Diversion of surface water away from exposed soils provides the most economic and effective erosion control possible since it is more advantageous to control erosion at the source than to design controls to trap suspended sediment.
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**LIST OF APPENDICES**

Appendix A: Temporary Structural Measures
Appendix B: Permanent Structural Measures
1.0 INTRODUCTION

OwnEnergy, Inc., (OwnEnergy or the Project Owner), is proposing to develop a wind-powered generating facility in the Town of Denmark, Lewis County and the Towns of Rutland, Champion and Watertown, Jefferson County, New York. The Project is located east of Interstate 81, bordered to the north by County Highway 126, to the east by County Highway 26, to the south by the Lowville, Harrisburg, and Pinckney Town Lines, while the generating portion of the Project area is bisected by State Route 12 (see Figure 1 and 2 of the DEIS).

Prior to construction, the Project Owner will prepare a complete Stormwater Pollution Prevention Plan (SWPPP). The purpose of the SWPPP is to describe the erosion and sediment control practices that will be implemented during construction activities and the permanent stormwater management practices that will be used to reduce the pollutants in stormwater discharges after the Project construction has been completed.

This document will provide a preliminary summary of the Project SWPPP.

In New York State, the primary objective of a SWPPP is to comply with the current State Pollution Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activities. This will be done by:

- Assessing the physical characteristics of the site to determine how it can be developed with the lowest risk of environmental damage.
- Minimizing impacts by maintaining vegetative buffer strips between disturbed and adjacent areas.
- Providing an erosion and sediment control plan that emphasizes controlling runoff and stabilizing soil as its main component, and sediment control as a management practice. The reduction of soil loss reduces the risk of degrading natural resources.
- Managing the impact of stormwater runoff on the water quality of the receiving waters.
- Controlling of the increased volume and peak rate of stormwater runoff during and after construction.
- Operation and maintenance of erosion, sediment, and stormwater management practices during and after construction.

This preliminary SWPPP is prepared in accordance with the following guidance documents:

- New York State Standards and Specifications for Erosion and Sediment Control, (NYS Standards), New York State Department of Environmental Conservation, August 2005.

1.1 SWPPP Contents

The SWPPP will include the following required information:

1. Description of the Project location, type and size.
2. Description of the erosion and sediment control practices and where required, post-construction stormwater management practices that will be constructed.
3. Site map showing all facilities to be constructed, areas of disturbance, existing vegetation, water resources, existing and proposed grading, soil types, spoil and borrow areas, and stormwater discharge locations.
4. Description of the soils.
5. Construction phasing plan that includes sequencing of erosion and sediment control practices.
7. Site map(s) showing the location, dimensions, material specifications, installation details, and operation and maintenance requirements for all erosion and sediment control and post-construction stormwater management practices and structures.
8. SWPPP inspection schedule.
10. Description of any stormwater discharges anticipated at the site other than from construction activities.
11. Identification of erosion and sediment control and stormwater management practices that are not in conformance with NYS Standards and discussion that demonstrates that the alternate design(s) are equivalent to the Standards.
12. Detailed summary of engineering design criteria.

1.2 General Project Description

The Project includes 62 wind turbines, which will deliver up to 100 MW of electrical power to the New York state grid. As presently envisioned, the Project will use the GE 1.6 - 100 wind turbine (or equivalent) with a rated capacity of 1.6 MW. Each turbine will include a three-bladed upwind rotor, with a diameter of 100 meters (328 feet), mounted on a 96-meter (315-foot) tubular steel tower. The Project will also involve construction of approximately 17 miles of gravel access roads, approximately 24 miles of buried electrical collection lines, a collection substation, a point of interconnection (POI) substation, and three permanent 100-meter (328 feet) tall meteorological towers. To service the facility, an operations and maintenance building (O&M facility) will house operations personnel, equipment and materials, and provide staff parking.

Project construction is anticipated to occur in a single phase. Pending the receipt of all required permits, construction is scheduled to start in the summer of 2014 and be completed by December 31 of that year. A radius of up to 200 feet will be cleared around each tower, a 100-foot wide corridor will be cleared (or forested vegetation trimmed) along access roads, and a 25-foot-wide corridor will be cleared along underground electric collection lines that are not adjacent to access roads.

1.3 Soil Resource Summary

Clay is composed of mineral soil particles less than 0.002 millimeters in diameter. Silt is composed of individual rock or mineral fragments that range in diameter from the upper limit of clay to the lower limit of very fine sand. Sand is composed of individual rock or mineral fragments in soils ranging from 0.05 to 2.0 millimeters in diameter.

Loam is soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles. Different names are given to soils with slightly different proportions of sand, silt, and clay: sandy loam, silty loam, clay loam, sandy clay loam, silty clay loam, and loam. Loam soil retains nutrients well.

Channery soil contains thin, flat fragments of sandstone or siltstone, as much as 6 inches in length along the longer axis.

A fragipan is a loamy, brittle, subsurface layer of soil that is very low in organic matter and clay but is rich in silt or very fine sand. The layer seems to be cemented when dry, has a hard consistence, and has a high bulk density in comparison to the soil layers above it. Bulk density is a measure of the weight of the soil per unit volume. When moist, a fragipan tends to rupture suddenly if pressure is applied.
Till is unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

The following soils, which are presented in alphabetical order, are mapped within the limits of the Project area (descriptions obtained from the USDA’s Official Soil Series Descriptions, accessed on February 12, 2013). A map of the following soils may be referred to in Figure 4 of the DEIS.

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<td>Wayland silt loam, 0 to 2 percent slopes</td>
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1.4 **NYS Historic Preservation Office Requirements**

The complete SWPPP will include documentation that describes:

1. Information on whether the stormwater discharge or construction activities would have an effect on property that is listed or eligible for listing on the State or National Register of Historic Places.
2. Results of historic places screening-determinations conducted.
3. Where effects may occur, a description of measures necessary to minimize effects on historic places including any written agreements with governmental agencies having jurisdiction.

1.5 **Roadway Reconstruction**

It is expected that portions of the local road system will require reconstruction of intersections and reinforcement of culverts to accommodate the delivery of wind system components. Erosion and sediment control practices as discussed in section 2 of this document will be provided. Post-construction stormwater management practices will be provided if required by NYSDEC regulations.

1.6 **Riparian Buffers**

The ecosystem benefits of riparian areas will be preserved by protecting existing vegetation within 100 feet of the top of all stream banks where practicable. All temporary and permanent waterway crossings will, at a minimum, meet the requirements of the applicable regulatory agencies (NYSDEC, USACOE).
2.0 STORMWATER MANAGEMENT PRACTICES

2.1 Erosion and Sediment Control

Erosion is the wearing away of the land surface as the result of uncontrolled wind and water energy. Sedimentation is the result of transport and deposition of eroded soil particles. Erosion and sediment control practices are classified as either vegetative or structural controls.

Vegetative erosion control is the system of seedbed preparation, soil amendments, plant selection, proper timing of planting, and mulching that will optimize the chances of successfully establishing vigorous, stable vegetation. Temporary seeding and mulching will be utilized on all areas that will be exposed for more than 14 days. Where soil disturbing activity has been temporarily or permanently ceased, temporary or permanent soil stabilization measures will be installed within 7 days from the date that soil disturbance activity has ceased. Permanent stabilization will be performed as soon as possible after establishment of finished grade.

Structural erosion control practices may be either temporary or permanent. They are necessary when disturbed areas cannot be promptly stabilized with vegetation. Temporary practices are installed during construction and are removed after site stabilization has been completed. Permanent practices may be installed during or after construction, are an integral part of the Project design, and continue to be operated and maintained when the Project work has been completed.

The complete SWPPP will include an erosion and sediment control plan that details the location and necessary dimensions for vegetative and structural measures that will be used for each stage of the Project. Retention of existing vegetation, stabilizing the land with plant materials, and the use of structural measures will be shown. Dewatering practices for use during installation of applicable project components will also be included.

Construction phasing notes that relate the establishment of vegetative and structural practices and their timing relative to other construction practices, and an inspection and maintenance plan will be provided for the site.

Erosion and sediment control measures will be inspected at least once every 7 days (or following significant storm events) by a person knowledgeable in the principles and practices of erosion and sediment control until all soil disturbance has ceased and a vigorous vegetative cover or equivalent stabilization measures have been established on all disturbed areas across the Project Area. Inspections will be in accordance with the 2010 SPDES General Permit for Stormwater Discharges from Construction.

Prior to beginning construction, the Project Owner will submit a Notice of Intent (NOI) in conformance with the current SPDES regulations and obtain authorization to commence construction activities from the NYSDEC Bureau of Water Permits in Albany.

Probable erosion and sediment control practices are discussed in the following subsections.

2.2 Vegetative Erosion and Sediment Control Measures

Factors such as soil texture and steepness affect slope stability. Topsoil will be stockpiled for reuse after site construction has been completed. Appropriate plants will be selected to meet the final slope and soil conditions for the site.
2.2.1 Temporary Seedings

Temporary seedings provide erosion control protection for an interim period. Temporary control is achieved by covering all bare ground areas that exist on the construction site.

Temporary seedings will be used where final grading is complete and it is necessary to wait for the optimal time to establish permanent vegetation, where a disturbed site will remain exposed for more than 14 days, when preparing for winter work shutdown, or when permanent seedings are expected to fail because of a mid-summer drought.

2.2.2 Permanent Seedings

Establishing perennial vegetative cover on disturbed slopes subject to erosion will reduce erosion and sediment transport. The seedbed will be prepared to promote good soil to seed contact, remove large stones and other debris from the surface, and amended with topsoil, fertilizer, and/or other appropriate material as necessary to promote prompt establishment of vigorous vegetation. Seed mixtures will be appropriate to the Project Area; priority will be given to native seed mixtures.

2.2.3 Vegetating Waterways

A natural or constructed drainage way, waterways are vegetated to safely convey excess surface runoff from construction sites without causing erosion. Waterways will be protected from erosion by vegetative means as soon after construction as practical. Jute mesh, stone, or other erosion control products will be used as necessary to avoid center gullies.

2.2.4 Mulching

Hydromulch or clean (weed-free) cereal grain straw will be applied at rates recommended in the NYS Standards to provide initial erosion control while seeding is becoming established. Mulch will also be used alone for temporary stabilization during the dormant season (non-growing months). Straw mulch will be applied at the rate of 2 tons/acre. Hydromulch will be applied at the rate of 2000 pounds per acre.

All mulch placed atop permanent seedings on slopes steeper than 3:1 will be anchored with a biodegradable rolled erosion control product installed according to manufacturer’s directions.

2.2.5 Protecting Vegetation During Construction

Existing vegetation determined to be important for erosion control, water quality protection, wetland protection and wildlife habitat will be preserved by limiting soil disturbance near such vegetation and by clearly delineating the limits of construction in the field using silt fencing or construction fencing. Limiting large areas of disturbance and grading and stabilizing large areas of disturbance in stages will be adopted during development of this wind power Project.

2.3 Structural Erosion and Sediment Control Measures

Temporary structural measures are used during construction to prevent offsite sedimentation. The permanent structures are used to convey surface water to a stable outlet; they will remain in place and continue to function after the completion of construction.

Runoff control structures will be the first items constructed when grading begins and will be stabilized and fully functional before downslope land disturbance takes place. Sediment trapping devices will be stabilized.
and fully functional before upslope land disturbance takes place. Sheet flow runoff will be treated with silt fence and vegetative buffer strips. The structural measures will be maintained so that they remain effective in their pollution control function.

2.4 Temporary Structural Measures

See Appendix A for typical details.

2.4.1 Temporary Swale

A temporary excavated drainage way, temporary swales prevent runoff from entering disturbed areas by intercepting and diverting it to a stabilized outlet or to intercept sediment-laden water and divert it to a sediment trapping device.

2.4.2 Water Bar

A ridge, or ridge and channel, constructed diagonally across a slopping road or utility right-of-way subject to erosion, a water bar is constructed to limit the accumulation of erosive velocity water by diverting surface runoff at pre-designated intervals.

2.4.3 Silt Fence

The purpose of a silt fence is to reduce runoff velocity and effect deposition of the transported sediment load. A temporary barrier of geotextile fabric installed on posts placed on the contour across a slope, silt fence is used to intercept sediment laden runoff from small drainage areas of disturbed soil. Silt fence installation, including its placement at intervals along a slope, will be as recommended by NYS Standards. As allowed, silt fence will also be placed at least 10 feet below the toe of slope to allow for maintenance and material roll down. The area below the silt fence will be stable.

2.4.4 Check Dam

Constructed of well graded hard durable stone, 2-9 inches in size (NYSDOT Light Stone Fill), check dams are small barriers placed across a drainage way that reduce erosion in a drainage channel by restricting the velocity of flow in the channel. Check dams are spaced as necessary in the drainage way so that the crest of the downstream dam is equal to the elevation of the toe of the upstream dam. The maximum height of check dams will not be greater than 2 feet, with the center of each check dam at least 9 inches lower than the abutments which extend to natural ground elevation at the top of the drainage way slope. Check dams will be anchored in the channel by a cutoff trench 1.5 feet wide x 6 inches deep that has been lined with geotextile. The area below check dams will be stabilized with stone or vegetation to resist erosion. Check dams will be inspected after runoff events to correct any damage to the downstream channel, to replace missing stones, and to remove accumulated sediment above the check dam as needed.

Check dams will be left in place permanently if they do not present a hazard to vehicles on adjacent roads.

2.4.5 Sediment Trap

A temporary sediment control device formed by excavation and/or embankment to intercept sediment laden runoff and retain the sediment, stone outlet and grass outlet sediment traps will be located so that they can be installed prior to grading within the drainage way they are designed to protect. The outlet from sediment traps will be designed, constructed and maintained so that sediment does not leave the trap and that erosion does not occur at or below the outlet. Sediment traps will also be placed adjacent to dewatering
activities associated with turbine foundation construction, and will be constructed so that their outlet discharge is directed to a stable swale or roadside ditch. Sediment traps will be designed and detailed as required by NYS Standards.

2.4.6 Stabilized Construction Entrance

Located where traffic will leave the Project Area to a public right-of-way, stabilized construction entrances consist of a pad of clean #2 stone at least 6 inches thick, placed upon a suitable geotextile. They will be maintained in a condition that will prevent tracking of sediment outside the Project Area. Provisions will be made to drain runoff away from the construction entrance to a stable location away from the public right-of-way.

2.4.7 Stabilized Equipment Staging Area

Located where the Contractors will stockpile materials and park equipment and construction trailers, stabilized staging areas will consist of clean #2 stone at least 6 inches thick, placed upon a suitable geotextile. The staging areas will be constructed such that runoff is directed to a stable outlet.

2.4.8 Construction Road Stabilization

Stable construction roads will be located to reduce erosion potential, minimize impact on existing site resources, and allow operations to be conducted in a safe manner.

2.4.9 Temporary Access Waterway Crossing

Constructed to provide safe and environmentally responsive access across a waterway for construction equipment, they will be used for the shortest practical timeframe, and will be removed when the need for their use is completed. Their design and construction will be based upon waterway geometry and the aquatic habitat.

2.4.10 Sump Pit for Temporary Dewatering

A temporary pit that is constructed during excavation and dewatering activities, sump pits will be used as necessary to trap and filter water prior to pumping it to a stable discharge area.

Flow from Project activities and dewatering, will be routed to a stable vegetated area or structure outside the ordinary high water line to allow removal of fine sediment and other contaminants.

The stable outlet area or structure must be appropriate to filter sediment, able to withstand the velocity of the discharged water to prevent erosion, sized and operated such that pumped water will flow through a sediment removal device. Sediment should be settled prior to discharge. The flow path should be protected to prevent mobilization of additional sediment.

If the collected water is contaminated with oil, grease, or other petroleum products, an oil/water separator or collection and transport offsite will be used.

2.4.11 Perimeter Dike/Swale

The purpose of a perimeter dike/swale is to prevent off-site storm runoff from entering a disturbed area and to prevent sediment laden storm runoff from leaving the construction site. It may be used on slopes up to 8 percent and will have a stable outlet, such as a sediment basin.
2.4.12 **Brush Barrier**

A temporary sediment barrier constructed at the perimeter of disturbed areas of less than 1/4 acre from materials obtained from clearing and grubbing the site. This practice does not replace a sediment trap.

During clearing and grubbing operations, equipment can push or dump the mixture of limbs, small vegetation, and root map along with minor amounts of soil and rock into windrows along the toe of a slope where erosion and accelerated runoff are expected. Filter fabric may be placed over the brush barrier to provide additional sediment control.

The barrier height may be 2 to 3 feet and the width of its base should be over 5 feet, but less than 10 feet. When the barrier is no longer needed, any filter fabric will be removed to allow natural vegetation to be established inside the barrier. The barrier will rot away over time.

2.4.13 **Pipe Slope Drain**

Used where concentrated flow from surface runoff must be conveyed down a slope of 3 percent or greater in a manner that prevents erosion, a pipe slope drain will consist of an earth dike at the entrance to a pipe extending from the top to the bottom of a slope. The maximum allowable drainage area will be 3.5 acres. The pipe will outlet across a stone outlet into an appropriately sized sediment trap.

2.5 **Permanent Structural Measures**

See Appendix B for typical details.

2.5.1 **Diversion**

A drainage way with a supporting ridge on its lower side that is constructed to intercept and convey runoff to stable outlets at non-erosive velocities, diversions will only be constructed below stabilized or protected areas and on slopes less than 15%. They will be sized to convey the peak runoff from a ten year storm event.

2.5.2 **Grass Waterway**

Used where added vegetative protection is needed to control erosion resulting from concentrated runoff, the grass waterways will be constructed wide and shallow and will convey runoff without causing damage from erosion. Each waterway will have a stable outlet. Where base flow is continuous, the channel will have a stone center.

2.5.3 **Culvert Installation**

Culverts will be installed in the dry or in isolation from the stream flow by the installation of a bypass flume or culvert, or by pumping the stream flow around the work area. Exceptions may be granted if installing the culvert in the flowing stream reduces siltation or turbidity. The bypass reach will be limited to the minimum distance necessary to complete the Project. Fish stranded in the bypass reach will be safely removed to the flowing stream.

Permanent access roads across sensitive sites will employ management strategies and field techniques that protect the riparian area’s attributes to the maximum extent practicable.
Culverts replaced within the public right-of-way will be sized according to the requirements of the agency of government having jurisdiction.

2.5.4 Stone Lined Waterway

Where grass waterways would be inadequate due to high flow velocities, stone lined waterways will provide for the passage of concentrated runoff without damage from erosion or flooding. Stone lining will be constructed where steep grades, wetness, prolonged base flow, seepage or piping would cause erosion, where damage from use by animals, pedestrians, or vehicles precludes the use of grass waterways, or adjacent structures require that the design flows be carried within a swale of limited space.

2.5.5 Rock Outlet Protection

A section of rock protection placed at the outlet of culverts or channels. The outlet protection will be designed and constructed to reduce the depth, velocity, and energy of water, so that the flow will not erode the downstream receiving reach.

2.5.6 Landgrading

Where the existing land surface is reshaped according to Project plans, a grading plan will be provided that shows existing and proposed contours, practices necessary for erosion control, slope stabilization, safe passage and disposal of runoff water, and the phasing of these practices.

2.5.7 Surface Roughening

To aid the establishment of vegetative cover from seedings by reducing runoff velocities and increasing infiltration, after finished grade is established, the bare soil surface will be roughened by tracking perpendicular to the slope with construction equipment.

2.6 Stormwater Management Practices

Where necessary to comply with SPDES regulations, post-construction stormwater management practices will be installed that provide water quality treatment and runoff reduction, and longevity in the field acceptable to NYSDEC.

2.6.1 Sheetflow to Riparian Buffers or Filter Strips

Vegetated filter strips or undisturbed natural areas such as riparian buffers can be used to treat and control stormwater runoff from some areas of development. Vegetated filter strips are vegetated surfaces that are designed to treat sheet flow from adjacent surfaces and remove pollution through filtration and infiltration. Riparian reforestation can be applied to existing impacted riparian corridors.

Runoff can be directed toward riparian buffers and other undisturbed natural areas delineated to infiltrate runoff, reduce runoff velocity and remove pollutants.

2.6.2 Open Stormwater Channels

Vegetated open channels are explicitly designed to capture and treat the stormwater quality volume within dry or wet cells created by check dams constructed within the channel. Dry swales are preferable. Wet
swales will be used only in areas with high groundwater tables. These open stormwater channels will be
designed in accordance with the NYS Stormwater Design Manual.

2.7 Operation and Maintenance of Erosion and Sediment Control, and Stormwater
Management Practices

All erosion and sediment control and stormwater management practices will be constructed and operated in
accordance with their design and maintained to assure continued performance of their intended function and
to prevent sediment-laden runoff from leaving the site during construction. Vegetative practices will be
fertilized, limed, and mowed to maintain a dense protective vegetative cover.

Runoff control measures such as grass waterways, perimeter dikes/swales, water bars, check dams, pipe
slope drains, sump pits, and rock outlet protection, will be the first items constructed when clearing and/or
grading begins, and will be completely functional before downslope land disturbance begins. All temporary
and permanent structural measures will be stabilized before being considered functional.

After runoff control structures are operational and sediment control measures are in place, clearing and
grading on the rest of the site will begin.

During construction, all practices will be inspected at least every seven calendar days (or following a
significant storm event). Prior permission for disturbance will be obtained from the NYSDEC and all
practices will be inspected twice every seven calendar days if more than 5 acres is disturbed at any one
time.

Vegetative and structural measures will be maintained as required by the New York Standards, and the New
York State Stormwater Management Design Manual. The inspection and maintenance requirements for the
various practices anticipated are outlined in the following table.

<table>
<thead>
<tr>
<th>Practice</th>
<th>Recommended Maintenance</th>
<th>Recommended Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary &amp; Permanent Seeding and Straw Mulching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re-seed areas failing to establish 80% cover within one month. If re-seeding is not effective, use sodding and/or erosion control blankets. Eroded areas shall be corrected, re-planted, and irrigated as required.</td>
<td>Weekly &amp; After Storms</td>
<td></td>
</tr>
<tr>
<td>Preserving Natural Vegetation</td>
<td>Inspect flagged areas to make sure flagging has not been removed. If tree roots have been exposed or injured, recover and/or seal them.</td>
<td>Daily</td>
</tr>
<tr>
<td>Protecting Vegetation during Construction</td>
<td>If fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.</td>
<td>Daily</td>
</tr>
<tr>
<td>Practice</td>
<td>Recommended Maintenance</td>
<td>Recommended Frequency</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>Temporary Swale</td>
<td>During growing season, inspect grass after rainstorms. Remove accumulated sediments. Inspect outlets to prevent scouring and erosion.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Water Bar</td>
<td>Periodically inspect for erosion and sediment. Check outlet areas and make repairs as needed to restore operations.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Silt Fence</td>
<td>Repair damaged fencing. Intercept concentrated flows &amp; reroute. Remove sediment when its depth exceeds six inches. Replace deteriorated fencing material. Dispose of used fencing off-site.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Check Dam</td>
<td>Remove sediment when sump is half-full. Check and repair erosion around edges of dams. Make sure prefabricated sections are secured.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Turbidity Curtain</td>
<td>Inspect and repair or replace. Check anchorage. Remove floating debris. Remove accumulated silt, if necessary, in a direction away from the protected water body.</td>
<td>Daily</td>
</tr>
<tr>
<td>Sediment Trap</td>
<td>Remove sediment when it reaches a depth of 1-foot. Repair damage to embankments and slopes.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Stabilized Construction Entrance and Equipment Staging Areas</td>
<td>Crushed stone shall be added when needed. If entrance or yard are not working to keep streets clean, then install wheel wash and sweep streets.</td>
<td>Daily</td>
</tr>
<tr>
<td>Construction Road Stabilization</td>
<td>Top dress with new stone as needed. Check adjacent ditches for erosion and sedimentation. Maintain adjacent vegetation in a healthy, vigorous condition.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Practice</td>
<td>Recommended Maintenance</td>
<td>Recommended Frequency</td>
</tr>
<tr>
<td>----------------------------</td>
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</tr>
<tr>
<td>Temporary Access Waterway Crossing</td>
<td>Remove and dispose of trapped sediment and debris. Sediment shall be disposed of and stabilized outside the waterway flood plain.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Sump Pit</td>
<td>Protect from damage. Remove sediment when it may interfere with operation. Check for oil/grease contamination.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Topsoil Stockpile Stabilization</td>
<td>Stabilize areas that have eroded.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Diversion</td>
<td>During growing season, inspect grass after rainstorms. Remove accumulated sediments. Inspect outlets to prevent scouring and erosion.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Grass Waterway</td>
<td>During growth period, inspect grass after rainstorms. Remove accumulated sediments. Inspect outlets to prevent scouring and erosion.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Stone Lined Waterway</td>
<td>Maintain to prevent undermining or deterioration. Vegetation next to stone lining should be maintained in good condition to prevent scouring if the stone lining is overtopped.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Rock Outlet Protection</td>
<td>Inspect for signs of scour beneath the rock and for dislodged rock.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td>Land Grading</td>
<td>Keep benches free of sediment; stabilize areas that have eroded.</td>
<td>Monthly &amp; After Storms</td>
</tr>
<tr>
<td>Surface Roughening</td>
<td>Stabilize areas that have eroded.</td>
<td>Monthly &amp; After Storms</td>
</tr>
<tr>
<td>Open Stormwater Channels</td>
<td>Remove sediment build-up within the bottom of the swale when 5” deep.</td>
<td>Weekly &amp; After Storms</td>
</tr>
<tr>
<td></td>
<td>Maintain a grass height of 4 to 6 inches in dry swales.</td>
<td>Weekly &amp; After Storms</td>
</tr>
</tbody>
</table>
3.0 CONSTRUCTION ACTIVITIES

Construction of the wind power Project will include improvements to local roads, construction of site roads, installation of electrical collection/interconnection facilities, and construction of the wind turbines. Site improvements will proceed in an organized manner.

Excess excavated materials not used as fill will be disposed of in a manner that will not result in erosion and adverse impacts upon surface water and wetland quality. The manner in which the soil is disposed of will include applicable stormwater management practices.

Prior to the start of construction activity, the Project Owner will identify the contractors and subcontractors that will be responsible for installing, constructing, repairing, inspecting, and maintaining the erosion and sediment control and post-construction stormwater management practices included in the SWPPP.

Each such contractor and subcontractor will identify at least one trained individual from their company that will be responsible for implementation of the SWPPP. Each contractor or subcontractor responsible for implementation of the SWPPP will sign a copy of the SWPPP certification before they commence construction activity.

3.1 Construction Phasing Schedule

A schedule that establishes the construction sequence of vegetative and permanent and temporary structural erosion and sediment control practices, and their timing relative to other construction activities will be included. Phasing of the access road, utility, crane pad and component lay-down area construction will likely be in a manner that facilitates the construction of the individual wind turbine sites. A preliminary construction phasing schedule is included below.

1. Obtain all applicable permits
2. Participate in a pre-construction meeting at least one week prior to the beginning of earthwork operations to discuss and provide Contractor certifications for the Stormwater Pollution Prevention Plan.
3. Survey/flag the work limits.
4. Install vegetation protection.
5. Install stabilized construction entrances.
6. Clear and grade as needed, strip and stockpile topsoil, vegetation removal/tree clearing
7. Install stabilized equipment storage areas.
8. Construct stabilized construction roads.
11. Stabilize culvert outfalls with rock outlet protection.
13. Allow vegetation to become established.
15. Apply temporary seed and mulch to all topsoil and excess excavated earth stockpiles. Surround stockpiles with silt fence.
16. Construct stabilized access roads and install utility cables.
17. Excavate and construct turbine foundations. Stabilize as indicated in the contract drawings.
18. Construct crane pads and component lay-down areas. Stabilize as indicated in the contract drawings.
20. In areas where soil disturbance activity has temporarily ceased, seed and mulch will be applied within 7 days from the date the soil disturbance activity ceased.

21. In areas where soil disturbance activity has permanently ceased, fine grade, and permanently seed with the appropriate seed mixtures.

22. Construct collection station/interconnection substation and the operations and maintenance building.

23. Decommission construction width access roads (approximately 36') to operation width access roads (approximately 20')

24. Tie edge of disturbance into undisturbed ground such that water drains away from the public right-of-way without damage to the Project infrastructure and adjacent private and public property. The maximum slopes at these locations will be 4:1 (run: rise).

25. Remove temporary erosion and sediment control practices when the site is stabilized.

3.2 Disturbance Limits

1. Construction activity will not disturb more than 5 acres of soil at any one time without prior written permission of the NYSDEC. In order to be authorized to disturb greater than 5 acres of soil at any one time, the following requirements will be met:

   a. A qualified inspector shall conduct at least two site inspections every 7 days. The inspections must be separated by a minimum of 2 days.

   b. Where soil disturbance activity has been temporarily or permanently ceased, temporary and/or permanent soil stabilization measures must be installed within 7 days from the date the soil disturbance activity ceased.

   c. Preparation of a phasing plan that defines maximum disturbed area per phase and shows the required cuts and fills.

   d. Installation of any additional site-specific practices needed to protect water quality.

   e. Document the NYSDEC approved plans and practices as revisions to the Project SWPPP.
4.0 SITE WASTE MANAGEMENT AND SPILL PREVENTION

All potential pollutants other than sediment will be handled and disposed of in a manner that does not cause contamination of stormwater. The following non-sediment pollutants may be present during construction activities.

1. Petroleum products including fuel, lubricants, hydraulic fluids, and concrete-form oils
2. Concrete
3. Asphalt
4. Paints
5. Fertilizers
6. Herbicides and pesticides

These materials, and other materials used during construction with the potential to impact stormwater, will be stored, managed, used, and disposed of in a manner that minimizes the potential for releases to the environment, including stormwater.

Emergency contacts for the Project will be posted at the Project office and will be included in the complete SWPPP.

4.1 General Materials Handling Practices

The following general practices will be used throughout the Project to reduce the potential for spills.

Potential pollutants will be stored and used in a manner consistent with the manufacturer’s instructions in a secure location. Hazardous material storage areas will not be located near water courses or storm drain inlets and will be equipped with covers, roofs, and secondary containment to prevent stormwater from contacting stored materials. Chemicals that are not compatible (such as sodium bicarbonate and hydrochloric acid) will be stored in segregated areas so that spilled materials cannot combine and react.

Material disposal will be in accordance with the manufacturer’s instructions and all applicable local, state, and federal regulations.

Materials no longer required for construction will be removed from the site as soon as practicable.

Adequate garbage, construction waste, and sanitary waste handling and disposal facilities will be provided to the extent necessary to keep the site clear of obstruction and stormwater management practices clear and functional. All agencies or government having jurisdiction will approve off-site spoil areas.

4.2 Specific Materials Handling Practices

All pollutants, including waste materials and demolition debris, that occur on-site during construction will be handled in a way that does not contaminate groundwater or stormwater.

All chemicals including liquid products, petroleum products, water treatment chemicals, and wastes stored on site will be covered, contained and protected from vandalism.

Maintenance and repair of all equipment and vehicles involving oil changes, hydraulic system drain down, de-greasing operations, fuel tank drain down and removal, and other activities that may result in the accidental release of contaminants, will be conducted off-site. Materials spilled during maintenance operations will be cleaned up immediately and properly disposed of.
Any wheel wash water generated on-site will be settled and discharged on site by infiltration.

Application of agricultural chemicals, including fertilizers and pesticides, will be conducted in a manner and at application rates that will not result in loss of chemicals to stormwater runoff. Manufacturers’ recommendations will be followed for application rates and procedures.

Materials that modify pH will be managed to prevent contamination of runoff and stormwater collected on site. The most common sources of pH-modifying materials are bulk cement, cement dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, and concrete pumping and mixer washout waters.

Detergents will be used only as recommended, and their use will be limited to stabilized areas that drain to municipal sanitary sewers or that drain into temporary containers that can be transported to and properly discharged at a wastewater treatment plant.

### 4.3 Spill Response

The primary objective in responding to a spill is to quickly contain the material(s) and prevent or minimize its migration into the groundwater and into stormwater runoff and conveyance systems. If the release has impacted water resources, it is critical to contain the released materials and the contaminated water and prevent their release into receiving waters.

If a spill of pollutants threatens groundwater or stormwater at the site, the spill response procedures outlined below will be implemented in a timely manner to prevent the release of pollutants.

The site superintendent will be notified immediately when a spill, or the threat of a spill, is observed. The superintendent will assess the situation and determine the appropriate response.

If spills represent an imminent threat of entering the receiving waters, facility personnel will respond immediately to contain the release and notify the superintendent after the situation has been stabilized.

Spill kits containing materials and equipment for spill response and cleanup will be maintained at the site. Each spill kit will contain oil absorbent pads, oil absorbent booms, 55-gallon drums, 9-mil plastic bags, and personal protective equipment including gloves and goggles.

If an oil sheen is observed on surface water (e.g., sediment traps, grass swales), absorbent pads and/or booms will be applied to contain and remove the oil. The source of the oil sheen will also be identified and removed or repaired as necessary to prevent further releases.

The site superintendent, or his designee, will be responsible for completing the spill reporting form and for reporting the spill to the appropriate state or local agency. A form will be provided in the complete SWPPP.

Facility personnel with primary responsibility for spill response and cleanup will receive training from the site superintendent. This training will include identifying the location of spill kits and other spill response equipment and the use of spill response materials.

Spill response equipment will be inspected and maintained as necessary to replace any materials used in spill response activities.
4.4 **Spill Notification Procedure**

In the event of a spill, the appropriate notification(s) consistent with the following procedures will be made:

Any spill of oil which 1) violates water quality standards, 2) produces a “sheen” on a surface water, or 3) causes a sludge or emulsion must be reported immediately by telephone to the **NYSDEC Spill Hotline: 1-800-457-7362**.

Any oil, hazardous substance, or hazardous waste release or spill must be reported immediately by telephone to the **NYSDEC Spill Hotline: 1-800-457-7362**.

4.5 **Nutrient Management**

Fertilizer and limestone soil amendments will be applied at appropriate rates as determined by soil tests or at rates indicated for Permanent Critical Area Plantings in the **NY Standards**.

Soil amendments will be incorporated into the upper 2 to 4 inches of soil where feasible. Soil amendments will not be applied within 15 feet of drainage ways.

Soil erosion control practices that prevent soil amendments from being carried offsite will be established prior to the application of soil amendments.
5.0 SITE INSPECTION AND MAINTENANCE

5.1 Project Management

Implementation and management of the environmental aspects of this Project included in the SWPPP are the responsibilities of the Owner and the Contractor. Communication between all parties performing work on the site is essential for proper implementation of the SWPPP. The Contractor and all Subcontractors involved with site work will be familiar with the complete SWPPP and their responsibilities under the plan.

The Contractor will obtain written authorization from the NYSDEC and the Owner’s Representative to allow the disturbance of five (5) acres or more of soil at any one time during the construction process.

From the beginning of construction until its completion, the stormwater treatment system will remain operational to purify stormwater impacted by construction activities.

Activities such as grading and trenching in areas directly adjacent to a drainage way during rainstorms could easily result in sediment-contaminated stormwater discharging from the site. This work will be performed during dry weather and/or with the appropriate erosion and sediment control practices.

The Contractor’s superintendent and Project manager will be familiarized with the major elements of the plan. The Contractor will provide construction workers and others at the site with appropriate training information at the conclusion of “tailgate” safety meetings or on an as-needed basis. All Contractors providing services on the Project that may cause stormwater pollution will be given a copy of the SWPPP and appropriate training regarding stormwater pollution prevention. Subcontractor oversight to ensure compliance with the SWPPP will be provided by the Contractor’s superintendent or Project manager. Informal, on-the-job training should be the first level of communication followed by on site observation of training compliance.

SWPPP inspections will be the responsibility of the Owner’s Representative. Spill reports will be completed and submitted by the Contractor.

The SWPPP will be revised and updated to address changes in site conditions, new or revised government regulations, and additional on-site stormwater pollution controls.

5.2 Construction Site Inspection

The complete SWPPP will be prepared in accordance with all applicable requirements and a completed Notice of Intent (NOI) will be submitted to the NYSDEC Bureau of Water Permits in Albany.

Before construction activities begin, authorization to discharge under the current SPDES General Permit for Construction Activity will be obtained.

A licensed professional engineer, landscape architect, certified professional in erosion and sediment control, or other individual endorsed by the NYSDEC who is knowledgeable in the principles and practices of erosion and sediment control will be employed by the Project Owner to conduct an assessment of the site prior to the commencement of construction. This qualified inspector will verify that appropriate erosion and sediment control practices as described in the SWPPP and as required by the Permit for Stormwater Discharges from Construction Activities have been installed and implemented to ensure that the site is properly prepared for construction of the wind power facilities to commence.
During construction, when soil disturbance activities are on-going, the qualified inspector will conduct a site inspection at least once every seven days. When soil disturbance activities are underway and authorization has been received from NYSDEC to disturb more than five acres of soil, the qualified inspector will conduct at least two site inspections every seven days. When only two inspections are performed every seven days, the inspections will be separated by a minimum of two days.

5.3 Construction Site Record Keeping

A copy of the current SPDES General Permit for Construction Activity, NOI, NOI Acknowledgement Letter, signed SWPPP, and inspection reports will be maintained in a secure location on-site that is accessible during working hours to an individual performing a compliance inspection.

Construction site inspection reports will be maintained on site. They will document the following information:

1. Description of the weather and soil conditions;
2. Condition of the runoff at all points of discharge from the construction site, including discharges of sediment;
3. Identification of all erosion and sediment control practices that need repair or maintenance;
4. Identification of all erosion and sediment control practices that have not been installed correctly or are not functioning as designed and need to be reinstalled or replaced;
5. Corrective actions that must be taken to install, repair, replace or maintain erosion and sediment control practices and to correct deficiencies identified with the post-construction stormwater management practices.
6. Site maps that indicate the following:
   a. All areas expected to undergo initial disturbance or site work within the next 14 days;
   b. All disturbed areas that have received temporary or permanent stabilization;
   c. All disturbed areas that have not undergone active site work during the previous 14-day period.
   d. Location of erosion and sediment control practices required by the former and projected site disturbance activities.
   e. Current phase of construction of all post-construction stormwater management practices and identification of all construction that is not in conformance with the SWPPP and NYS technical standards.

Within one business day of the completion of a SWPPP inspection, the qualified inspector will notify the Project Owner and the appropriate contractor of any corrective action that needs to be taken. The inspector will sign all inspection reports.
6.0 TERMINATION OF PERMIT COVERAGE

After all construction activity identified in the SWPPP has been completed, the Project Owner will have a qualified inspector perform a final site inspection. If the following conditions have been met, the qualified inspector will sign the NYSDEC certification statements “Final Stabilization” and “Post-Construction Stormwater Management Practice” contained within the Notice of Termination (NOT):

1. All areas of disturbance have achieved final stabilization,
2. All temporary structural erosion and sediment control measures have been removed, and
3. All post-construction stormwater management practices have been constructed in conformance with the SWPP and are operational.

The Project Owner will ensure that the necessary post-construction stormwater management maintenance procedures and practices are in place as required by NYSDEC.

When the above conditions have been met, the Project Owner will be eligible to terminate coverage under the current SPDES General Permit for Stormwater Discharges from Construction. Within 14 days of becoming eligible, the Project Owner will provide the necessary certifications and information to submit a completed Notice of Termination (NOT) to the NYSDEC Bureau of Water Permits in Albany.
7.0 REFERENCES

New York State Standards and Specifications for Erosion and Sediment Control, (NYS Standards), New York State Department of Environmental Conservation, August 2005.


Appendix A

Structural Measures - Temporary
STANDARD AND SPECIFICATIONS FOR TEMPORARY SWALE

Definition

A temporary excavated drainage way.

Purpose

The purpose of a temporary swale is to prevent runoff from entering disturbed areas by intercepting and diverting it to a stabilized outlet or to intercept sediment laden water and divert it to a sediment trapping device.

Conditions Where Practice Applies

Temporary swales are constructed:

1. to divert flows from entering a disturbed area.
2. intermittently across disturbed areas to shorten overland flow distances.
3. to direct sediment laden water along the base of slopes to a trapping device.
4. to transport offsite flows across disturbed areas such as rights-of-way.

Swales collecting runoff from disturbed areas shall remain in place until the disturbed areas are permanently stabilized.

Design Criteria

See Figure 5A.2 on page 5A.5 for details.

<table>
<thead>
<tr>
<th>Type of Treatment</th>
<th>Flow Channel A (&lt;5 Ac.)</th>
<th>Flow Channel B (5-10 Ac.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area</td>
<td>Swale A: &lt;5 Ac.</td>
<td>Swale B: 5-10 Ac.</td>
</tr>
<tr>
<td>Bottom Width of Flow Channel</td>
<td>4 ft</td>
<td>6 ft</td>
</tr>
<tr>
<td>Depth of Flow Channel</td>
<td>1 ft</td>
<td>1 ft</td>
</tr>
<tr>
<td>Side Slopes</td>
<td>2:1 or flatter</td>
<td>2:1 or flatter</td>
</tr>
<tr>
<td>Grade</td>
<td>0.5% Min.</td>
<td>0.5% Min.</td>
</tr>
<tr>
<td></td>
<td>20% Max.</td>
<td>20% Max.</td>
</tr>
</tbody>
</table>

For drainage areas larger than 10 acres, refer to the Standard and Specification for Waterways on page 5B.11.

Stabilization

Stabilization of the swale shall be completed within 7 days of installation in accordance with the appropriate standard and specifications for vegetative stabilization or stabilization with mulch as determined by the time of year. The flow channel shall be stabilized as per the following criteria:

1. 0.5-3.0% Seed & Straw Mulch
2. 3.1-5.0% Seed & Straw Mulch
3. 5.1-8.0% Seed and cover with RECP, Sod. or lined with plastic or 2 in. stone
4. 8.1-20% Line with 4-8 in. stone or Recycled Concrete Equivalent or geotextile

1 In highly erodible soils, as defined by the local approving agency, refer to the next higher slope grade for type of stabilization.
2 Recycled Concrete Equivalent shall be concrete broken into the required size, and shall contain no steel reinforcement.
Outlet

Swale shall have an outlet that functions with a minimum of erosion, and dissipates runoff velocity prior to discharge off the site.

Runoff shall be conveyed to a sediment trapping device such as a sediment trap or sediment basin until the drainage area above the swale is adequately stabilized.

The on-site location may need to be adjusted to meet field conditions in order to utilize the most suitable outlet condition.

If a swale is used to divert clean water flows from entering a disturbed area, a sediment trapping device may not be needed.
Figure 5A.2
Temporary Swale

CONSTRUCTION SPECIFICATIONS

1. ALL TEMPORARY SWALES SHALL HAVE UNINTERRUPTED POSITIVE GRADE TO AN OUTLET.

2. DIVERTED RUNOFF FROM A DISTURBED AREA SHALL BE CONVEYED TO A SEDIMENT TRAPPING DEVICE.

3. DIVERTED RUNOFF FROM AN UNDISTURBED AREA SHALL OUTLET DIRECTLY INTO AN UNDISTURBED STABILIZED AREA AT NON-EROSIVE VELOCITY.

4. ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED AND DISPOSED OF SO AS NOT TO INTERFERE WITH THE PROPER FUNCTIONING OF THE SWALE.

5. THE SWALE SHALL BE EXCAVATED OR SHAPED TO LINE, GRADE, AND CROSS SECTION AS REQUIRED TO MEET THE CRITERIA SPECIFIED HEREIN AND BE FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES WHICH WILL IMPede NORMAL FLOW.

6. FILLS SHALL BE COMPACTED BY EARTH MOVING EQUIPMENT.

7. ALL EARTH REMOVED AND NOT NEEDED FOR CONSTRUCTION SHALL BE PLACED SO THAT IT WILL NOT INTERFERE WITH THE FUNCTIONING OF THE SWALE.

8. STABILIZATION SHALL BE AS PER THE FLOW CHANNEL STABILIZATION CHART BELOW:

<table>
<thead>
<tr>
<th>TYPE OF CHANNEL</th>
<th>GRADE</th>
<th>A (5 AC. OR LESS)</th>
<th>B (5 AC. - 10AC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>05-3.0%</td>
<td>SEED AND STRAW MULCH</td>
<td>SEED AND STRAW MULCH</td>
</tr>
<tr>
<td>2</td>
<td>3.1-5.0%</td>
<td>SEED AND STRAW MULCH</td>
<td>SEED AND COVER USING RECIP</td>
</tr>
<tr>
<td>3</td>
<td>5.1-8.0%</td>
<td>SEED AND COVER WITH RECIP</td>
<td>LINED WITH 4-8' RIP-RAP OR GEOTEXTILE</td>
</tr>
<tr>
<td>4</td>
<td>8.1-20%</td>
<td>LINED WITH 4-8' RIP-RAP OR GEOTEXTILE</td>
<td>ENGINEERED DESIGN</td>
</tr>
</tbody>
</table>

9. PERIODIC INSPECTION AND REQUIRED MAINTENANCE MUST BE PROVIDED AFTER EACH RAIN EVENT.

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NEW YORK STATE DEPARTMENT OF TRANSPORTATION,
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION,
NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE
STANDARD AND SPECIFICATIONS FOR PERIMETER DIKE/SWALE

Definition
A temporary ridge of soil excavated from an adjoining swale located along the perimeter of the site or disturbed area.

Purpose
The purpose of a perimeter dike/swale is to prevent off site storm runoff from entering a disturbed area and to prevent sediment laden storm runoff from leaving the construction site or disturbed area.

Conditions Where Practice Applies
Perimeter dike/swale is constructed to divert flows from entering a disturbed area, or along tops of slopes to prevent flows from eroding the slope, or along base of slopes to direct sediment laden flows to a trapping device.

The perimeter dike/swale shall remain in place until the disturbed areas are permanently stabilized.

Design Criteria
See Figure 5A.3 on page 5A.8 for details.

The perimeter dike/swale shall not be constructed outside the property lines without obtaining legal easements from affected adjacent property owners. A design is not required for perimeter dike/swale. The following criteria shall be used:

Drainage area – Less than 2 acres (for drainage areas larger than 2 acres but less than 10 acres, see earth dike or temporary swale; for drainage areas larger than 10 acres, see standard and specifications for diversion).

Height – 18 inches minimum from bottom of swale to top of dike evenly divided between dike height and swale depth.

Bottom width of dike – 2 feet minimum.

Width of swale – 2 feet minimum.

Grade – Dependent upon topography, but shall have positive drainage (sufficient grade to drain) to an adequate outlet. Maximum allowable grade not to exceed 8 percent.

Stabilization – The disturbed area of the dike and swale shall be stabilized within 7 days of installation, in accordance with the standard and specifications for temporary swales.

Outlet
1. Perimeter dike/swale shall have a stabilized outlet.

2. Diverted runoff from a protected or stabilized upland area shall outlet directly onto an undisturbed stabilized area.

3. Diverted runoff from a disturbed or exposed upland area shall be conveyed to a sediment trapping device such as a sediment trap, sediment basin, or to an area protected by any of these practices.

4. The on-site location may need to be adjusted to meet field conditions in order to utilize the most suitable outlet.
CONSTRUCTION SPECIFICATIONS

1. ALL PERIMETER DIKE/SWALE SHALL HAVE UNINTERRUPTED POSITIVE GRADE TO AN OUTLET.

2. DIVERTED RUNOFF FROM A DISTURBED AREA SHALL BE CONVEYED TO A SEDIMENT TRAPPING DEVICE.

3. DIVERTED RUNOFF FROM AN UNDISTURBED AREA SHALL OUTLET INTO AN UNDISTURBED STABILIZED AREA AT NON-erosion VELOCITY.

4. THE SWALE SHALL BE EXCAVATED OR SHAPED TO LINE GRADE, AND CROSS SECTION AS REQUIRED TO MEET THE CRITERIA SPECIFIED IN THE STANDARD.

5. STABILIZATION OF THE AREA DISTURBED BY THE DIKE AND SWALE SHALL BE DONE IN ACCORDANCE WITH THE STANDARD AND SPECIFICATIONS FOR TEMPORARY SEEDING AND MULCHING, AND SHALL BE DONE WITHIN 10 DAYS.

6. PERIODIC INSPECTION AND REQUIRED MAINTENANCE MUST BE PROVIDED AFTER EACH RAIN EVENT.

MAX. DRAINAGE AREA LIMIT: 2 ACRES

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PERIMETER DIKE OR SWALE
Definition

A ridge or ridge and channel constructed diagonally across a sloping road or utility right-of-way that is subject to erosion.

Purpose

To limit the accumulation of erosive velocity of water by diverting surface runoff at pre-designed intervals.

Conditions Where Practice Applies

Where runoff protection is needed to prevent erosion on sloping access right-of-ways or either long, narrow sloping areas generally less than 100 feet in width.

Design Criteria

Design computations are not required.

1. The design height shall be minimum of 12 inches measured from channel bottom to ridge top.

2. The side slopes shall be 2:1 or flatter, a minimum of 4:1 where vehicles cross.

3. The base width of the ridge shall be six feet minimum.

4. The spacing of the water bars shall be as follows:

<table>
<thead>
<tr>
<th>Slope (%)</th>
<th>Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>125</td>
</tr>
<tr>
<td>5 TO 10</td>
<td>100</td>
</tr>
<tr>
<td>10 TO 20</td>
<td>75</td>
</tr>
<tr>
<td>20 TO 35</td>
<td>50</td>
</tr>
<tr>
<td>&gt;35</td>
<td>25</td>
</tr>
</tbody>
</table>

5. The positive grade of the water bar shall not exceed 2%. A crossing angle of approximately 60 degrees is preferred.

6. Once diverted, water must be conveyed to a stable system (i.e. vegetated swale or storm sewer system). Water bars should have stable outlets, either natural or constructed. Site spacing may need to be adjusted for field conditions to use the most suitable areas for water disposal.

See Figure 5A.4 for details.
CONSTRUCTION SPECIFICATIONS

1. INSTALL THE WATER BAR AS SOON AS THE RIGHT OF WAY IS CLEARED AND GRADED.

2. DISK OR STRIP THE SOD FROM THE BASE FOR THE CONSTRUCTED RIDGE BEFORE PLACING FILL.

3. TRACK THE RIDGE TO COMPACT IT TO THE DESIGN CROSS SECTION.

4. THE OUTLET SHALL BE LOCATED ON AN UNDISTURBED AREA. FIELD SPACING WILL BE ADJUSTED TO USE THE MOST STABLE OUTLET AREAS. OUTLET PROTECTION WILL BE PROVIDED WHEN NATURAL AREAS ARE NOT ADEQUATE.

5. VEHICLE CROSSING SHALL BE STABILIZED WITH GRAVEL. EXPOSED AREAS SHALL BE IMMEDIATELY SEEDED AND MULCHED.

6. PERIODICALLY INSPECT WATER BARS FOR EROSION DAMAGE AND SEDIMENT. CHECK OUTLET AREAS AND MAKE REPAIRS AS NEEDED TO RESTORE OPERATION.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE
STANDARD AND SPECIFICATIONS FOR LEVEL SPREADER

Design Criteria

The design capacity shall be determined by estimating the peak flow from the 10-year storm. The drainage area shall be restricted to limit the maximum flows into the spreader to 30 cfs. The level spreader shall have the following minimum dimension:

<table>
<thead>
<tr>
<th>Design Flow (cfs)</th>
<th>Minimum Entrance Width (ft.)</th>
<th>Depth (ft.)</th>
<th>End Width (ft.)</th>
<th>Length (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>10</td>
<td>0.5</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>10-20</td>
<td>16</td>
<td>0.6</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>20-30</td>
<td>24</td>
<td>0.7</td>
<td>3</td>
<td>30</td>
</tr>
</tbody>
</table>

A transition section 20 feet in length shall be constructed from the width of the diversion or channel to the width of the spreader to ensure uniform outflow. This last transition section will blend the diversion grade to zero grade at the beginning of the spreader.

Construct the level lip in undisturbed soil to a uniform height and zeros grade over the length of the spreader. Protect the lip with an erosion resistant material or mat to prevent erosion and allow vegetation to become established.

The outlet area should be a generally smooth, well-vegetated areas no steeper than 10 percent.

See Figure 5A.5 on page 5A.14 for details.

Definition

A temporary non-erosive outlet for concentrated runoff, constructed to disperse flow uniformly across a slope.

Purpose

To convert concentrated flow to sheet flow and release it uniformly over a stabilized area.

Conditions Where Practice Applies

Where sediment-free storm runoff can be released in sheet flow down a stabilized slope without causing erosion; where a level lip can be constructed without filling; where the area below the level lip is uniform with a slope of 10% or less and the runoff will not re-concentrate after release; and where no traffic will be allowed over spreader.
CONSTRUCTION SPECIFICATIONS

1. THE MATTING SHOULD BE A MINIMUM OF 4FT. WIDE EXTENDING 6 INCHES OVER THE LIP AND BURIED 6 INCHES DEEP IN A VERTICAL TRENCH ON THE LOWER EDGE. THE UPPER EDGE SHOULD BUTT AGAINST SMOOTHLY CUT SOIL AND BE SECURELY HELD IN PLACE WITH CLOSELY SPACED HEAVY DUTY WIRE STAPLES AT LEAST 12 INCHES IN LENGTH.

2. ENSURE THAT THE LIP IS LEVEL TO UNIFORMLY SPREAD DISCHARGE.

3. THE LIP SHALL BE CONSTRUCTED ON UNDISTURBED SOIL NOT FILL.

4. A 20 FOOT TRANSITION SECTION WILL BE CONSTRUCTED FROM THE DIVERSION CHANNEL TO THE SPREADER TO SMOOTHLY BLEND THE DIFFERENT DIMENSION AND GRADES.

5. THE RUNOFF DISCHARGE WILL BE OUTLETED ONTO A STABILIZED VEGETATED SLOPE NOT EXCEEDING 10%.

6. SEED AND MULCH THE DISTURBED AREA IMMEDIATELY AFTER CONSTRUCTION.

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LEVEL SPREADER

<table>
<thead>
<tr>
<th>Q(cfs)</th>
<th>E.W.(ft)</th>
<th>D(ft)</th>
<th>LENGTH(ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>10</td>
<td>0.5</td>
<td>10</td>
</tr>
<tr>
<td>10-20</td>
<td>16</td>
<td>0.6</td>
<td>20</td>
</tr>
<tr>
<td>20-30</td>
<td>24</td>
<td>0.7</td>
<td>30</td>
</tr>
</tbody>
</table>
STANDARD AND SPECIFICATIONS
FOR
PIPE SLOPE DRAIN

Definition
A temporary structure placed from the top of a slope to the bottom of a slope.

Purpose
The purpose of the structure is to convey surface runoff down slopes without causing erosion.

Conditions Where Practice Applies
Pipe slope drains are used where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion. The maximum allowable drainage area shall be 3.5 acres.

Design Criteria
See Figures 5A.6 on page 5A.16 for details.

General

<table>
<thead>
<tr>
<th>Size</th>
<th>Pipe/Tubing Diameter (in.)</th>
<th>Maximum Drainage Area (Ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSD-12</td>
<td>12</td>
<td>0.5</td>
</tr>
<tr>
<td>PSD-18</td>
<td>18</td>
<td>1.5</td>
</tr>
<tr>
<td>PSD-21</td>
<td>21</td>
<td>2.5</td>
</tr>
<tr>
<td>PSD-24</td>
<td>24</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Outlet
The pipe slope drain shall outlet into a sediment trapping device when the drainage area is disturbed. A riprap apron shall be installed below the pipe outlet where water is being discharged into a stabilized area.

Construction Specifications
1. The pipe slope drain shall have a slope of 3 percent or steeper.
2. The top of the earth dike over the inlet pipe, and those dikes carrying water to the pipe, shall be at least one (1) foot higher at all points than the top of the inlet pipe.
3. Corrugated plastic pipe or equivalent shall be used with watertight connecting bands.
4. A flared end section shall be attached to the inlet end of pipe with a watertight connection.
5. The soil around and under the pipe and end section shall be hand tampered in 4 in. lifts to the top of the earth dike.
6. Where flexible tubing is used, it shall be the same diameter as the inlet pipe and shall be constructed of a durable material with hold down grommets spaced 10 ft. on centers.
7. The flexible tubing shall be securely fastened to the corrugated plastic pipe with metal strapping or watertight connecting collars.
8. The flexible tubing shall be securely anchored to the slope by staking at the grommets provided.
9. Where a pipe slope drain outlets into a sediment trapping device, it shall discharge at the riser crest or weir elevation.
10. A riprap apron shall be used below the pipe outlet where clean water is being discharged into a stabilized area. See Figure 7A.6.
11. Inspection and any needed maintenance shall be performed after each storm.
Figure 5A.6
Pipe Slope Drain

NOTE:
SIZE DESIGNATION IS:
PSD=PIPE DIAM, EX. PSD-18=PIPE
SLOPE DRAIN WITH 18"DIAM. PIPE.

DISCHARGE INTO A
STABILIZED WATERCOURSE,
SEDIMENT TRAPPING DEVICE,
OR ONTO A STABILIZED AREA.

LENGTH AS
NECESSARY TO
GO THRU DIKE

22 1/2" PIPE
FITTING

WATERTIGHT
CONNECTING
BAND

FLEXIBLE
PIPE

4' MIN & LESS THAN 1% SLOPE PROFILE

CONSTRUCTION SPECIFICATIONS

1. THE INLET PIPE SHALL HAVE A SLOPE OF 3% OR STEEPER.

2. THE TOP OF THE EARTH DIKE OVER THE INLET PIPE AND THOSE DIKES CARRYING WATER TO THE PIPE
   SHALL BE AT LEAST 1' HIGHER AT ALL POINTS THAN THE TOP OF THE INLET PIPE.

3. THE INLET PIPE SHALL BE CORRUGATED METAL PIPE WITH WATERTIGHT CONNECTING BANDS.

4. THE FLEXIBLE TUBING SHALL BE THE SAME DIAMETER AS THE INLET PIPE AND SHALL BE CONSTRUCTED
   OF A DURABLE MATERIAL WITH HOLE-UP HINGED GROMMETS SPACED AT 10" ON CENTER.

5. THE FLEXIBLE TUBING SHALL BE SECURELY FASTENED TO THE CORRUGATED METAL PIPE WITH METAL
   STRAPPING OR WATERTIGHT CONNECTING COLLARS.

6. THE FLEXIBLE TUBING SHALL BE SECURELY ANCHORED TO THE SLOPE BY STAKING AT THE GROMMETS
   PROVIDED.

7. A RIPRAP APRON SHALL BE PROVIDED AT THE OUTLET. THIS SHALL CONSIST OF 6"DIAMETER STONE
   PLACED AS SHOWN.

8. THE SOIL AROUND AND UNDER INLET PIPE AND ENTRANCE SECTION SHALL BE HAND TAMMED IN 4"LIFTS
   TO THE TOP OF EARTH DIKE.

9. FOLLOW-UP INSPECTION AND ANY NEEDED MAINTENANCE SHALL BE PERFORMED AFTER EACH STORM.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS,
NEW YORK STATE DEPARTMENT OF TRANSPORTATION,
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION,
NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

PIPE SLOPE DRAIN
FLEXIBLE
STANDARD AND SPECIFICATIONS
FOR
SILT FENCE

Definition

A temporary barrier of geotextile fabric installed on the contours across a slope used to intercept sediment laden runoff from small drainage areas of disturbed soil.

Purpose

The purpose of a silt fence is to reduce runoff velocity and effect deposition of transported sediment load. Limits imposed by ultraviolet stability of the fabric will dictate the maximum period the silt fence may be used (approximately one year).

Conditions Where Practice Applies

A silt fence may be used subject to the following conditions:

1. Maximum allowable slope lengths contributing runoff to a silt fence placed on a slope are:

<table>
<thead>
<tr>
<th>Slope Steepness</th>
<th>Maximum Length (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:1</td>
<td>25</td>
</tr>
<tr>
<td>3:1</td>
<td>50</td>
</tr>
<tr>
<td>4:1</td>
<td>75</td>
</tr>
<tr>
<td>5:1 or flatter</td>
<td>100</td>
</tr>
</tbody>
</table>

2. Maximum drainage area for overland flow to a silt fence shall not exceed 1/4 acre per 100 feet of fence, with maximum ponding depth of 1.5 feet behind the fence; and

3. Erosion would occur in the form of sheet erosion; and

4. There is no concentration of water flowing to the barrier.

Design Criteria

Design computations are not required for installations of 1 month or less. Longer installation periods should be designed for expected runoff. All silt fences shall be placed as close to the areas as possible, but at least 10 feet from the toe of a slope to allow for maintenance and roll down. The area beyond the fence must be undisturbed or stabilized.

Sensitive areas to be protected by silt fence may need to be reinforced by using heavy wire fencing for added support to prevent collapse.

Where ends of filter cloth come together, they shall be overlapped, folded and stapled to prevent sediment bypass. A detail of the silt fence shall be shown on the plan. See Figure 5A.8 on page 5A.21 for details.

Criteria for Silt Fence Materials

1. Silt Fence Fabric: The fabric shall meet the following specifications unless otherwise approved by the appropriate erosion and sediment control plan approval authority. Such approval shall not constitute statewide acceptance.

<table>
<thead>
<tr>
<th>Fabric Properties</th>
<th>Minimum Acceptable Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile</td>
<td>90</td>
<td>ASTM D1682</td>
</tr>
<tr>
<td>Strength (lbs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elongation at</td>
<td>50</td>
<td>ASTM D1682</td>
</tr>
<tr>
<td>Failure (%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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New York Standards and Specifications
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Mullen Burst Strength (PSI) 190 ASTM D3786

Puncture Strength (lbs) 40 ASTM D751 (modified)

Slurry Flow Rate (gal/min/sf) 0.3

Equivalent Opening Size 40-80 US Std Sieve CW-02215

Ultraviolet Radiation Stability (%) 90 ASTM G-26

2. Fence Posts (for fabricated units): The length shall be a minimum of 36 inches long. Wood posts will be of sound quality hardwood with a minimum cross sectional area of 3.0 square inches. Steel posts will be standard T and U section weighing not less than 1.00 pound per linear foot.

3. Wire Fence (for fabricated units): Wire fencing shall be a minimum 14 gage with a maximum 6 in. mesh opening, or as approved.

4. Prefabricated Units: Envirofence, Geofab, or approved equal, may be used in lieu of the above method providing the unit is installed per details shown in Figure 5A.8.
Figure 5A.8
Silt Fence

CONSTRUCTION SPECIFICATIONS

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPE OR HARDWOOD.

2. FILTER CLOTH TO BE TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE, 6" MAXIMUM MESH OPENING.

3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFT 100X, STABILINKA T140N, OR APPROVED EQUIVALENT.

4. PREFABRICATED UNITS SHALL BE GEOFAB, ENVIRONFENCE, OR APPROVED EQUIVALENT.

5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

ADAPTED FROM DETAILS PROVIDED BY USDA - NRCS,
NEW YORK STATE DEPARTMENT OF TRANSPORTATION,
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION,
NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE
STANDARD AND SPECIFICATIONS FOR CHECK DAM

Definition
Small barriers or dams constructed of stone, bagged sand or gravel, or other durable material across a drainage way.

Purpose
To reduce erosion in a drainage channel by restricting the velocity of flow in the channel.

Condition Where Practice Applies
This practice is used as a temporary or emergency measure to limit erosion by reducing velocities in small open channels that are degrading or subject to erosion and where permanent stabilization is impractical due to short period of usefulness and time constraints of construction.

Design Criteria

Drainage Area: Maximum drainage area above the check dam shall not exceed two (2) acres.

Height: Not greater than 2 feet. Center shall be maintained 9 inches lower than abutments at natural ground elevation.

Side Slopes: Shall be 2:1 or flatter.

Spacing: The check dams shall be spaced as necessary in the channel so that the crest of the downstream dam is at the elevation of the toe of the upstream dam. This spacing is equal to the height of the check dam divided by the channel slope.

Therefore:

\[ S = \frac{h}{s} \]

Where:

- \( S \) = spacing interval (ft.)
- \( h \) = height of check dam (ft.)
- \( s \) = channel slope (ft./ft.)

Example:

For a channel with a 4% slope and 2 ft. high stone check dams, they are spaced as follows:

\[ S = \frac{2 \text{ ft.}}{0.04 \text{ ft./ft.}} = 50 \text{ ft.} \]

Stone size: Use a well graded stone matrix 2 to 9 inches in size (NYS – DOT Light Stone Fill meets these requirements).

The overflow of the check dams will be stabilized to resist erosion that might be caused by the check dam. See Figure 5A.9 on page 5A.24 for details.

Check dams should be anchored in the channel by a cutoff trench 1.5 ft. wide and 0.5 ft. deep and lined with filter fabric to prevent soil migration.

Maintenance

The check dams should be inspected after each runoff event. Correct all damage immediately. If significant erosion has occurred between structures, a liner of stone or other suitable material should be installed in that portion of the channel.

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. Replace stones as needed to maintain the design cross section of the structures.
Figure 5A.9
Check Dam

CONSTRUCTION SPECIFICATIONS

1. STONE WILL BE PLACED ON A FILTER FABRIC FOUNDATION TO THE LINES, GRADES AND LOCATIONS SHOWN IN THE PLAN.

2. SET SPACING OF CHECK DAMS TO ASSUME THAT THE ELEVATIONS OF THE CREST OF THE DOWNSTREAM DAM IS AT THE SAME ELEVATION OF THE TOE OF THE UPSTREAM DAM.

3. EXTEND THE STONE A MINIMUM OF 1.5 FEET BEYOND THE DITCH BANKS TO PREVENT CUTTING AROUND THE DAM.

4. PROTECT THE CHANNEL DOWNSTREAM OF THE LOWEST CHECK DAM FROM SCOUR AND EROSION WITH STONE OR LINER AS APPROPRIATE.

5. ENSURE THAT CHANNEL APPURtenANCES SUCH AS CULVERT ENTRANCES BELOW CHECK DAMS ARE NOT SUBJECT TO DAMAGE OR BLOCKAGE FROM DISPLACED STONE. MAXIMUM DRAINAGE AREA 2 ACRES.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

CHECK DAM
STANDARD AND SPECIFICATIONS
FOR
SEDIMENT TRAP

Definition
A temporary sediment control device formed by excavation and/or embankment to intercept sediment laden runoff and retain the sediment.

Purpose
The purpose of the structure is to intercept sediment-laden runoff and trap the sediment in order to protect drainage ways, properties, and rights-of-way below the sediment trap from sedimentation.

Conditions Where Practice Applies
A sediment trap is usually installed in a drainage way, at a storm drain inlet, or other points of collection from a disturbed area.

Sediment traps should be used to artificially break up the natural drainage area into smaller sections where a larger device (sediment basin) would be less effective.

Design Criteria
If any of the design criteria presented here cannot be met, see Standard and Specification for Sediment Basin on page 5A.49.

Drainage Area
The drainage area for sediment traps shall be in accordance with the specific type of sediment trap used (Type 1 through V).

Location
Sediment traps shall be located so that they can be installed prior to grading or filling in the drainage area they are to protect. Traps must not be located any closer than 20 feet from a proposed building foundation if the trap is to function during building construction. Locate traps to obtain maximum storage benefit from the terrain and for ease of cleanout and disposal of the trapped sediment.

Trap Size
The volume of a sediment trap as measured at the elevation of the crest of the outlet shall be at least 3,600 cubic feet per acre of drainage area. The volume of a constructed trap shall be calculated using standard mathematical procedures. The volume of a natural sediment trap may be approximated by the equation: Volume (cu.ft.) = 0.4 x surface area (sq.ft.) x maximum depth (ft.).

Trap Cleanout
Sediment shall be removed and the trap restored to the original dimensions when the sediment has accumulated to 1/3 of the design depth of the trap. Sediment removed from the trap shall be deposited in a protected area and in such a manner that it will not erode.

Embankment
All embankments for sediment traps shall not exceed five (5) feet in height as measured at the low point of the original ground along the centerline of the embankment. Embankments shall have a minimum four (4) foo: wide top and side slopes of 2:1 or flatter. The embankment shall be compacted by traversing with equipment while it is being constructed. The embankment shall be stabilized with seed and mulch as soon as it is completed.

The elevation of the top of any dike directing water to any sediment trap will equal or exceed the maximum height of the outlet structure along the entire length of the trap.

Excavation
All excavation operations shall be carried out in such a manner that erosion and water pollution shall be minimal. Excavated portions of sediment traps shall have 1:1 or flatter slopes.

Outlet
The outlet shall be designed, constructed, and maintained in such a manner that sediment does not leave the trap and that erosion at or below the outlet does not occur.
Sediment traps must outlet onto stabilized (preferable undisturbed) ground, into a watercourse, stabilized channel, or into a storm drain system. Distance between inlet and outlet should be maximized to the longest length practicable.

**Trap Details Needed on Erosion and Sediment Control Plans**

Each trap shall be delineated on the plans in such a manner that it will not be confused with any other features. Each trap on a plan shall indicate all the information necessary to properly construct and maintain the structure. If the drawings are such that this information cannot be delineated on the drawings, then a table shall be developed. If a table is developed, then each trap on a plan shall have a number and the numbers shall be consecutive.

The following information shall be shown for each trap in a summary table format on the plans.

1. Trap number
2. Type of trap
3. Drainage area
4. Storage required
5. Storage provided (if applicable)
6. Outlet length or pipe sizes
7. Storage depth below outlet or cleanout elevation
8. Embankment height and elevation (if applicable)

**Type of Sediment Traps**

There are five (5) specific types of sediment traps which vary according to their function, location, or drainage area.

I. Pipe Outlet Sediment Trap
II. Grass Outlet Sediment Trap
III. Catch Basin Sediment Trap
IV. Stone Outlet Sediment Trap
V. Riprap Outlet Sediment Trap

**I. Pipe Outlet Sediment Trap**

A Pipe Outlet Sediment Trap consists of a trap formed by embankment or excavation. The outlet for the trap is through a perforated riser and a pipe through the embankment. The outlet pipe and riser shall be made of steel, corrugated metal or other suitable material. The top of the embankment shall be at least 1 1/2 feet above the crest of the riser. The top 2/3 of the riser shall be perforated with one (1) inch nominal diameter holes or slits spaced six (6) inches vertically and horizontally placed in the concave portion of the corrugated pipe.

No holes or slits will be allowed within six (6) inches of the top of the horizontal barrel. All pipe connections shall be watertight. The riser shall be wrapped with ½ to ½ inch hardware cloth wire then wrapped with filter cloth with a sieve size between #40-80 and secured with strapping or connecting band at the top and bottom of the cloth. The cloth shall cover an area at least six (6) inches above the highest hole and six (6) inches below the lowest hole. The top of the riser pipe shall not be covered with filter cloth. The riser shall have a base with sufficient weight to prevent flotation of the riser. Two approved bases are:

1. A concrete base 12 in. thick with the riser embedded 9 in. into the concrete base, or
2. One quarter inch, minimum, thick steel plate attached to the riser by a continuous weld around the circumferance of the riser to form a watertight connection. The plate shall have 2.5 feet of stone, gravel, or earth placed on it to prevent flotation. In either case, each side of the square base measurement shall be the riser diameter plus 24 inches.

Pipe outlet sediment traps shall be limited to a five (5) acre maximum drainage area. Pipe outlet sediment traps may be interchangeable in the field with stone outlet or riprap sediment traps provided that these sediment traps are constructed in accordance with the detail and specifications for that trap.

Select pipe diameter from the following table:

<table>
<thead>
<tr>
<th>Minimum Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Barrel Diameter</strong>¹</td>
</tr>
<tr>
<td>(in.)</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>21</td>
</tr>
<tr>
<td>21</td>
</tr>
</tbody>
</table>

¹ Barrel diameter may be same size as riser diameter.

See details for Pipe Outlet Sediment Trap ST-1 in Figure 5A.16 (1) and 5A.16 (2) on pages 5A.38 and 5A.39.

**II. Grass Outlet Sediment Trap**

A Grass Outlet Sediment Trap consists of a trap formed by excavating the earth to create a holding area. The trap has a discharge point over natural existing grass. The outlet crest width (feet) shall be equal to four (4) times the drainage area (acres) with a minimum width of four (4) feet. The outlet shall be free of any restrictions to flow. The outlet lip must remain undisturbed and level. The volume of this trap shall be computed at the elevation of the crest of the outlet. Grass outlet sediment traps shall be limited to a five (5) acre maximum drainage area.

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See details for Grass Outlet Sediment Trap ST-II in Figure 5A.17 on page 5A.40.

III. Catch Basin Sediment Trap

A Catch Basin Sediment Trap consists of a basin formed by excavation on natural ground that discharges through an opening in a storm drain inlet structure. This opening can either be the inlet opening or a temporary opening made by omitting bricks or blocks in the inlet.

A yard drain inlet or an inlet in the median strip of a dual highway could use the inlet opening for the type outlet. The trap should be out of the roadway so as not to interfere with future compaction or construction. Placing the trap on the opposite side of the opening and diverting water from the roadway to the trap is one means of doing this. Catch basin sediment traps shall be limited to a three (3) acre maximum drainage area. The volume of this trap is measured at the elevation of the crest of the outlet (invert of the inlet opening).

See details for Catch Basin Sediment Trap ST-III in Figure 5A.18 on page 5A.41.

IV. Stone Outlet Sediment Trap

A Stone Outlet Sediment Trap consists of a trap formed by an embankment or excavation. The outlet of this trap is over a stone section placed on level ground. The minimum length (feet) of the outlet shall be equal to four (4) times the drainage area (acres).

Required storage shall be 3,600 cubic feet per acre of drainage area.

The outlet crest (top of stone in weir section) shall be level, at least one (1) foot below top of embankment and no more than one (1) foot above ground beneath the outlet. Stone used in the outlet shall be small riprap (4 in. x 8 in.). To provide more efficient trapping effect, a layer of filter cloth should be embedded one (1) foot back into the upstream face of the outlet stone or a one (1) foot thick layer of two (2) inch or finer aggregate shall be placed on the upstream face of the outlet.

Stone Outlet Sediment Traps may be interchangeable in the field with pipe or riprap outlet sediment traps provided they are constructed in accordance with the detail and specifications for those traps. Stone outlet sediment traps shall be limited to a five (5) acre maximum drainage area.

See details for Stone Outlet Sediment Trap ST-IV in Figure 5A.19 on page 5A.42.

V. Riprap Outlet Sediment Trap

A Riprap Outlet Sediment Trap consists of a trap formed by an excavation and embankment. The outlet for this trap shall be through a partially excavated channel lined with riprap. This outlet channel shall discharge onto a stabilized area or to a stable watercourse. The riprap outlet sediment trap may be used for drainage areas of up to a maximum of 15 acres.

Design Criteria for Riprap Outlet Sediment Trap

1. The total contributing drainage area (disturbed or undisturbed either on or off the developing property) shall not exceed 15 acres.

2. The storage needs for this trap shall be computed using 3600 cubic feet of required storage for each acre of drainage area. The storage volume provided can be figured by computing the volume of storage area available behind the outlet structure up to an elevation of one (1) foot below the level weir crest.

3. The maximum height of embankment shall not exceed five (5) feet.

4. The elevation of the top of any dike directing water to a riprap outlet sediment trap will equal or exceed the minimum elevation of the embankment along the entire length of this trap.

<table>
<thead>
<tr>
<th>Riprap Outlet Sediment Trap ST-V (for Stone Lined Channel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contributing Drainage Area (ac.)</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
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<tr>
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<td>9</td>
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<td>10</td>
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<td>11</td>
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<tr>
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<tr>
<td>13</td>
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<tr>
<td>14</td>
</tr>
<tr>
<td>15</td>
</tr>
</tbody>
</table>

See details for Riprap Outlet Sediment Trap ST-V on Figures 5A.20(1) and 5A.20(2) on pages 5A.43 and 5A.44.

Optional Dewatering Methods

Optional dewatering devices may be designed for use with sediment traps. Included are two methods, which may be used. See Figure 5A.21 on page 5A.45 for details.
Figure 5A.16(1)
Pipe Outlet Sediment Trap: ST-I

Earth Embankment

Outlet Protection

Excavate if necessary for storage
* Riser embedded 9" into concrete or 1/4" metal plate welded all around.

Design volume is __________ cu.ft.

All slopes 2:1 or flatter

Perforated riser
1/4" to 1/2" hardware cloth with filter fabric securely fastened.
12"

W = Diameter of riser + 24"

Embankment section thru riser

Sizes of pipe needed:

Barrel diameter: __________
Riser diameter: __________

Note: Construction specification should be attached to this detail to complete design.

Maximum drainage area: 5 acres

Adapted from details provided by: USDA - NRCS, New York State Department of Transportation, New York State Department of Environmental Conservation, New York State Soil & Water Conservation Committee

Pipe Outlet Sediment Trap ST-I

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STANDARD AND SPECIFICATIONS FOR STABILIZED CONSTRUCTION ENTRANCE

Definition

A stabilized pad of aggregate underlain with geotextile located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk, or parking area.

Purpose

The purpose of stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights-of-way or streets.

Conditions Where Practice Applies

A stabilized construction entrance shall be used at all points of construction ingress and egress.

Design Criteria

See Figure 5A.35 on page 5A.76 for details.

Aggregate Size: Use a matrix of 1-4 inch stone, or reclaimed or recycled concrete equivalent.

Thickness: Not less than six (6) inches.

Width: 12-foot minimum but not less than the full width of points where ingress or egress occurs. 24-foot minimum if there is only one access to the site.

Length: As required, but not less than 50 feet (except on a single residence lot where a 30 foot minimum would apply).

Geotextile: To be placed over the entire area to be covered with aggregate. Filter cloth will not be required on a single-family residence lot. Piping of surface water under entrance shall be provided as required. If piping is impossible, a mountable berm with 5:1 slopes will be permitted.

Criteria for Geotextile

The geotextile shall be woven or nonwoven fabric consisting only of continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals, hydro-carbons, mildew, rot resistant, and conform to the fabric properties as shown:

<table>
<thead>
<tr>
<th>Fabric Properties</th>
<th>Light Duty(^1) Roads Grade</th>
<th>Heavy Duty(^2) Haul Roads Rough Graded</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile</td>
<td>200</td>
<td>220</td>
<td>ASTM D1682</td>
</tr>
<tr>
<td>Strength (lbs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elongation at</td>
<td>50</td>
<td>60</td>
<td>ASTM D1682</td>
</tr>
<tr>
<td>Failure (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mullen Burst</td>
<td>190</td>
<td>430</td>
<td>ASTM D3786</td>
</tr>
<tr>
<td>Strength (lbs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puncture</td>
<td>40</td>
<td>125</td>
<td>ASTM D751 modified</td>
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<tr>
<td>Strength (lbs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equivalent</td>
<td>40-80</td>
<td>40-80</td>
<td>US Std Sieve</td>
</tr>
<tr>
<td>Opening Size</td>
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<td></td>
<td>CW-02215</td>
</tr>
<tr>
<td>Aggregate Depth</td>
<td>6</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)Light Duty Road: Area sites that have been graded to subgrade and where most travel would be single axle vehicles and an occasional multi-axle truck. Acceptable materials are Trevira Spanbond 1115, Mirafi 100X, Typar 3401, or equivalent.

\(^2\)Heavy Duty Road: Area sites with only rough grading, and where most travel would be multi-axle vehicles. Acceptable materials are Trevira Spanbond 1135, Mirafi 600X, or equivalent.

\(^3\)Fabrics not meeting these specifications may be used only when design procedure and supporting documentation are supplied to determine aggregate depth and fabric strength.

Maintenance

The entrance shall be maintained in a condition which will prevent tracking of sediment onto public rights-of-way or streets. This may require periodic top dressing with additional aggregate. All sediment spilled, dropped, or washed onto public rights-of-way must be removed immediately.

When necessary, wheels must be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment-trapping device. All sediment shall be prevented from entering storm drains, ditches, or watercourses.
CONSTRUCTION SPECIFICATIONS

1. STONE SIZE - USE 1-4 INCH STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.

2. LENGTH - NOT LESS THAN 50 FEET (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30 FOOT MINIMUM LENGTH WOULD APPLY).

3. THICKNESS - NOT LESS THAN SIX (6) INCHES.

4. WIDTH - TWELVE (12) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.

5. GEOTEXILE - WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.

6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED BENEATH THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.

7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY, ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACTED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.

8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON A AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

STABILIZED CONSTRUCTION ENTRANCE
STANDARD AND SPECIFICATIONS
FOR
SUMP PIT

Design Criteria

The number of sump pits and their locations shall be determined by the contractor/engineer. A design is not required, but construction should conform to the general criteria outlined on Figure 7A.39 on page 7A.90.

A perforated vertical standpipe is placed in the center of the pit to collect filtered water. Water is then pumped from the center of the pipe to a suitable discharge area.

Discharge of water pumped from the standpipe should be to a sediment trap, sediment basin, or stabilized area, such as a filter strip. If water from the sump pit will be pumped directly to a storm drain system, filter cloth (Mirafi 100X, Poly Filter GB, or a filter cloth with an equivalent sieve size between 40-80) should be wrapped around the standpipe to ensure clean water discharge. It is recommended that ¼ to ½ inch hardware cloth be wrapped around and secured to the standpipe prior to attaching the filter cloth. This will increase the rate of water seepage into the standpipe.

Definition

A temporary pit which is constructed to trap and filter water for pumping to a suitable discharge area.

Purpose

To remove excessive water from excavations.

Conditions Where Practice Applies

Sump pits are constructed when water collects during the excavation phase of construction. This practice is particularly useful in urban areas during excavation for building foundations.
CONSTRUCTION SPECIFICATIONS

1. PIT DIMENSIONS ARE OPTIONAL.
2. THE STANDPIPE SHOULD BE CONSTRUCTED BY PERFORATING A 12-24" DIAMETER CORRUGATED OR PVC PIPE.
3. A BASE OF 2" AGGREGATE SHOULD BE PLACED IN THE PIT TO A DEPTH OF 12". AFTER INSTALLING THE STANDPIPE, THE PIT SURROUNDING THE STANDPIPE SHOULD BE BACKFILLED WITH 2" AGGREGATE.
4. THE STANDPIPE SHOULD EXTEND 12-18" ABOVE THE LIP OF THE PIT.
5. IF DISCHARGE WILL BE PUMPED DIRECTLY TO A STORM DRAINAGE SYSTEM, THE STANDPIPE SHOULD BE WRAPPED WITH FILTERCLOTH BEFORE INSTALLATION. IF DESIRED, 1/4"-1/2" HARDWARE CLOTH MAY BE PLACED AROUND THE STANDPIPE, PRIOR TO ATTACHING THE FILTERCLOTH.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS,
NEW YORK STATE DEPARTMENT OF TRANSPORTATION,
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION,
NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

SUMP PIT
Appendix B

Structural Measures - Permanent
STANDARD AND SPECIFICATIONS FOR DIVERSION

Definition
A drainage way of parabolic or trapezoidal cross-section with a supporting ridge on the lower side that is constructed across the slope.

Purpose
The purpose of a diversion is to intercept and convey runoff to stable outlets at non-erosive velocities.

Conditions Where Practice Applies
Diversions are used where:

1. Runoff from higher areas has potential for damaging properties, causing erosion, or interfering with, or preventing the establishment of, vegetation on lower areas.

2. Surface and/or shallow subsurface flow is damaging sloping upland.

3. The length of slopes needs to be reduced so that soil loss will be kept to a minimum.

Diversions are only applicable below stabilized or protected areas. Avoid establishment on slopes greater than fifteen percent. Diversions should be used with caution on soils subject to slippage. Construction of diversions shall be in compliance with state drainage and water laws.

Design Criteria
Location
Diversions location shall be determined by considering outlet conditions, topography, land use, soil type, length of slope, seep planes (when seepage is a problem), and the development layout.

Capacity
Peak rates of runoff values used in determining the capacity requirements shall be computed by TR-55, Urban Hydrology for Small Watersheds, or other appropriate methods.

The constructed diversion shall have capacity to carry, as a minimum, the peak discharge from a ten-year frequency rainfall event with freeboard of not less than 0.3 feet.

Diversions designed to protect homes, schools, industrial buildings, roads, parking lots, and comparable high-risk areas, and those designed to function in connection with other structures, shall have sufficient capacity to carry peak runoff expected from a storm frequency consistent with the hazard involved.

Cross Section
The diversion channel shall be parabolic or trapezoidal in shape. Parabolic Diversion design charts are provided in Figures 5B.2 through 5B.7 on pages 5B.4 to 5B.9. The diversion shall be designed to have stable side slopes. The side slopes shall not be steeper than 2:1 and shall be flat enough to ensure ease of maintenance of the diversion and its protective vegetative cover.

The ridge shall have a minimum width of four feet at the design water elevation; a minimum of 0.3 feet freeboard and a reasonable settlement factor shall be provided.

Velocity and Grade
The permissible velocity for the specified method of stabilization will determine the maximum grade. Maximum permissible velocities of flow for the stated conditions of stabilization shall be as shown in Table 5B.1 on page 5B.2 of this standard.

Diversions are not usually applicable below high sediment producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment in the channels, are installed with, or before, the diversions.
Outlets
Each diversion must have an adequate outlet. The outlet may be a grassed waterway, vegetated or paved area, grade stabilization structure, stable watercourse, or subsurface drain outlet. In all cases, the outlet must convey runoff to a point where outflow will not cause damage. Vegetated outlets shall be installed before diversion construction, if needed, to ensure establishment of vegetative cover in the outlet channel.

The design elevation of the water surface in the diversion shall not be lower than the design elevation of the water surface in the outlet at their junction when both are operating at design flow.

Stabilization
Diversions shall be stabilized in accordance with the following tables.

Construction Specifications
See Figure 5B.1 on page 5B.3 for details.

Table 5B.1
Diversion Maximum Permissible Design Velocities

<table>
<thead>
<tr>
<th>Soil Texture</th>
<th>Retardance and Cover</th>
<th>Permissible Velocity (ft / second) for Selected Channel Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand, Silt, Sandy loam, silty loam, loamy sand</td>
<td>C-Kentucky 31 tall fescue and Kentucky bluegrass</td>
<td>3.0</td>
</tr>
<tr>
<td>(ML, SM, SP, SW)</td>
<td>D-Annuals¹ Small grain (rye, oats, barley, millet) Ryegrass</td>
<td>2.5</td>
</tr>
<tr>
<td>Silty clay loam, Sandy clay loam (ML-CL, SC)</td>
<td>C-Kentucky 31 tall fescue and Kentucky bluegrass</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>D-Annuals¹ Small grain (rye, oats, barley, millet) Ryegrass</td>
<td>3.5</td>
</tr>
<tr>
<td>Clay (CL)</td>
<td>C-Kentucky 31 tall fescue and Kentucky bluegrass</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>D-Annuals¹ Small grain (rye, oats, barley, millet) Ryegrass</td>
<td>4.0</td>
</tr>
</tbody>
</table>

¹ Annuals—Use only as temporary protection until permanent vegetation is established.

Table 5B.2—Retardance Factors for Various Grasses and Legumes

<table>
<thead>
<tr>
<th>Retardance</th>
<th>Cover</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Reed canarygrass</td>
<td>Excellent stand, tall (average 36 inches)</td>
</tr>
<tr>
<td>B</td>
<td>Smooth bromegrass</td>
<td>Good stand, mowed (average 12 to 15 inches)</td>
</tr>
<tr>
<td></td>
<td>Tall fescue</td>
<td>Good stand, unmowed (average 18 inches)</td>
</tr>
<tr>
<td></td>
<td>Grass-legume mixture—Timothy, smooth bromegrass, or Orchard grass</td>
<td>Good stand, uncut (average 20 inches)</td>
</tr>
<tr>
<td></td>
<td>with birdsfoot trefoil</td>
<td>Good stand, mowed (average 12 to 15 inches)</td>
</tr>
<tr>
<td></td>
<td>Reed canarygrass</td>
<td>Good stand, uncut (average 18 inches)</td>
</tr>
<tr>
<td></td>
<td>Tall fescue, with birdsfoot trefoil or ladino clover</td>
<td>Good stand, headed (15 to 20 inches)</td>
</tr>
<tr>
<td>C</td>
<td>Redtop</td>
<td>Good stand, headed (6 to 8 inches)</td>
</tr>
<tr>
<td></td>
<td>Grass-legume mixture—summer (Orchard grass, redtop, Annual ryegrass,</td>
<td>Good stand, headed (6 to 12 inches)</td>
</tr>
<tr>
<td></td>
<td>and ladino or white clover)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kentucky bluegrass</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Red fescue</td>
<td>Good stand, headed (2 to 18 inches)</td>
</tr>
<tr>
<td></td>
<td>Grass-legume mixture—fall, spring (Orchard grass, redtop, Annual</td>
<td>Good stand, uncut (4 to 5 inches)</td>
</tr>
<tr>
<td></td>
<td>ryegrass, and white or ladino clover)</td>
<td></td>
</tr>
</tbody>
</table>
CONSTRUCTION SPECIFICATIONS

1. ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED AND DISPOSED OF SO AS NOT TO INTERFERE WITH THE PROPER FUNCTIONING OF THE DIVERSION.

2. THE DIVERSION SHALL BE EXCAVATED OR SHAPED TO LINE, GRADE, AND CROSS SECTION AS REQUIRED TO MEET THE CRITERIA SPECIFIED HEREIN, AND BE FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES WHICH WILL IMPede NORMAL FLOW.

3. FILLS SHALL BE COMPACTED AS NEEDED TO PREVENT UNEQUAL SETTLEMENT THAT WOULD CAUSE DAMAGE IN THE COMPLETE DIVERSION.

4. ALL EARTH REMOVED AND NOT NEEDED IN CONSTRUCTION SHALL BE SPREAD OR DISPOSED OF SO THAT IT WILL NOT INTERFERE WITH THE FUNCTIONING OF THE DIVERSION.

5. STABILIZATION SHALL BE DONE ACCORDING TO THE APPROPRIATE STANDARD AND SPECIFICATIONS FOR VEGETATIVE PRACTICES.
   A. FOR DESIGN VELOCITIES OF LESS THAN 3.5 FT. PER. SEC., SEEDING AND MULCHING MAY BE USED FOR THE ESTABLISHMENT OF THE VEGETATION. IT IS RECOMMENDED THAT, WHEN CONDITIONS PERMIT, TEMPORARY DIVERSIONS OR OTHER MEANS SHOULD BE USED TO PREVENT WATER FROM ENTERING THE DIVERSION DURING THE ESTABLISHMENT OF THE VEGETATION.
   B. FOR DESIGN VELOCITIES OF MORE THAN 3.5 FT. PER. SEC., THE DIVERSION SHALL BE STABILIZED WITH SOD, WITH SEEDING PROTECTED BY JUTE OR EXCELSIOR MATTING OR WITH SEEDING AND MULCHING INCLUDING TEMPORARY DIVERSION OF THE WATER UNTIL THE VEGETATION IS ESTABLISHED.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

DIVERSION
Figure 5B.2
Parabolic Diversion Design, Without Freeboard-1 (USDA - NRCS)
STANDARD AND SPECIFICATIONS
FOR
GRASSED WATERWAY

Definition
A natural or man-made channel of parabolic or trapezoidal cross-section that is below adjacent ground level and is stabilized by suitable vegetation. The flow channel is normally wide and shallow and conveys the runoff down the slope.

Purpose
The purpose of a grassed waterway is to convey runoff without causing damage by erosion.

Conditions Where Practice Applies
Grass waterways are used where added vegetative protection is needed to control erosion resulting from concentrated runoff.

Design Criteria
Capacity
The minimum capacity shall be that required to confine the peak rate of runoff expected from a 10-year frequency rainfall event or a higher frequency corresponding to the hazard involved. This requirement for confinement may be waived on slopes of less than one (1) percent where out-of-bank flow will not cause erosion or property damage.

Peak rates of runoff values used in determining the capacity requirements shall be computed by TR-55, Urban Hydrology for Small Watersheds, or other appropriate methods.
Where there is base flow, it shall be handled by a stone center, subsurface drain, or other suitable means since sustained wetness usually prevents adequate vegetative cover. The cross-sectional area of the stone center or subsurface drain size to be provided shall be determined by using a flow rate of 0.1 cfs/acre or by actual measurement of the maximum base flow.

Velocity
Please see Table 5B.1, Diversion Maximum Permissible Design Velocities, for seed, soil, and velocity variables.

Cross Section
The design water surface elevation of a grassed waterway receiving water from diversions or other tributary channels shall be equal to or less than the design water surface elevation in the diversion or other tributary channels.

The top width of parabolic waterways shall not exceed 30 feet and the bottom width of trapezoidal waterways shall not exceed 15 feet unless multiple or divided waterways, stone center, or other means are provided to control meandering of low flows.

Structural Measures
In cases where grade or erosion problems exist, special control measures may be needed such as lined waterways (5B.17), or grade stabilization measures (5B.31). Where needed, these measures will be supported by adequate design computations. For typical cross sections of waterways with riprap sections or stone centers, refer to Figure 5B.8 on page 5B.13.

The design procedures for parabolic and trapezoidal channels are available in the NRCS Engineering Field Handbook; Figure 5B.9 on page 5B.14 also provides a design chart for parabolic waterway.

Outlets
Each waterway shall have a stable outlet. The outlet may be another waterway, a stabilized open channel, grade stabilization structure, etc. In all cases, the outlet must discharge in such a manner as not to cause erosion. Outlets shall be constructed and stabilized prior to the operation of the waterway.
Stabilization

Waterways shall be stabilized in accordance with the appropriate vegetative stabilization standard and specifications, and will be dependent on such factors as slope, soil class, etc.

Construction Specifications

See Figure 5B.10 on page 5B.15 for details.
CONSTRUCTION SPECIFICATIONS

1. ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED AND DISPOSED OF SO AS NOT TO INTERFERE WITH THE PROPER FUNCTIONING OF THE WATERWAY.

2. THE WATERWAY SHALL BE EXCAVATED OR SHAPED TO LINE, GRADE, AND CROSS SECTION AS REQUIRED TO MEET THE CRITERIA SPECIFIED HEREIN, AND BE FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES WHICH WILL IMPEDE NORMAL FLOW.

3. FILLS SHALL BE COMPACTED AS NEEDED TO PREVENT UNEQUAL SETTLEMENT THAT WOULD CAUSE DAMAGE IN THE COMPLETE WATERWAY.

4. ALL EARTH REMOVED AND NOT NEEDED IN CONSTRUCTION SHALL BE SPREAD OR DISPOSED OF SO THAT IT WILL NOT INTERFERE WITH THE FUNCTIONING OF THE WATERWAY.

5. STABILIZATION SHALL BE DONE ACCORDING TO THE APPROPRIATE STANDARD AND SPECIFICATIONS FOR VEGETATIVE PRACTICES.

A. FOR DESIGN VELOCITIES OF LESS THAN 3.5 FT. PER. SEC., SEEDING AND MULCHING MAY BE USED FOR THE ESTABLISHMENT OF THE VEGETATION.
   IT IS RECOMMENDED THAT, WHEN CONDITIONS PERMIT, TEMPORARY WATERWAYS OR OTHER MEANS SHOULD BE USED TO PREVENT WATER FROM ENTERING THE WATERWAY DURING THE ESTABLISHMENT OF THE VEGETATION.

B. FOR DESIGN VELOCITIES OF MORE THAN 3.5 FT. PER. SEC., THE WATERWAY SHALL BE STABILIZED WITH SOD, WITH SEEDING PROTECTED BY JUTE OR EXCELSIOR MATTING OR WITH SEEDING AND MULCHING INCLUDING TEMPORARY DIVERSION OF THE WATER UNTIL THE VEGETATION IS ESTABLISHED.

C. STRUCTURAL - VEGETATIVE PROTECTION
   SUBSURFACE DRAIN FOR BASE FLOW SHALL BE CONSTRUCTED AS SHOWN ON THE STANDARD DRAWING AND AS SPECIFIED IN THE STANDARD AND SPECIFICATIONS FOR SUBSURFACE DRAIN.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

GRASSED WATERWAY
STANDARD AND SPECIFICATIONS
FOR
LINED WATERWAY OR OUTLET

Definition
A waterway or outlet with a lining of concrete, stone, or other permanent material. The lined section extends up the side slopes to the designed depth. The earth above the permanent lining may be vegetated or otherwise protected.

Purpose
To provide for the disposal of concentrated runoff without damage from erosion or flooding, where grassed waterways would be inadequate due to high velocities.

Scope
This standard applies to waterways or outlets with linings of cast-in-place concrete, flagstone mortared in place, rock riprap, gabions, or similar permanent linings. It does not apply to irrigation ditch or canal linings, grassed waterways with stone centers or small lined sections that carry prolonged low flows, or to reinforced concrete channels. The maximum capacity of the waterway flowing at design depth shall not exceed 100 cubic feet per second.

Conditions Where Practice Applies
This practice applies where the following or similar conditions exist:

1. Concentrated runoff is such that a lining is required to control erosion.

2. Steep grades, wetness, prolonged base flow, seepage, or piping that would cause erosion.

3. The location is such that damage from use by people or animals precludes use of vegetated waterways or outlets.

4. Soils are highly erosive or other soil and climate conditions preclude using vegetation.

5. High value property or adjacent facilities warrant the extra cost to contain design runoff in a limited space.

Design Criteria

Capacity

1. The minimum capacity shall be adequate to carry the peak rate of runoff from a 10-year, 24-hour storm. Velocity shall be computed using Manning's equation with a coefficient of roughness "n" as follows:

<table>
<thead>
<tr>
<th>Lined Material</th>
<th>&quot;n&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete (Type):</td>
<td></td>
</tr>
<tr>
<td>Trowel Finish</td>
<td>0.015</td>
</tr>
<tr>
<td>Float Finish</td>
<td>0.019</td>
</tr>
<tr>
<td>Gunite</td>
<td>0.019</td>
</tr>
<tr>
<td>Flagstone</td>
<td>0.022</td>
</tr>
<tr>
<td>Riprap</td>
<td>Determine from Figure 5B.11 on page 5B.19</td>
</tr>
<tr>
<td>Gabion</td>
<td>0.030</td>
</tr>
</tbody>
</table>

2. Riprap gradation and filter (bedding) are generally designed in accordance with criteria set forth in the National Cooperative Highway Research Program Report 108, available from the University Microfilm International, 300 N. Rec Road, Ann Arbor, Michigan 48016, Publication No. PB-00839; or the Hydraulic Engineering Circular No. 11, prepared by the U.S. Bureau of Public Roads, available from Federal Highway Administration, 400 7th Street, S.W., Washington, D.C. 20590, HNG-31, or the procedure in the USDA-NRCS's Engineering Field Manual, Chapter 16.

Velocity

1. Maximum design velocity shall be as shown below. Except for short transition sections, flow with a channel gradient within the range of 0.7 to 1.3 of this
flow's critical slope must be avoided unless the channel is straight. Velocities exceeding critical will be restricted to straight reaches.

<table>
<thead>
<tr>
<th>Design Flow Depth (ft.)</th>
<th>Maximum Velocity (ft./sec.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.5</td>
<td>25</td>
</tr>
<tr>
<td>0.5 - 1.0</td>
<td>15</td>
</tr>
<tr>
<td>Greater than 1.0</td>
<td>10</td>
</tr>
</tbody>
</table>

2. Waterways or outlets with velocities exceeding critical shall discharge into an energy dissipater to reduce velocity to less than critical, or to a velocity the downstream soil and vegetative conditions will allow.

**Cross Section**

The cross section shall be triangular, parabolic, or trapezoidal. Monolithic concrete or gabions may be rectangular.

**Freeboard**

The minimum freeboard for lined waterways or outlets shall be 0.25 feet above design high water in areas where erosion resistant vegetation cannot be grown adjacent to the paved side slopes. No freeboard is required where good vegetation can be grown and is maintained.

**Side Slope**

Steepest permissible side slopes, horizontal to vertical will be as follows:

1. Non-Reinforced Concrete
   - Hand-placed, formed concrete
   - Height of lining, 1.5 ft or less........... Vertical
   - Hand placed screened concrete or mortared
   - In-place flagstone
   - Height of lining, less than 2 ft........... 1 to 1
   - Height of lining, more than 2 ft........... 2 to 1
2. Slip form concrete:
   - Height of lining, less than 3 ft........... 1 to 1
3. Rock Riprap.......................... 2 to 1
4. Gabions.............................. Vertical
5. Pre-cast Concrete Sections.......... Vertical

**Lining Thickness**

Minimum lining thickness shall be as follows:

1. Concrete...................4 in. (In most problem areas, shall be 5 in. with welded wire fabric reinforcing.)
2. Rock Riprap......1.5 x maximum stone size plus thickness of filter or bedding.
3. Flagstone.............4 in. including mortar bed.

**Related Structures**

Side inlets, drop structures, and energy dissipaters shall meet the hydraulic and structural requirements of the site.

**Filters or Bedding**

Filters or bedding to prevent piping, reduce uplift pressure, and collect water will be used as required and will be designed in accordance with sound engineering principles. Weep holes and drains should be provided as needed.

**Concrete**

Concrete used for lining shall be so proportioned that it is plastic enough for thorough consolidation and stiff enough to stay in place on side slopes. A dense product will be required. A mix that can be certified as suitable to produce a minimum strength of at least 3,000 pounds per square inch will be required. Cement used shall be Portland Cement, Type I, II, IV, or V. Aggregate used shall have a maximum diameter of 1 ½ inches.

Weep holes should be provided in concrete footings and retaining walls to allow free drainage of water. Pipe used for weep holes shall be non-corrosive.

**Mortar**

Mortar used for mortared in-place flagstone shall consist of a mix of cement, sand, and water. Follow directions on the bag of mortar for proper mixing of mortar and water.

**Contraction Joints**

Contraction joints in concrete linings, where required, shall be formed transversely to a depth of about one third the thickness of the lining at a uniform spacing in the range of 10 to 15 feet.

**Rock Riprap or Flagstone**

Stone used for riprap or gabiions shall be dense and hard enough to withstand exposure to air, water, freezing, and thawing. Flagstone shall be flat for ease of placement and have the strength to resist exposure and breaking. Rock riprap maximum size shall be as follows:

<table>
<thead>
<tr>
<th>Velocity, f.p.s.</th>
<th>dmax, inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>6</td>
</tr>
<tr>
<td>8.5</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>15</td>
<td>36</td>
</tr>
</tbody>
</table>

A complete riprap gradations is provided in Table 5B.4, page 5B.38.
STANDARD AND SPECIFICATIONS
FOR
ROCK OUTLET PROTECTION

Definition
A section of rock protection placed at the outlet end of the culverts, conduits, or channels.

Purpose
The purpose of the rock outlet protection is to reduce the depth, velocity, and energy of water, such that the flow will not erode the receiving downstream reach.

Scope
This standard applies to the planning, design, and construction of rock riprap and gabions for protection of downstream areas. It does not apply to rock lining of channels or streams.

Conditions Where Practice Applies
This practice applies where discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This applies to:
1. Culvert outlets of all types.
2. Pipe conduits from all sediment basins, dry storm water ponds, and permanent type ponds.
3. New channels constructed as outlets for culverts and conduits.

Design Criteria
The design of rock outlet protection depends entirely on the location. Pipe outlet at the top of cuts or on slopes steeper than 10 percent, cannot be protected by rock aprons or riprap sections due to re-concentration of flows and high velocities encountered after the flow leaves the apron.

Many counties and state agencies have regulations and design procedures already established for dimensions, type and size of materials, and locations where outlet protection is required. Where these requirements exist, they shall be followed.

Tailwater Depth
The depth of tailwater immediately below the pipe outlet must be determined for the design capacity of the pipe. If the tailwater depth is less than half the diameter of the outlet pipe, and the receiving stream is wide enough to accept divergence of the flow, it shall be classified as a Minimum Tailwater Condition; see Figure 5B.12 on page 5B.25 as an example. If the tailwater depth is greater than half the pipe diameter and the receiving stream will continue to confine the flow, it shall be classified as a Maximum Tailwater Condition; see Figure 5B.13 on page 5B.26 as an example. Pipes which outlet onto flat areas with no defined channel may be assumed to have a Minimum Tailwater Condition; see Figure 5B.12 on page 5B.25 as an example.

Apron Size
The apron length and width shall be determined from the curves according to the tailwater conditions:

Minimum Tailwater – Use Figure 5B.12 on page 5B.25
Maximum Tailwater – Use Figure 5B.13 on page 5B.26

If the pipe discharges directly into a well defined channel, the apron shall extend across the channel bottom end up the channel banks to an elevation one foot above the maximum tailwater depth or to the top of the bank, whichever is less.

The upstream end of the apron, adjacent to the pipe, shall have a width two (2) times the diameter of the outlet pipe, or conform to pipe end section if used.
Bottom Grade

The outlet protection apron shall be constructed with no slope along its length. There shall be no overfall at the end of the apron. The elevation of the downstream end of the apron shall be equal to the elevation of the receiving channel or adjacent ground.

Alignment

The outlet protection apron shall be located so that there are no bends in the horizontal alignment.

Materials

The outlet protection may be done using rock riprap, grouted riprap, or gabions.

Riprap shall be composed of a well-graded mixture of stone size so that 50 percent of the pieces, by weight, shall be larger than the \( d_{50} \) size determined by using the charts. A well-graded mixture, as used herein, is defined as a mixture composed primarily of larger stone sizes, but with a sufficient mixture of other sizes to fill the smaller voids between the stones. The diameter of the largest stone size in such a mixture shall be 1.5 times the \( d_{50} \) size.

Thickness

The minimum thickness of the riprap layer shall be 1.5 times the maximum stone diameter for \( d_{50} \) of 15 inches or less; and 1.2 times the maximum stone size for \( d_{50} \) greater than 15 inches. The following chart lists some examples:

<table>
<thead>
<tr>
<th>( D_{90} ) (inches)</th>
<th>( d_{max} ) (inches)</th>
<th>Minimum Blanket Thickness (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>9</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>12</td>
<td>18</td>
<td>27</td>
</tr>
<tr>
<td>15</td>
<td>22</td>
<td>32</td>
</tr>
<tr>
<td>18</td>
<td>27</td>
<td>32</td>
</tr>
<tr>
<td>21</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td>24</td>
<td>36</td>
<td>43</td>
</tr>
</tbody>
</table>

Stone Quality

Stone for riprap shall consist of field stone or rough unhewn quarry stone. The stone shall be hard and angular and of a quality that will not disintegrate on exposure to water or weathering. The specific gravity of the individual stones shall be at least 2.5.

Recycled concrete equivalent may be used provided it has a density of at least 150 pounds per cubic foot, and does not have any exposed steel or reinforcing bars.

Filter

A filter is a layer of material placed between the riprap and the underlying soil surface to prevent soil movement into and through the riprap. Riprap shall have a filter placed under it in all cases.

A filter can be of two general forms: a gravel layer or a plastic filter cloth. The plastic filter cloth can be woven or non-woven monofilament yarn, and shall meet these basic requirements: thickness 20-60 mils, grab strength 90-120 lbs; and shall conform to ASTM D-1777 and ASTM D-1682.

Gravel filter blanket, when used, shall be designed by comparing particle sizes of the overlying material and the base material. Design criteria are available in Standard and Specification for Riprap Slope Protection on page 5B.57.

Gabions

Gabions shall be made of hexagonal triple twist mesh with heavily galvanized steel wire. The maximum linear dimension of the mesh opening shall not exceed 4 ½ inches and the area of the mesh opening shall not exceed 10 square inches.

Gabions shall be fabricated in such a manner that the sides, ends, and lid can be assembled at the construction site into a rectangular basket of the specified sizes. Gabions shall be of single unit construction and shall be installed according to manufacturers recommendations.

The area on which the gabion is to be installed shall be graded as shown on the drawings. Foundation conditions shall be the same as for placing rock riprap, and filter cloth shall be placed under all gabions. Where necessary, key, or tie, the structure into the bank to prevent undermining of the main gabion structure.

Maintenance

Once a riprap outlet has been installed, the maintenance needs are very low. It should be inspected after high flows for evidence of scour beneath the riprap or for dislodged stones. Repairs should be made immediately.

Design Procedure

1. Investigate the downstream channel to assure that nonerosive velocities can be maintained.

2. Determine the tailwater condition at the outlet to establish which curve to use.

3. Enter the appropriate chart with the design discharge to
determine the riprap size and apron length required. It is noted that references to pipe diameters in the charts are based on full flow. For other than full pipe flow, the parameters of depth of flow and velocity must be used to adjust the design discharges.

4. Calculate apron width at the downstream end if a flare section is to be employed.

Examples

Example 1: Pipe Flow (full) with discharge to unconfined section.

Given: A circular conduit flowing full.

\[ Q = 280 \text{ cfs}, \text{diam} = 66 \text{ in.}, \text{tailwater (surface)} \text{ is 2 ft. above pipe invert (minimum tailwater condition).} \]

Find: Read \( d_{90} \) = 1.2 and apron length \( (L_a) \) = 38 ft.

Apron width = diam. + \( L_a \) = 5.5 + 38 = 43.5 ft.

Use: \( d_{90} = 15'' \), \( d_{max} = 22'' \), blanket thickness = 32''

Example 2: Box Flow (partial) with high tailwater

Given: A box conduit discharging under partial flow conditions. A concrete box 5.5 ft. x 10 ft. flowing 5.0 ft. deep,

\[ Q = 600 \text{ cfs and tailwater surface is 5 ft. above invert (max. tailwater condition).} \]

Since this is not full pipe and does not directly fit the nomograph assumptions of Figure 7B.13 substitute depth as the diameter, to find a discharge equal to full pipe flow for that diameter, in this case 60 inches.

Since, \( Q = AV \) and \( A = \pi \frac{D^2}{4} \)

First, compute velocity:

\[ V = \frac{Q}{A} = \frac{600}{(5)(1)} = 12 \text{ fps} \]

Then substituting:

\[ Q = \pi \frac{D^2}{4} \times V = 3.14 \frac{(5 \text{ ft})^2}{4} \times 12 \text{ fps} = 236 \text{ cfs} \]

At the intersection of the curve \( d = 60 \text{ in.} \) and \( Q = 236 \text{ cfs} \), read \( d_{90} = 0.4 \text{ ft.} \)

Then reading the \( d = 60 \text{ in.} \) curve, read apron length \( (L_a) = 40 \text{ ft.} \)

Apron width, \( W = \text{conduct width} + (6.4)(L_a) = 10 + (0.4)(40) = 26 \text{ ft.} \)

Example 3: Open Channel Flow with Discharge to Unconfined Section

Given: A trapezoidal concrete channel 5 ft. wide with 2:1 side slopes is flowing 2 ft. deep, \( Q = 180 \text{ cfs} \) (velocity = 10 fps) and the tailwater surface downstream is 0.8 ft. (minimum tailwater condition).

Find: Using similar principles as Example 2, compute equivalent discharge for a 2 foot, using depth as a diameter, circular pipe flowing full at 10 feet per second.

Velocity:

\[ Q = \frac{\pi (2ft)^2 \times 10 \text{ fps}}{4} = 31.4 \text{ cfs} \]

At intersection of the curve, \( d = 24 \text{ in.} \) and \( Q = 32 \text{ cfs} \), read \( d_{90} = 0.6 \text{ ft.} \)

Then reading the \( d = 24 \text{ in.} \) curve, read apron length \( (L_a) = 20 \text{ ft.} \)

Apron width, \( W = \text{bottom width of channel} + L_a = 5 + 20 = 25 \text{ ft.} \)

Example 4: Pipe flow (partial) with discharge to a confined section

Given: A 48 in. pipe is discharging with a depth of 3 ft. \( Q = 100 \text{ cfs} \), and discharge velocity of 10 fps (established from partial flow analysis) to a confined trapezoidal channel with a 2 ft. bottom, 2:1 side slopes, \( n = .04 \), and grade of 0.6%.

Calculation of the downstream channel (by Manning’s Equation) indicates a normal depth of 3.1 ft. and normal velocity of 3.9 fps.

Since the receiving channel is confined, the maximum tailwater condition controls.

Find: discharge using previous principles:

\[ Q = \frac{\pi (3ft)^2 \times 10 \text{ fps}}{4} = 71 \text{ cfs} \]

At the intersection of \( d = 36 \text{ in.} \) and \( Q = 71 \text{ cfs} \), read \( d_{90} = 0.3 \text{ ft.} \)

Reading the \( d = 36'' \) curve, read apron length \( (L_a) = 30 \text{ ft.} \)

Since the maximum flow depth in this reach is 3.1 ft., that is the minimum depth of riprap to be maintained for the entire length.
Construction Specifications

1. The subgrade for the filter, riprap, or gabion shall be prepared to the required lines and grades. Any fill required in the subgrade shall be compacted to a density of approximately that of the surrounding undisturbed material.

2. The rock or gravel shall conform to the specified grading limits when installed respectively in the riprap or filter.

3. Filter cloth shall be protected from punching, cutting, or tearing. Any damage other than an occasional small hole shall be repaired by placing another piece of cloth over the damaged part or by completely replacing the cloth. All overlaps, whether for repairs or for joining two pieces of cloth shall be a minimum of one foot.

4. Stone for the riprap or gabion outlets may be placed by equipment. Both shall each be constructed to the full course thickness in one operation and in such a manner as to avoid displacement of underlying materials. The stone for riprap or gabion outlets shall be delivered and placed in a manner that will ensure that it is reasonably homogenous with the smaller stones and spalls filling the voids between the larger stones. Riprap shall be placed in a manner to prevent damage to the filter blanket or filter cloth. Hand placement will be required to the extent necessary to prevent damage to the permanent works.
Figure 5B.14
Riprap Outlet Protection Detail (1)

NOTE: APRON @ ZERO GRADE
SIDE SLOPE 2:1

PROFILE VIEW

W = d + 0.4 La

SEE RIPRAP STANDARDS AND SPECIFICATIONS
MINIMUM TAILWATER CONDITIONS

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS,
NEW YORK STATE DEPARTMENT OF TRANSPORTATION,
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION,
NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

RIPRAPH OUTLET PROTECTION EXAMPLE

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New York Standards and Specifications
For Erosion and Sediment Control
Figure 5B.15
Riprap Outlet Protection Detail (2)

Plan View

PROFILE VIEW

MINIMUM DEPTH OF RIPRAP = MAXIMUM DEPTH OF FLOW (DOWNSTREAM NORMAL DEPTH OR DISCHARGE DEPTH, WHICHEVER IS GREATER).

FILTER CLOTH OR GRADED AGGREGATE FILTER
WIDTH OF BOTTOM TO VARY FROM 1/2 PIPE DIAMETER AT PIPE OUTLET TO EXISTING CHANNEL BOTTOM AT END OF APRON.

SLOPE TO VARY FROM 2:1 AT PIPE OUTLET TO EXISTING CHANNEL SLOPE AT END OF APRON.

ADAPTED FROM DETAILS PROVIDED BY USDA - NRCS, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

RIPRAP OUTLET PROTECTION EXAMPLE
Figure 5B.16
Riprap Outlet Protection Detail (3)

PLANVIEW

MIN. DEPTH = DISCHARGE OR TAILWATER DEPTH, WHICHEVER IS GREATER

PROFILE VIEW

SECTION A-A
(AT END OF CULVERT)

SECTION B-B
(AT END OF APRON)

NOTE:
SEE RIPRAP STANDARDS AND SPECIFICATIONS
MAXIMUM TAILWATER CONDITIONS

IMAGE: Diagram illustrating a riprap outlet protection detail.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS,
NEW YORK STATE DEPARTMENT OF TRANSPORTATION,
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION,
NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

RIPRAP OUTLET PROTECTION EXAMPLE
STANDARD AND SPECIFICATIONS
FOR
LANDGRADING

Definition
Reshaping of the existing land surface in accordance with a plan as determined by engineering survey and layout.

Purpose
The purpose of a landgrading specification is to provide for erosion control and vegetative establishment on those areas where the existing land surface is to be reshaped by grading according to plan.

Design Criteria
The grading plan should be based upon the incorporation of building designs and street layouts that fit and utilize existing topography and desirable natural surrounding to avoid extreme grade modifications. Information submitted must provide sufficient topographic surveys and soil investigations to determine limitations that must be imposed on the grading operation related to slope stability, effect on adjacent properties and drainage patterns, measures for drainage and water removal, and vegetative treatment, etc.

Many counties have regulations and design procedures already established for land grading and cut and fill slopes. Where these requirements exist, they shall be followed.

The plan must show existing and proposed contours of the area(s) to be graded. The plan shall also include practices for erosion control, slope stabilization, safe disposal of runoff water and drainage, such as waterways, lined ditches, reverse slope benches (include grade and cross section), grade stabilization structures, retaining walls, and surface and subsurface drains. The plan shall also include phasing of these practices. The following shall be incorporated into the plan:

1. Provisions shall be made to safely conduct surface runoff to storm drains, protected outlets, or to stable water courses to ensure that surface runoff will not damage slopes or other graded areas; see standards and specifications for Grassed Waterway, Diversion, Grade Stabilization Structure.

2. Cut and fill slopes that are to be stabilized with grasses shall not be steeper than 2:1. Where slopes exceed 2:1, special design and stabilization consideration are required and shall be adequately shown on the plans. (Note: Where the slope is to be mowed, the slope should be no steeper than 3:1, although 4:1 is preferred because of safety factors related to mowing steep slopes.)

3. Reverse slope benches or diversion shall be provided whenever the vertical interval (height) of any 2:1 slope exceeds 20 feet; for 3:1 slope it shall be increased to 30 feet and for 4:1 to 40 feet. Benches shall be located to divide the slope face as equally as possible and shall convey the water to a stable outlet. Soils, seeps, rock outcrops, etc., shall also be taken into consideration when designing benches.

A. Benches shall be a minimum of six feet wide to provide for ease of maintenance.

B. Benches shall be designed with a reverse slope of 6:1 or flatter to the toe of the upper slope and with a minimum of one foot in depth. Bench gradient to the outlet shall be between 2 percent and 3 percent, unless accompanied by appropriate design and computations.

C. The flow length within a bench shall not exceed 800 feet unless accompanied by appropriate design and computations; see Standard and Specifications for Diversion on page 5B.1

4. Surface water shall be diverted from the face of all cut and/or fill slopes by the use of diversions, ditches and swales or conveyed downslope by the use of a designed structure, except where:

A. The face of the slope is or shall be stabilized and the face of all graded slopes shall be protected from surface runoff until they are stabilized.
B. The face of the slope shall not be subject to any concentrated flows of surface water such as from natural drainage ways, graded swales, downspouts, etc.

C. The face of the slope will be protected by special erosion control materials, sod, gravel, riprap, or other stabilization method.

5. Cut slopes occurring in ripable rock shall be serrated as shown in Figure 5B.23 on page 5B.51. The serrations shall be made with conventional equipment as the excavation and slope preparation are made. Each step or serration shall be constructed on the contour and will have steps cut at nominal two-foot intervals with nominal three-foot horizontal shelves. These steps will vary depending on the slope ratio or the cut slope. The nominal slope line is 1 1/2:1. These steps will weather and act to hold moisture, lime, fertilizer, and seed thus producing a much quicker and longer-lived vegetative cover and better slope stabilization. Overland flow shall be diverted from the top of all serrated cut slopes and carried to a suitable outlet.

6. Subsurface drainage shall be provided wherever necessary to intercept seepage that would otherwise adversely affect slope stability or create excessively wet site conditions.

7. Slopes shall not be created so close to property lines as to endanger adjoining properties without adequately protecting such properties against sedimentation, erosion, slippage, settlement, subsidence, or other related damages.

8. Fill material shall be free of brush, rubbish, rocks, logs, stumps, building debris, and other objectionable material. It should be free of stones over two (2) inches in diameter where compacted by hand or mechanical tampers or over eight (8) inches in diameter where compacted by rollers or other equipment. Frozen material shall not be placed in the fill nor shall the fill material be placed on a frozen foundation.

9. Stockpiles, borrow areas, and spoil shall be shown on the plans and shall be subject to the provisions of this Standard and Specifications.

10. All disturbed areas shall be stabilized structurally or vegetatively in compliance with the Standard and Specifications for Critical Area Treatment in Section 3.

Construction Specifications
See Figures 5B.23 and 5B.24 for details.

1. All graded or disturbed areas, including slopes, shall be protected during clearing and construction in accordance with the erosion and sediment control plan until they are adequately stabilized.

2. All erosion and sediment control practices and measures shall be constructed, applied and maintained in accordance with the sediment control plan and the "New York Standards and Specifications for Erosion and Sediment Control."

3. Topsoil required for the establishment of vegetation shall be stockpiled in amount necessary to complete finished grading of all exposed areas.

4. Areas to be filled shall be cleared, grubbed, and stripped of topsoil to remove trees, vegetation, roots, or other objectionable material.

5. Areas that are to be topsoiled shall be scarified to a minimum depth of four inches prior to placement of topsoil.

6. All fills shall be compacted as required to reduce erosion, slippage, settlement, subsidence, or other related problems. Fill intended to support buildings, structures, and conduits, etc., shall be compacted in accordance with local requirements or codes.

7. All fill shall be placed and compacted in layers not to exceed 9 inches in thickness.

8. Except for approved landfills or nonstructural fills, fill material shall be free of frozen particles, brush, roots, sod, or other foreign objectionable materials that would interfere with, or prevent, construction of satisfactory fills.

9. Frozen material or soft, mucky or highly compressible materials shall not be incorporated into fill slopes or structural fills.

10. Fill shall not be placed on saturated or frozen surfaces.

11. All benches shall be kept free of sediment during all phases of development.

12. Seeps or springs encountered during construction shall be handled in accordance with the Standard and Specification for Subsurface Drainage on page 5B.44 or other approved methods.

13. All graded areas shall be permanently stabilized immediately following finished grading.

14. Stockpiles, borrow areas, and spoil areas shall be shown on the plans and shall be subject to the provisions of this Standard and Specifications.
CONSTRUCTION SPECIFICATIONS

1. All graded or disturbed areas including slopes shall be protected during clearing and construction in accordance with the approved sediment control plan until they are permanently stabilized.

2. All sediment control practices and measures shall be constructed, applied and maintained in accordance with the approved sediment control plan and the "Standards and Specifications for Soil Erosion and Sediment Control in Developing Areas".

3. Topsoil required for the establishment of vegetation shall be stockpiled in amount necessary to complete finished grading of all exposed areas.

4. Areas to be filled shall be cleared, grubbed, and stripped of topsoil to remove trees, vegetation, roots or other objectionable material.

5. Areas which are to be topsoiled shall be scarified to a minimum depth of four inches prior to placement of topsoil.

6. All fills shall be compacted as required to reduce erosion, slippage, settlement, subsidence or other related problems. Fill intended to support buildings, structures and conduits, etc. shall be compacted in accordance with local requirements or codes.

7. All fill to be placed and compacted in layers not to exceed 9 inches in thickness.

8. Except for approved landfills, fill material shall be free of frozen particles, brush, roots, sod, or other foreign or other objectionable materials that would interfere with or prevent construction of satisfactory fills.

9. Frozen materials or soft, mucky or highly compressible materials shall not be incorporated in fills.

10. Fill shall not be placed on saturated or frozen surfaces.

11. All benches shall be kept free of sediment during all phases of development.

12. Seeps or springs encountered during construction shall be handled in accordance with the standard and specification for subsurface drain or other approved method.

13. All graded areas shall be permanently stabilized immediately following finished grading.

14. Stockpiles, borrow areas and spoil areas shall be shown on the plans and shall be subject to the provisions of this standard and specification.

Adapted from details provided by: USDA - NRCS, New York State Department of Transportation, New York State Department of Environmental Conservation, New York State Soil & Water Conservation Committee.

LANDGRADING SPECIFICATIONS
STANDARD AND SPECIFICATIONS
FOR
SURFACE ROUGHENING

Definition
Roughening a bare soil surface whether through creating horizontal grooves across a slope, stair-stepping, or tracking with construction equipment.

Purpose
To aid the establishment of vegetative cover from seed, to reduce runoff velocity and increase infiltration, and to reduce erosion and provide for trapping of sediment.

Conditions Where Practice Applies
All construction slopes require surface roughening to facilitate stabilization with vegetation, particularly slopes steeper than 3:1.

Design Criteria
There are many different methods to achieve a roughened soil surface on a slope. No specific design criteria is required. However, the selection of the appropriate method depends on the type of slope. Methods include tracking, grooving, and stair-stepping. Steepness, mowing requirements, and/or a cut or fill slope operation are all factors considered in choosing a roughening method.

Construction Specifications
A. Cut Slope. No mowing.

1. Stair-step grade or groove cut slopes with a gradient steeper than 3:1 (Figure 5B.25).
2. Use stair-step grading on any erodible material soft enough to be ripped with a bulldozer. Slopes of soft rock with some soil are particularly suited to stair-step grading.
3. Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the “step” to the vertical wall.
4. Do not make vertical cuts more than 2 feet in soft materials or 3 feet in rocky materials.

Grooving uses machinery to create a series of ridges and depressions that run perpendicular to the slope following the contour. Groove using any appropriate implement that can be safely operated on the slope, such as disks, tillers, spring harrows, or the teeth of a front-end loader bucket. Do not make the grooves less than 3 inches deep or more than 15 inches apart.

B. Fill Slope. No mowing

1. Place fill to create slopes with a gradient steeper than 3:1 in lifts 9 inches or less and properly compacted. Ensure the face of the slope consists of loose, uncompacted fill 4 to 6 inches deep. Use grooving as described above to roughen the slope, if necessary.
2. Do not blade or scrape the final slope face.

C. Cuts/Fills. Mowed Maintenance

1. Make mowed slopes no steeper than 3:1
2. Roughen these areas to shallow grooves by normal tilling, diskng, harrowing, or use of culipacker-seeder. Make the final pass of such tillage equipment on the contour.
3. Make grooves at least 1 inch deep and a maximum of 10 inches apart.
4. Excessive roughness is undesirable where mowing is planned.

Tracking should be used primarily in sandy soils to avoid undue compaction of the soil surface. Tracking is generally not as effective as the other roughening methods described. (It has been used as a method to track down mulch.) Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during the final grading operation.
Figure 5B.25
Surface Roughening

DEBRIS FROM SLOPE ABOVE IS CAUGHT BY STEPS

DRAINAGE

GREATER THAN VERTICAL

2-3' (DEPENDING ON MATERIAL)

CUT STEPS WITH DRAINAGE TO THE BACK. AVOID LOW SPOTS.

STAIR STEPPING CUT SLOPES

GROOVE BY CUTTING FURROWS ALONG THE CONTOUR. IRREGULARITIES IN THE SOIL SURFACE CATCH RAINWATER AND RETAIN LIME, FERTILIZER AND SEED.

GROOVING SLOPES

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE

SURFACE ROUGHENING DETAILS