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 as part of a resource management system 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 water-spreading or water-harvesting systems.
- Increase or decrease the drainage area above ponds.
- 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 applies to all land uses where surface runoff water control and/or management are ~~is~~ needed. It also applies where soils and topography are such that the diversion can be constructed and a suitable outlet is available or can be provided.

CRITERIA

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 0.3 ft. (Refer to Figure 12 of SCS-TP-61 for proper hydraulic proportioning with freeboard.)

Diversions installed on reclaimed mined land may be either temporary or permanent. Temporary diversions include those used to divert streams and overland flow during mining and reclamation operations. They are not to

remain after reclamation as part of the post-mining land use. Permanent diversions include those which remain after mining and reclamation operations. Diversions collecting runoff from disturbed lands must outlet into structures suitable for removal of sediment.

Design depth is the channel storm flow depth plus freeboard, where required. The minimum capacity should be that required to confine the peak runoff from the design storm plus required freeboard. Design for capacity should be in accordance with the techniques set forth in the NRCS Engineering Field Handbook (EFH) Part 650, Chapters 7 and 9.

Cross section. The channel may be parabolic, V-shaped, or trapezoidal.

The ridge shall have a minimum top width of 4 feet at the design depth, except that 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 ridge height shall include an adequate settlement factor of at least 10 percent.

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

The diversion shall be designed to have a stable cross section; preventing both erosion and deposition for the entire length of the diversion.

Stability. Channel grades may be uniform or variable. Minimum depth and width requirements for channel stability shall be determined using the procedures in the NRCS Engineering Field Handbook (EFH) Part 650, Chapter 9, or Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-Lined Open Channels (Sept. 1987); or other equivalent methods.

When a retardance class method is used to determine capacity by the equation

$$Q = AV,$$

and the velocity (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, and soil type shall determine the location of the diversion.

Protection against sedimentation. Diversions normally should not be used below high sediment producing areas. When they are, a practice or combination of practices needed to prevent damaging accumulations of sediment in the channel shall be installed. This may include practices such as land treatment erosion control practices, cultural or tillage practices, vegetated filter strip, or structural measures. Install practices 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 level spreader above a vegetated or paved area, a grade stabilization structure, an underground outlet, a stable watercourse, a sediment basin, 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 ensure establishment of vegetative cover in the outlet channel.

When a level spreader is used, the length shall be one foot per CFS based upon the design discharge with a minimum length of 5 feet; however the maximum length need not exceed 30 feet. The entrance channel shall

not exceed 1% grade for a minimum of 20 feet before entering the level spreader. The outlet must convey runoff to a point where outflow will not cause damage.

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. Underground outlets shall meet the requirements of PA620.

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.

Vegetation. Disturbed areas that are not to be cultivated shall be seeded as soon as practicable after construction.

Diversions shall be vegetated according to Critical Area Planting PA342. 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. Sites with erosive soils, high velocities, or local E&S regulations may require the use of erosion control blankets during vegetation establishment. 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 gravel, rock riprap, cellular block, or other approved manufactured lining systems may be used.

Liners shall be designed in accordance with Lined Waterway or Outlet PA468.

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 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.

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.

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

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.
- Requirements for vegetative establishment and E&S control.

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 No. 667.

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

Penn State College of Agricultural Science. 1997. “Erosion Control and Conservation Planting on Noncropland.”