NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

DIVERSION

(Ft.)

CODE 362

DEFINITION

A channel generally constructed across the slope with a supporting ridge on the lower side.

PURPOSE

This practice may be applied to support one or more of the following purposes.

- Break up concentrations of water on long slopes, on undulating land surfaces, and on land that is generally considered too flat or irregular for terracing.
- Divert water away from farmsteads, agricultural waste systems, and other improvements.
- Collect or direct water for storage, water-spreading or water-harvesting systems.
- Protect terrace systems by diverting water from the top terrace where topography, land use, or land ownership prevents terracing the land above.
- Intercept surface and shallow subsurface flow.
- Reduce runoff damages from upland runoff.
- Reduce erosion and runoff on urban or developing areas and at construction or mining sites.
- Divert water away from active gullies or critically eroding areas.
- Supplement water management on conservation cropping or stripcropping systems.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where surface runoff water control and/or management are needed and where soils and topography are such that the diversion can be constructed and a suitable outlet is available or can be provided.

GENERAL CRITERIA

Diversions shall not retain or retard water

Legal Requirement. If the primary purpose of the diversion is to make beneficial use of the water through water spreading, a legal water right must exist or be obtained prior to construction.

Capacity. Diversions as temporary measures, with an expected life span of less than 2 years, shall have a minimum capacity for the peak discharge from the 2-year frequency, 24-hour duration storm.

Diversions that protect agricultural land shall have a minimum capacity for the peak discharge from a 10-year frequency, 24-hour duration storm.

Diversions designed to protect areas such as urban areas, buildings, roads, and animal waste management systems shall have a minimum capacity for the peak discharge from a storm frequency consistent with the hazard involved but not less than a 25-year frequency, 24-hour duration storm. Freeboard shall be not less than 0.5 ft.

Design depth is the channel storm flow depth plus freeboard.

Cross section. The channel may be parabolic, V-shaped, or trapezoidal. The diversion shall be designed to have stable side slopes.

The structure ridge shall have design side slopes on the downstream side not steeper than 2:1 and on the upstream side not steeper than 3:1.

At the design depth, the ridge shall have a minimum width of 4 feet and a maximum width of 8.0 feet. The ridge height shall include an adequate settlement factor.

The ridge top width may be 3 feet at the design depth for diversions with less than 10 acres drainage area above cropland, pastureland, or woodland.

The top of the constructed ridge at any point shall not be lower than the design depth plus the specified overfill for settlement.

The design depth at culvert crossings shall be the culvert headwater depth for the design storm plus freeboard.

On the upstream side of the ridge, no excavation will be permitted below the elevation of the existing channel bottom. The minimum spillway channel to ridge height shall be 1.5 feet.

Grade and Velocity. Channel grades will be designed and installed to as uniform grade as possible. Channel velocity shall not exceed that considered erosive for the soil and planned vegetation or lining.

Maximum channel velocities for permanently vegetated channels shall not exceed those recommended in the NRCS Engineering Field Handbook (EFH) Part 650, Chapter 7, or Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-Lined Open Channels (Sept. 1987).

When the capacity is determined by the formula Q = (A)x(V) and the V is calculated by using Manning's equation, the highest expected value of "n" shall be used.

Location. The outlet conditions, topography, land use, cultural operations, cultural resources, soil type, and length of slope shall determine the location of the diversion.

Protection against sedimentation. Diversions normally should not be used below high sediment producing areas. If they are, a practice or combination of practices needed to prevent damaging accumulations of sediment in the channel shall be installed. This may include land treatment erosion control practices, cultural or tillage practices, vegetated filter strip, or structural measures. These preventive practices shall be installed in conjunction with or before the diversion construction.

If movement of sediment into the channel is a problem, the design shall include extra capacity for sediment or periodic removal as outlined in the operation and maintenance plan.

Outlets. Each diversion must have a safe and stable outlet with adequate capacity. The outlet may be a grassed waterway, a lined waterway, a vegetated or paved area, a grade stabilization structure, an underground outlet, a stable watercourse, a sediment basin, tile outlet, or a combination of these practices. The outlet must convey runoff to a point where outflow will not cause damage. Vegetative outlets shall be installed and established before diversion construction to insure establishment of vegetative cover in the outlet channel.

The release rate of an underground outlet, when combined with storage, shall be such that the design storm runoff will not overtop the diversion ridge.

The design depth 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.

In all cases, the outlet must convey runoff to a point where outflow will not cause damage.

Vegetative Establishment. Diversions shall be vegetated according to NRCS Conservation Practice Standard Critical Area Planting (342). Species selected shall be suited to the site conditions and intended uses. Selected species will have the capacity to achieve adequate density, height, and vigor within an appropriate time frame to stabilize the diversion.

Establish vegetation as soon as conditions permit. Use mulch anchoring, nurse crop, rock, straw or hay bale dikes, fabric checks, filter fences, or runoff diversion to protect the vegetation until it is established. Planting of a close growing crop, e.g. small grains or millet, on the contributing watershed prior to construction of the diversion can significantly reduce the flow through the diversion during establishment.

Lining. If the soils or climatic conditions preclude the use of vegetation for erosion protection, non-vegetative linings such as concrete, gravel, rock riprap, cellular block, or

other approved manufactured lining systems may be used.

Liners shall be designed in accordance with NRCS Conservation Practice Standard Lined Waterway or Outlet (468).

ADDITIONAL CRITERIA FOR MINOR STRUCTURES

Minor structure diversions (road bars, kickers and gully plugs) are not applicable below high sediment producing areas unless erosion is controlled with land treatment practices or other structural measures. Such structures are limited to those having an individual length less than 200 feet, a maximum height of five feet in the gully section and 2½ feet in the spillway section, and an embankment volume less than 200 cubic yards. The drainage area above an individual structure shall be limited to 15 acres or less. The total area above several structures in series shall be limited to 40 acres or less. Exceeding any of these six limits indicates that the location is not appropriate for installation of a minor structure.

Hydraulic and hydrologic computations are not required for minor structure diversions (road bars, kickers and gully plugs).

ADDITIONAL CRITERIA FOR NET WIRE DIVERSIONS

A low barrier constructed of posts and net wire across shallow depressions shall apply to areas of active erosion as evidenced by head cuts or over falls, small channels or gullies, and/or sheet erosion, or to potential erosion such as at spillway outlets

The following requirements shall be met in the design of a net wire diversion:

- Wire height will not be less than 10 inches or more than 24 inches.
- The diversion shall be constructed on the contour or on a grade of not more than 0.50 foot per 100 feet.
- Posts may be juniper with a minimum top diameter of three inches, treated wood posts with a minimum top diameter of four inches, T, U, or I section steel posts, or iron pipe of not less than 1¼ inches inside diameter.
- Posts shall be set a minimum of 2½ feet in the ground and spaced at ten feet or less.
- Standard woven galvanized wire fencing with a maximum spacing of the vertical stays of seven inches shall be used.
- Standard nine gage, 1¼ inch staples or iron tie wire may be used in wood posts; tie wire shall be used to secure the net wire to all steel posts.
- The wire shall be placed on the upstream side of the posts.

Hydraulic and hydrologic computations are not required for net wire diversions.

CONSIDERATIONS

A diversion in a cultivated field should be aligned and spaced from other structures or practices to permit use of modern farming equipment. The side slope lengths should be sized to fit equipment widths when cropped.

At non-cropland sites, consider planting native vegetation in areas disturbed due to construction.

Maximize wetland functions and values with the diversion design. Minimize adverse effects to existing wetland functions and values. Diversion of upland water to prevent entry into a wetland may convert a wetland by changing the hydrology. Any construction activities should minimize disturbance to wildlife habitat. Opportunities should be explored to restore and improve wildlife habitat, including habitat for threatened, endangered, and other species of concern.

On landforms where archeological sites are likely to occur, use techniques to maximize identification of such sites prior to planning, design, and construction.

For vegetated diversions, avoid areas where unsuitable subsurface, subsoil, substratum material that limits plant growth such as salts, acidity, root restrictions, etc., may be exposed during implementation of the practice. Where these areas cannot be avoided, seek recommendations from a soil scientist for ameliorating the condition or, if not feasible consider stock piling the topsoil, over-cutting the diversion and replace the topsoil over the cut area to facilitate vegetative establishment.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for diversions that describe the requirements for applying the

practice according to this standard. As a minimum the plans and specifications shall include:

- A plan view of the layout of the diversion.
- Typical cross sections of the diversion(s).
- Profile(s) of the diversion(s).
- Disposal requirements for excess soil material.
- Site specific construction specifications that describe the installation of the diversion. Include specification for control of concentrated flow during construction and vegetative establishment.
- Vegetative establishment requirements.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be prepared for use by the client. The plan shall include specific instructions for maintaining diversion capacity, storage, ridge height, and outlets.

The minimum requirements to be addressed in the operation and maintenance plan are:

1. Provide periodic inspections, especially immediately following significant storms.
2. Promptly repair or replace damaged components of the diversion as necessary.
3. Maintain diversion capacity, ridge height, and outlet elevations especially if high sediment yielding areas are in the drainage area above the diversion. Establish necessary clean-out requirements.
4. Each inlet for underground outlets must be kept clean and sediment buildup redistributed so that the inlet is at the lowest point. Inlets damaged by farm machinery must be replaced or repaired immediately.
5. Redistribute sediment as necessary to maintain the capacity of the diversion.
6. Maintain vegetation and trees and control brush by hand, chemical and/or mechanical means. Maintenance of vegetation will be scheduled outside of the primary nesting season for grassland birds.
7. Control pests that will interfere with the timely establishment of vegetation
8. Keep machinery away from steep sloped ridges. Keep equipment operators informed of all potential hazards.

REFERENCES

USDA, ARS. 1987. Stability design of grass-lined open channels. Agriculture Handbook 667.

USDA, NRCS. National Engineering Handbook, Part 650, Engineering Field Handbook, Chap. 9, Diversions