting) must be employed.

d) For any maintenance project which must extend past September 15th of any given year, all measures possible will be taken to limit exposure of soils. In addition, any soil disturbance between October 15 and April 15 will require inclusion of special winter erosion and sediment control measures.

e) All in-stream work (intermittent or perennial) must be performed in a dry work zone. An adequate de-watering plan must be in place to keep the work zone dry during construction. In doing so, to the maximum extent practicable, all efforts shall be taken to maintain the normal downstream flow conditions at all times.

6) Stormwater Infiltration/Treatment

a) All reasonable measures to allow stormwater runoff to infiltrate into the ground prior to discharging into receiving waters must be considered as part of any new culvert, culvert maintenance, or ditch maintenance project. When practical, energy dissipation and sheetflow must be promoted.

b) Acceptable permanent and temporary erosion prevention and sediment control practices must be in place to protect water quality. Adequate sedimentation and erosion control management measures, practices and devices, such as phased construction, vegetated filter strips, geotextile silt fences or other devices, must be installed and properly maintained to reduce erosion and retain sediment on site during and after construction. Such measures must be capable of preventing erosion, collecting sediment and suspended and floating materials, and filtering fine

sediment. The temporary devices must be removed upon completion of work, and the disturbed areas must be stabilized. The sediment collected by these devices must be removed and placed at an upland waste site location, in a manner that will prevent both long-term and short-term erosion. As previously stated, it is the responsibility of each District to identify proposed waste and borrow areas and submit them to the VTrans Environmental Specialist covering that region for review and clearance of cultural or natural resources impacts prior to their use.

c) All exposed soil and other fills must be permanently stabilized at the earliest practicable date. Guidance on temporary and permanent erosion controls can be found in the following documents:

ANR Low Risk Handbook (link):

http://www.anr.state.vt.us/dec/waterq/stormwater/docs/construction/sw_low_risk_site_handbook.pdf

VTrans Standard Specifications for Erosion Control (link):

<http://www.aot.state.vt.us/CaddHelp/DownLoad/Details/ErosionSedimentCtrl/EPSC%20Detail%20Master%20PDF.pdf>

d) Any and all non-VTrans stormwater and suspected illicit (non-stormwater) discharges originating outside the State right-of-way and entering the VTrans stormwater conveyance system must be reported to the VTrans Operations Environmental Coordinator for investigation, corrective action consideration, and potential enforcement actions. Corrective actions may require the non-VTrans property owner(s) to obtain Title 19, Section 1111 Permit coverage, implementation of acceptable erosion prevention and sediment controls to treat stormwater prior to entering the State right-of-way, or disconnecting an unauthorized discharge into the right-of-way.

e) It is inevitable that beaver activity will interfere with transportation drainage systems or threaten the facility all together. When this happens the District must consult with the VTrans Environmental Specialist who will consult with VTrans Environmental Biologist and Archeologists to ensure proper BMP(s) are followed for dealing with each specific situation.

Prior to consulting with the VTrans Environmental Section, District personnel must familiarize themselves with the VT Fish & Wildlife Department's Best Management Practices for Resolving Human-Beaver Conflicts in Vermont. This BMP Manual simplifies the legal and regulatory framework related to beaver management and attempts to maintain, whenever possible, the co-existence of beaver and near and adjacent land uses, including transportation facilities. This document may be found at the following link:

http://www.vtfishandwildlife.com/library/reports_and_documents/Furbearer/Best_Management_Practices_for_Human-Beaver_Conflicts.pdf

MAINTAINING AND CONSTRUCTING CULVERTS

1) Constructing, replacing, or repairing culverts in streams with a 0 - 0.24 square mile drainage area

The construction, replacement, or repair of culverts in streams with a drainage area of 0 - 0.24 square mile must meet or exceed the following conditions:

- a) If it is necessary to construct a detour around the culvert (for the purpose of either maintaining traffic or construction access), the District must submit a sketch plan to the VTrans Environmental Specialist covering that region for prior review and approval; and.
- b) All construction activities (other than in-kind replacements and repairs) on culverts carrying intermittent and/or perennial streams must occur between July 15 and October 1 unless a Category 2 General Permit is obtained from the COE; and
- c) A normal downstream flow must be maintained by means of temporary stream diversions and a contained by-pass system to carry the water through the construction area, unless site conditions preclude such; and
- d) Headwalls that minimize the project footprint are desirable erosion prevention features and must be considered, designed, and constructed whenever the District deems feasible; and
- e) The VTrans Historic Preservation Officer must review culvert construction, replacements, or repairs affecting structures older than 50 years per the Programmatic Agreement with the Vermont Division for Historic Preservation; and
- f) All activities must comply with the “General Guidelines for the Protection of the Environment,” above.

2) Constructing, replacing, or repairing culverts in streams with a 0.25 – 0.49 square mile drainage area

The construction, replacement, or repair of culverts in streams with a drainage area of 0.25 – 0.49 square mile must meet or exceed the following conditions:

- a) Meet or exceed current VTrans hydraulic standards; and
- b) Any rehabilitation, modification, or repair of an existing structure must not increase any existing structural encroachment into the bankfull cross section; and

- c) The width of the structure must meet or exceed the width of the OHW mark of the stream (as determined by the VTrans Biologists and hydraulic engineers) so as not to encroach into the bankfull cross-section; and
- d) The vertical alignment of the designed streambed profile through any new or replacement structure shall match, as closely as possible, the natural channel profile as determined outside the influence (induced deposition and scour) of the structure; and
- e) All in-stream work must be conducted between July 15 and October 1 (unless a Category 2 General Permit is obtained from the COE) (see Minimum Standards for a Section 404 Category 2 Permit, below); and
- f) All activities must comply with the “General Guidelines for the Protection of the Environment, above.”

3) Constructing, replacing, or repairing culverts in streams with a 0.5 – 0.99 square mile drainage area

The construction, replacement, or repair of culverts in streams with a drainage area of 0.5 – 0.99 square mile must meet or exceed the following conditions:

- a) Meet or exceed current VTrans hydraulic standards; and
- b) The width of the structure must meet or exceed the width of the OHW mark of the stream (as determined by the VTrans Biologists and Hydraulics Engineer) so as not to encroach into the bankfull cross-section; and
- c) The vertical alignment of the designed streambed profile through any new or replacement structure shall match, as closely as possible, the natural channel profile as determined outside the influence (induced deposition and scour) of the structure; and
- d) All in-stream work must be conducted between July 15 and October 1 (unless a Category 2 General Permit is obtained from the COE) (see Minimum Standards for a Section 404 Category 2 Permit, below); and
- e) Any rehabilitation, modification, or repair of an existing structure must not increase any existing structural encroachment into the bankfull cross section; and
- f) Projects subject to COE Category 2 Permitting in this category require a work

start/stop notification to both the COE and VTrans Biologists; and

- g) Any new or replacement structure must, unless waived by VDFW, provide AOP by being designed to:
- a. Maintain stream bed materials, velocities, turbulence, and depths within the structure, similar to and continuous with those found in adjacent stream reaches, across a range of desired flows; and
 - b. Retain the designed invert embedment depth, relative to stream bed elevation, for the life of the structure and in consideration of future channel conditions; and
- h) Any new construction or rehabilitation, modification, or repair of an existing structure (including all liners and invert repairs) must not result in a reduction in existing AOP capacity, unless waived by VDFW; and
- i) Invert construction and repairs require prior review and approval by a VTrans biologist, as a Section 404 Permit (Category 2) will be necessary (see Minimum Standards for a Section 404 Category 2 Permit); and
- j) If special circumstances exist, VTrans must contact an SAE for technical assistance. VTrans must incorporate any recommendations that the SAE makes into the project. Special circumstances include but are not limited to the following:
- Existing structures that do not encroach in the bank full cross section yet have a history of failure during floods and/or periodic channel maintenance;
 - Difficulty in ascertaining the bank full cross section and/or the natural channel profile;
 - Indicators of extreme sediment transport needs at the site;
 - Significant deviations in horizontal or vertical alignment; and
- k) All activities must comply with the “General Guidelines for the Protection of the Environment,” above.

4) Constructing, replacing, or repairing culverts in streams with a 1.0 square mile drainage area or larger

Work in this category requires prior review and approval by the VTrans Environmental Section. The construction, replacement, or repair of culverts in drainage areas of 1.0 square mile in size or larger may result in impacts upon the environment if not properly performed. It is therefore imperative that the design, construction, and maintenance of these structures consider the effects

of fish and wildlife passage. Due to the complexity of these projects, each of these projects must be coordinated through the VTrans Environmental Section well in advance of their anticipated construction.

AOP requirements for large culvert projects must be determined through consultation between the District, the VTrans Environmental Section, the SAE, the ANR Fisheries Biologist, and the COE.

Both ANR and the COE generally discourage culvert linings due to potential adverse effects associated with aquatic organism passage (AOP) and stream geomorphology.

The District Project Manager must notify the VTrans Environmental Specialist covering that region of any plans for culvert construction, replacements, repairs, or linings in this category. The District must provide project specific information for each culvert listed including, at a minimum: the location of each culvert (by town name, route number, mile marker, name of stream (if known) and a location map); a hydraulic report; plans (in a PDF format); and a description of the proposed construction (when and how the culvert will be constructed, repaired, replaced, etc.). Photos are helpful if available.

Upon receipt of the minimum required application materials, the VTrans Environmental Specialist covering that region must coordinate and solicit comments from VTrans resource specialists relative to the permitting requirements of the project. The VTrans Environmental Section shall be responsible for obtaining all necessary permits and clearances. The District must coordinate with the VTrans Environmental Section to develop ways to avoid and/or minimize the effect of these operations on the environment.

The VTrans Environmental Section must coordinate with the appropriate resource agencies for approval. Projects involving new culverts, full replacements, or culvert liners must be coordinated with the SAE, the ANR Fisheries Biologist, and the COE. The ANR Fisheries Biologist will provide comments to the SAE on the need to provide for AOP. Most projects in this category will require a Section 404 Category 2 General Permit. The VTrans Biologists will serve as the primary contact persons within VTrans responsible for the development, coordination, and submittal of all Section 404 Permits. See Minimum Standards for a Section 404 Category 2 Permit, below.

Minimum Standards for a Section 404 Category 2 Permit

A Category 2 General Permit is required for all culvert liner projects, projects requiring in-stream work beyond the July 15 to October 1 time period; when working in waters classified as *Essential Fish Habitat*, *Navigable Waterways*, or *Special Aquatic Sites*; and/or when the combined impacts below OHW and/or wetlands exceed 3,000 square feet.

Category 2 General Permits require the following minimum information, which must be supplied to the VTrans Biologists for review, coordination, and permit processing:

- Location Map
- Plan view of project with Ordinary High Water shown, differentiating between temporary and permanent impacts
- Edge of Wetlands (temporary/permanent impacts), if applicable (VTrans Biologists are responsible for determining this boundary)
- Channel cross-sections with OHW and edge of wetlands depicted
- Rare, threatened, endangered species review by VTrans Biologists
- Section 106 Clearance
- NEPA Documentation (if federal dollars are used to fund any portion of the project)
- Hydraulics report / recommendations
- Construction Time Schedule

5) Lining culverts and invert repairs on any size culvert, stream, or watershed

The lining or invert repair of a culvert in any size culvert, stream, or watershed requires the prior review and approval of the VTrans Environmental Section prior to conducting the work, as a Section 404 Permit is required for these activities because they decrease the hydraulic capacity of the existing structure. In such cases, the work must be coordinated with the VTrans Environmental Section via the Environmental Specialist covering that region. In addition, culvert liners and invert repairs must be reviewed by the VTrans Hydraulics Section.

The repair or replacement of the culvert must be considered prior to pursuing any culvert liner project. Culvert liners are a last resort effort and in most cases, their use must be limited to culverts in fills greater than 10 feet in depth.

6) Installation of new culverts of any size, on any stream, or any size drainage area

The District must notify the VTrans Environmental Specialist of any new culvert installations. The notification must include: a site description, the town name, route number, beginning and ending mile markers, the justification or need for the installation, photographs of the site, and location maps.

The Environmental Specialists serve as the initial point of contact for these activities and coordinate the permitting process. For projects in streams draining less than 1.0 square mile, the VTrans Biologist must review the project in accordance with the procedures outlined above.

MAINTENANCE AND CONSTRUCTION OF DITCHES

1) General Erosion Control and Sediment Prevention

Permanent and temporary erosion prevention and sedimentation control practices must be in place as necessary to control construction stormwater and discharges to protect water quality from the construction or maintenance of ditches. Sediment and erosion control management measures, practices, and devices, including phased construction, vegetated filter strips, geotextile silt fences, or other devices, shall be installed and properly maintained to reduce erosion and retain sediment on-site during and after construction. Such measures must be capable of preventing erosion and collecting sediment and suspended and floating materials and filtering fine sediment. Temporary devices must be removed upon completion of work, and the disturbed areas must be stabilized. The sediment collected by these devices must be removed and placed at an upland location in a manner that will prevent its later erosion into a waterway or wetland. All exposed soil and other fills must be permanently stabilized at the earliest practicable date. Further guidance on temporary and permanent erosion controls may be found in the following documents:

ANR Low Risk Handbook (link)

http://www.anr.state.vt.us/dec/waterq/stormwater/docs/construction/sw_low_risk_site_handbook.pdf

VTrans Standard Specifications for Erosion Control (link)

<http://www.aot.state.vt.us/CaddHelp/DownLoad/Details/ErosionSedimentCtrl/EPSC%20Detail%20Master%20PDF.pdf>

2) Grass-lined, Stone-lined, and Paved Ditches

VTrans recognizes the numerous benefits of grass-lined ditches and is committed to using them wherever possible to obtain maximum treatment of stormwater runoff. VTrans remains committed to eliminating paved ditches wherever possible by replacing them with grass and/or stone-lined ditches, depending upon the grade. VTrans recognizes that paved ditches provide no treatment of stormwater runoff while at accelerating flow velocities, thereby increasing the probability of erosion below the ditch. Paved ditches also contribute to higher water temperatures, which are known to harm many aquatic organisms. For these reasons, no ditch shall be paved without prior review and clearance by the VTrans Environmental Section.

3) Existing Ditch Maintenance

The maintenance of existing parallel ditches, as long as they are not enlarged, does not require review by ANR or the COE. As a general rule, ANR and the COE do not consider road and railroad ditches to be regulated wetlands if the ditch was originally constructed in an upland (non-wetland), even in cases where wetland plant species may have become established due to the lack of frequent maintenance. If in doubt, the VTrans Biologists should be contacted for better clarification. Maintenance work associated with existing parallel ditches does not require coordination with the VTrans Environmental Section unless the conditions of these procedures cannot be met. Ditches running perpendicular to a transportation facility, however, do require

review and coordination with the VTrans Environmental Specialist covering the region, to determine whether regulated resources may be present and/or involved. In all cases, ditch spoils must be removed from the immediate area and disposed of in a pre-approved waste location, as outlined previously in these procedures.

To ensure that ditches are stabilized, erosion control measures must be completed on each section by the end of each work week (or sooner if weather conditions dictate). Temporary erosion control measures must be utilized, inspected, and repaired as necessary until permanent controls are established. If wind or rain washes away seed and/or mulch, the measures must be reapplied as often as necessary to establish long-term vegetative stability in the ditches. Maintenance of a ditch will not be considered complete until permanent erosion control measures have been installed and are fully functional. These measures are dependent on the slope of the ditch as summarized in the following table:

Channel Slope	Ditch Linings	
	Lining	Min. Thickness
0 – 1 %	Seed & Mulch	4”
1 – 2.5 %	Natural Fiber Erosion Control Matting & Seed	--
2.5 – 10 %	Type I (stone)	12”
> 10 %	Type II (stone)	24”

- The ditch lining table is applicable between May 1 and September 15.
- Slopes that require only seed and mulch between May 1 and September 15 require seed and erosion matting between September 15 and October 15.
- Between October 15 and May 1, all slopes require winter control measures.
- Straw mulch is preferred over hay mulch as it avoids the spread of nuisance and other unwanted plant species.
- Type I Stone is defined as stone varying in size from 1” – 12”, with at least 50% 4” or greater
- Type II Stone is defined as stone varying in size from 2” – 36”, with at least 50% 12” or greater

See also the “General Guidelines for the Protection of the Environment, above.”

4) NEW DITCH CONSTRUCTION/EXISTING DITCH MODIFICATIONS

The construction of new or realigned ditches always requires review by the VTrans Environmental Section. It is the responsibility of the District to notify the Environmental Specialist covering that region, in writing, of projects involving the construction of new or re-

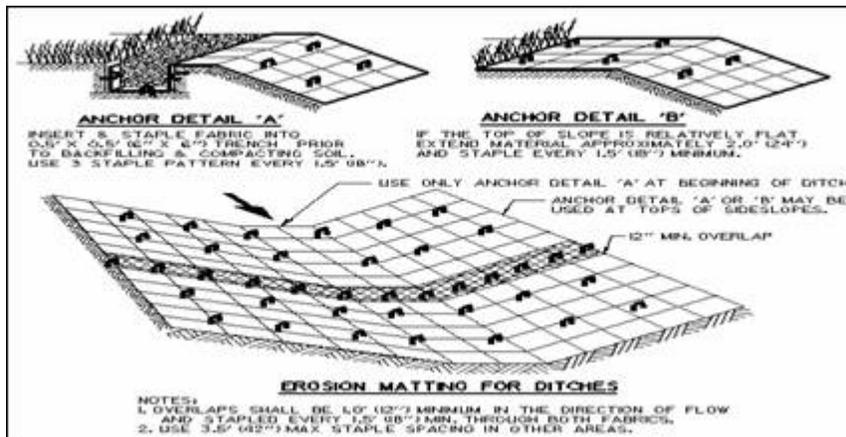
aligned roadside ditches. The notification should include at a minimum: the location of ditches to be constructed (by town name, route number and mile marker); the length of the proposed ditches; photos of existing site conditions; and a detailed description of the proposed waste disposal. A site visit by the VTrans Biologists and/or archeologists may be required.

Upon receipt of the foregoing information, the Environmental Specialist must distribute and coordinate with the Environmental Section staff responsible for the review of potential impacts upon regulated cultural and natural resources. Review comments and clearance documents must be furnished by the resource staff (or their consultants) to the VTrans Environmental Specialist covering that region for final consideration and project clearance. If a potential for resource impacts is identified, survey plans and other additional information may be required in order to obtain clearances and/or necessary permits. The VTrans Environmental Specialist is responsible for coordinating and obtaining permits necessary for the construction of new or re-aligned roadside ditches.

During construction of new or re-aligned ditches, all construction areas must be seeded and mulched by the close of each construction week. Temporary erosion control measures must be utilized, inspected, and repaired as necessary on a daily basis until permanent controls are established. If wind or rain washes away seed and/or mulch, the measures must be reapplied as often as necessary to establish long-term vegetative stability in the ditches. Maintenance of a ditch will not be considered complete until permanent erosion control measures have been installed and are fully functional.

Temporary Erosion Control Matting must be used for side slopes and back slopes steeper than 1:3 (1 vertical to 3 horizontal) or where seed and mulch are impractical. When matting is used, the ground surface must first be shaped to a smooth surface free of depressions and eroded areas that would allow water to collect or flow under the matting. The surface must be cleared of stones, sticks, and other obstructive material that would prevent the matting from maintaining close contact with the ground. Placement of topsoil, fertilizer, seed, and mulch, when required, must be completed prior to placement of the matting.

After the soil has been properly shaped, fertilized, and seeded, the matting must be placed parallel to the flow direction of water in channels or vertically on slopes and in direct contact with the soil surface. The matting material must not be stretched or allowed to bridge over surface inconsistencies. Erosion matting and ground fasteners must be installed as recommended by the manufacturer for the particular application. No vehicular traffic of any kind may be permitted over the matting during or after placement. Any torn or damaged material must be replaced. The matted area must be maintained until vegetation is established.



Temporary Erosion Matting Materials must conform to one of the specifications and corresponding properties found in the Temporary Rolled Erosion Control Products table below.

- a) Mulch Control Netting: A temporary biodegradable rolled erosion control product (RECP) composed of planar woven natural fiber.
- b) Erosion Control Blanket: A temporary all natural biodegradable rolled erosion control product composed of processed fibers mechanically bound together to form a continuous matrix.

TEMPORARY ROLLED EROSION CONTROL PRODUCTS

(For use where natural vegetation will provide permanent erosion protection)

Follow manufacturer recommendations for installation.

Product Description	Material Composition	Longevity (months)	Slope Applications	Channel Applications
			Maximum Gradient(v:h)	Maximum Shear Stress Pa(lbs/ft ²)
Mulch Control Nets	All natural biodegradable mesh or woven netting.	3	1:5	12 (0.25)
		12	1:5	12 (0.25)
		24	1:5	12 (0.25)
Netless Rolled Erosion Control Blankets	All natural biodegradable fibers mechanically interlocked together to form a continuous matrix.	3	1:4	24 (0.5)
		12	1:4	24 (0.5)
Single-net Erosion Control Blankets	All natural processed, biodegradable fibers mechanically bound together by a single net of yarn or twine woven into a	3	1:3	72 (1.5)
		12	1:3	72 (1.5)

	continuous matrix.			
Double-net Erosion Control Blankets	All natural processed, biodegradable fibers mechanically bound together between two nets of yarn or twine woven into a continuous matrix.	3	1:2	84 (1.75)
		12	1:2	84 (1.75)
		24	1:1.5	96 (2.00)
		36	1:1	108 (2.25)

Shear stress for mulch control nettings must be calculated for netting used in conjunction with pre-applied mulch material.

The required shear stress is the minimum shear stress the RECP (non-vegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in) soil loss) during a 30-minute flow event in large-scale testing. These performance test values should be supported by periodic bench scale testing under similar test conditions and failure criteria using ECTC Test Method #3.

The permissible shear stress levels established for each performance category are based on historical experience with products characterized by Manning's roughness coefficients in the range of 0.01 - 0.05.

Per the Engineer's discretion, the recommended acceptable large-scale testing protocol may include ASTM D 6460, ECTC Test Method #3 or other independent testing deemed acceptable by the Engineer.

Contact Information

OPERATIONS:

<http://www.aot.state.vt.us/maint/Operations.htm>

Craig "DiGi" DiGiammarino, Operations Environmental Coordinator, VTrans Operations Division

[tel. 802.828.0435] [cell. 802.922.4681] [fax. 802.828.2848]

Craig Dusablon, Landscape Coordinator, VTrans Operations Division

[tel. 802.527.5448] [cell. 802.782.0116]

PROGRAM DEVELOPMENT ENVIRONMENTAL:

<http://www.aot.state.vt.us/TechServices/EnvPermit/NewEnvirHomepage.htm>

John T. Narowski, Environmental Services Engineer [tel. 802.828.5265]

Environmental Specialists (link to Region Map noted below):

<http://www.aot.state.vt.us/TechServices/EnvPermit/Documents/EnvironmentalSpecialistMap2007.pdf>

Dennis Benjamin, Environmental Specialist Coordinator – Contact for NE Region [tel. 802.828.3978]

Chris Slesar, SW Region [tel. 802.828.5743]

Lee Goldstein, SE Region [tel. 802.828.3985]

Jeffrey Ramsey, NW Region [tel. 802.828.1278]

Environmental Biologists (link to Region Map noted below):

<http://vtransmap.aot.state.vt.us/omc/images/Bioregions2005.pdf>

John Lepore [tel. 802.828.3963]

Glenn Gingras [tel. 802.828.3979]

Environmental Cultural Resources Specialist:

<http://www.aot.state.vt.us/TechServices/EnvPermit/CulturalResources.htm>

Scott Newman, Historic Preservation Officer [tel. 802.828.3964]

Duncan Wilkie, Archaeology Officer [tel. 802.828.3965]

Jeannine Russell, Senior Transportation Archaeologist [tel. 802.828.3981]

Environmental Stormwater Engineer:

Jonathan Armstrong, Stormwater Engineer [tel. 802.828.1332]

PROGRAM DEVELOPMENT HYDRAULICS:

<http://www.aot.state.vt.us/techservices/Hydraulics/hydraulics.htm>

Nick Wark, Hydraulics Engineer [tel. 802.828.5763]