

**APPENDIX K: STORMWATER RUNOFF MINIMIZATION
MEASURES**

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STORMWATER RUNOFF MINIMIZATION MEASURES

The following measures should be implemented as a part of the design and construction phases of this project to reduce impacts resulting from stormwater.

Plan Development

Some basic principles which will be used during the development of the erosion and sediment control plan are:

- Design slopes consistent with soil properties
- Limiting the area and duration of unprotected soil exposure.
- Protecting soil with vegetative cover, mulch, or erosion resistant material.
- Controlling concentration of runoff.
- Retarding runoff with planned engineering works.
- Trapping sediment with temporary or permanent barriers, basins or other measures as close to the source as possible.
- Consideration of measures which could also serve as permanent control also serve as permanent control measures for highway runoff, such as drainage basins.

Erosion and sediment control during construction is highly dependent on the temporary and permanent measures contained in the plans and available to the construction force. The designer will provide measures and guidance through the contract documents to ensure that a well conceived and timely implemented staged erosion and sediment control plan is presented to the contract forces.

Highway Geometrics Affecting Erosion And Sedimentation

Highway geometrics can be advantageous in minimizing potential soil erosion and sedimentation problems and in selecting appropriate control measures. Project alignment and grade, the design cross section, as well as the number and involvement of stream crossings and encroachments are geometric features which have a range of flexibility. Within this range, adjustments will be made to reduce the damage potential and lessen the requirements and cost of control.

The alignment should be shifted when possible to eliminate or minimize encroachment into a surface water environment. Stream crossings should be made at stable reaches of stream, avoiding meanders that are subject to rapid shifting and channel profiles that are degrading or aggrading. To reduce the potential for problems, every effort should be made to minimize the number of stream crossings and encroachments.

Roadway embankment or cut slopes vary with the height of cut or fill and directly affect erosion control and vegetation measures. Flat slopes (2:1 or flatter) favor the establishment and maintenance of vegetation and are therefore preferred. Slopes with a greater than 3:1 gradient should have permanent stabilization measures which do not require mowing. Benching (or terracing) is a method of breaking and controlling sheet flow on long steep slopes. Benching will be considered for any gradient with a slope from 2:1 to 3:1. Serrated cut slopes will be considered as an aid in the establishment of vegetative cover on decomposed rock or shale slopes.

Scheduling Operations

Proper planning and scheduling of the construction operations are major factors in controlling anticipated erosion and sediment problems. A schedule should be developed and conformed to

which considers the probable weather conditions and the potential occurrence of storms, particularly if work in or adjacent to a stream is involved.

Clearing operations should be scheduled after perimeter control measures are installed, and performed to provide for erosion control measures to follow immediately. Construction of permanent drainage facilities should also begin immediately after the area is cleared.

Throughout the construction phase the schedule operations should provide for either temporary or permanent erosion control measures as soon as practical.

Operations should be scheduled with an individual or several natural drainage courses as a unit. The size of the unit should be determined considering the project earthwork balances, borrow pit locations, erodibility of the soil, number of watercourses and the contractor's ability to keep his finishing and turf establishment operations up with his earthwork operations.

Contractor's Responsibilities

The Contractor will follow the staged erosion and sediment control plan, which sets forth the proposed construction sequences and the accompanying erosion control measures that will be employed.

Adequate inspection and maintenance, which is essential for erosion and sediment control during construction, will be performed.

Clearing and Grubbing

The control of soil erosion is an essential consideration in clearing and grubbing operations. The contract documents should require that the work be performed in a manner which will cause minimum soil disturbance. These documents should also provide a limitation on the amount of erodible surface area which may be exposed at any one time during the performance of the work.

Excavation and Embankment Construction

When practical, the excavation and formation of embankment should be performed in such a manner that cut and fill slopes will be completed to final slopes and grade in a continuous operation. Diversion ditches on a high side of cuts will be constructed in the first phase of the grading operation.

Construction in or Near Waters of the United States

Equipment work within stream channels will be kept to a minimum. Specifications or special provisions will include control of the Contractor's operation when performing work in streams, particularly requiring conformance with regulations of water resource and fish and wildlife agencies. The Contractor will not be permitted to disturb stream banks and beds or destroy vegetation unless it is absolutely necessary, and a commitment for suitable restoration is made. Some types of construction and stream conditions may necessitate the construction of diversion ditches, sediment basins, or other protective measures to avoid sediment problems. Embankments slopes that encroach on stream channels will be adequately protected against erosion. Some form of protective diversion or filter barrier will be installed parallel to the waterway to protect it as much as possible from sediment. Care will be taken in locating these measures to avoid obstructing waterway openings. Where practical, either a protective area of

vegetative cover should be left, or established, between the highway embankment and adjacent stream channels.

Excavation from the roadway, channel changes, cofferdams, or other material will not be deposited in or near rivers, streams, impoundments, or wetland where it might be washed away by high water or run off to the detriment of the general environment.

When work is required in impounded water, a silt curtain or floating silt screen will be used to contain the suspended sediments within a specified area.

Sediment basins in lateral ditches leading to the waterways are essential, but additional features such as check dams may also be needed to slow the velocity of the water before it gets to the waterway. Temporary vegetation in the immediate work site areas can help to minimize surface runoff into waterway. If it is necessary to pump the working area, the sediment laden effluent will not be discharged directly into a waterway. Sediment laden water will be discharged in a waterway. Sediment laden water will be discharged in a sediment basin to trap prior to release.

A serious concern exists where bridge construction takes place over an existing waterway. In this event, careful planning of construction operations to limit the disturbance of stream banks is essential. Rock riprap or concrete slope protection placed as soon as practicable will also retard surface erosion.

Whenever practicable, the construction site for a proposed culvert or footings will be located outside the existing stream channel. However, for hydraulic and environmental reasons, it is seldom possible to locate a culvert outside the water way boundaries and some provision must be made to accommodate the stream flow while the structure is being constructed.

For an intermittent stream crossing, construction can at times be scheduled during a dry period. With multiple barrel structures, it may be practicable to construct one barrel outside of the stream bed and divert the flow to the completed segment, while the remainder of the structure is completed.

In some instances, it may be necessary to construct a diversion channel to convey the flow around the construction site while the permanent structure is being constructed.

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