SECTION 5.10

OUTLET PROTECTION

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Small (less than 8 inches in diameter) tile drain outfalls that outlet to a relatively large ditch or stream may be accommodated simply by projecting the tile from the channel slope. This is normally accomplished by use of a metal extension pipe as described in practice 1001: Tile Drain Outlet Extension.

Outlet protection for a pipe or an open drain tributary is required where the flow velocity of an outlet will exceed the permissible velocity of the receiving channel. Protection is usually achieved with a structurally lined apron downstream from the outlet where discharge changes from pipe flow to channel flow or from one open drain to another (Practice 1002). The purpose of the structure is to prevent scour at the discharge point, and to minimize the potential for downstream erosion by reducing the velocity of concentrated storm water flows.

For pipe, the depth of the tailwater immediately below the pipe outlet must be determined to calculate the design capacity of the pipe, as well as the design discharge velocity. Fluctuations in the assumed tailwater depth must be considered. The design of the outlet protection must determine the apron length and width, considering the bottom grade, sideslopes, alignment and materials.

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PRACTICE 1001
TILE DRAIN OUTLET EXTENSION

DESCRIPTION

- A section of rigid pipe, metal preferred, without perforation or open joints that is attached to the end of small size tile drains to provide a stable outfall.

Exhibit 1001a: A Tile Drain Outlet Extension (Source: Tipton County Files)

PURPOSE

- To provide an economical stable outlet for a closed tile drain

WHERE APPLICABLE

- Where small tile drains (less than 8 inches in diameter) outlet into an open ditch.

ADVANTAGES

- Very practical.
- Economical.
- Easy to install.

CONSTRAINTS

- May cause erosion in the receiving ditch, if the receiving drain is not wide and deep enough.
- May require additional structures if surface water also enters the ditch at the same location. (see "Special Considerations".)
- May require bank excavation if cover is not adequate.
- Not suitable where velocity of water exiting tile drain is too high.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Corrugated steel or aluminum pipe in adequate length.
- Swinging gate or some type of grating or coarse screen to exclude rodents or other small animals.

Installation

- Excavate a trench with sufficient width at least equal to the outside diameter of drain, up to 0.5 foot wider than the drain.
- Round the bottom of the trench so that the drain will be embedded in undisturbed soil at least 60 degrees of its circumference.
- The pipe should be sufficiently long to insure that there will be no

seepage around the drain which may cause erosion at the outlet.

- At least two-thirds of the pipe should be embedded in the bank to provide the required cantilever support (Exhibit 1001b).
- When sufficient depth of drain is not obtainable at the drain outlet, several methods may be used to protect the drain (Exhibit 1001c).

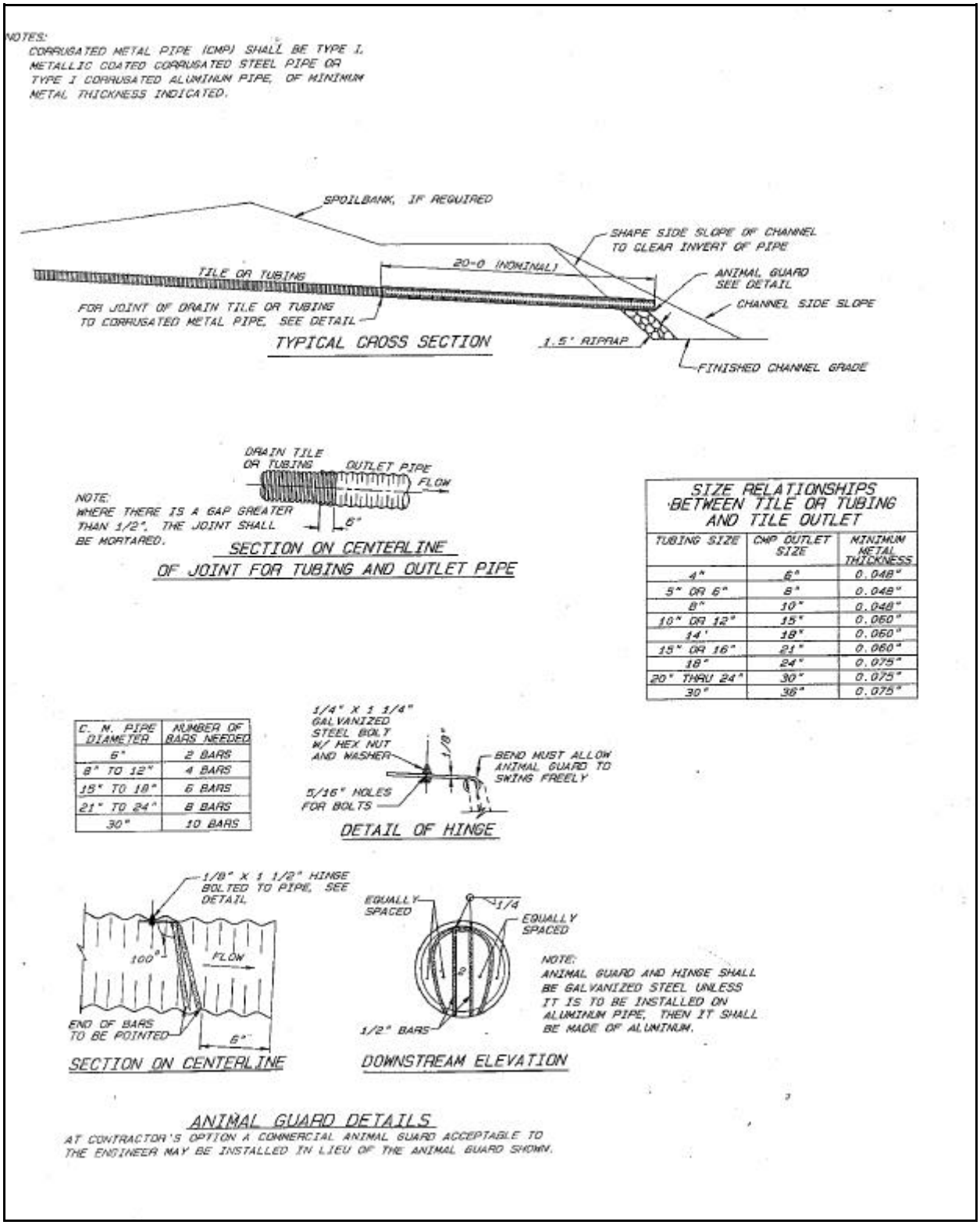

Exhibit 1001b: Typical Specifications for Pipe Outlet Extension (Source: NRCS Files)

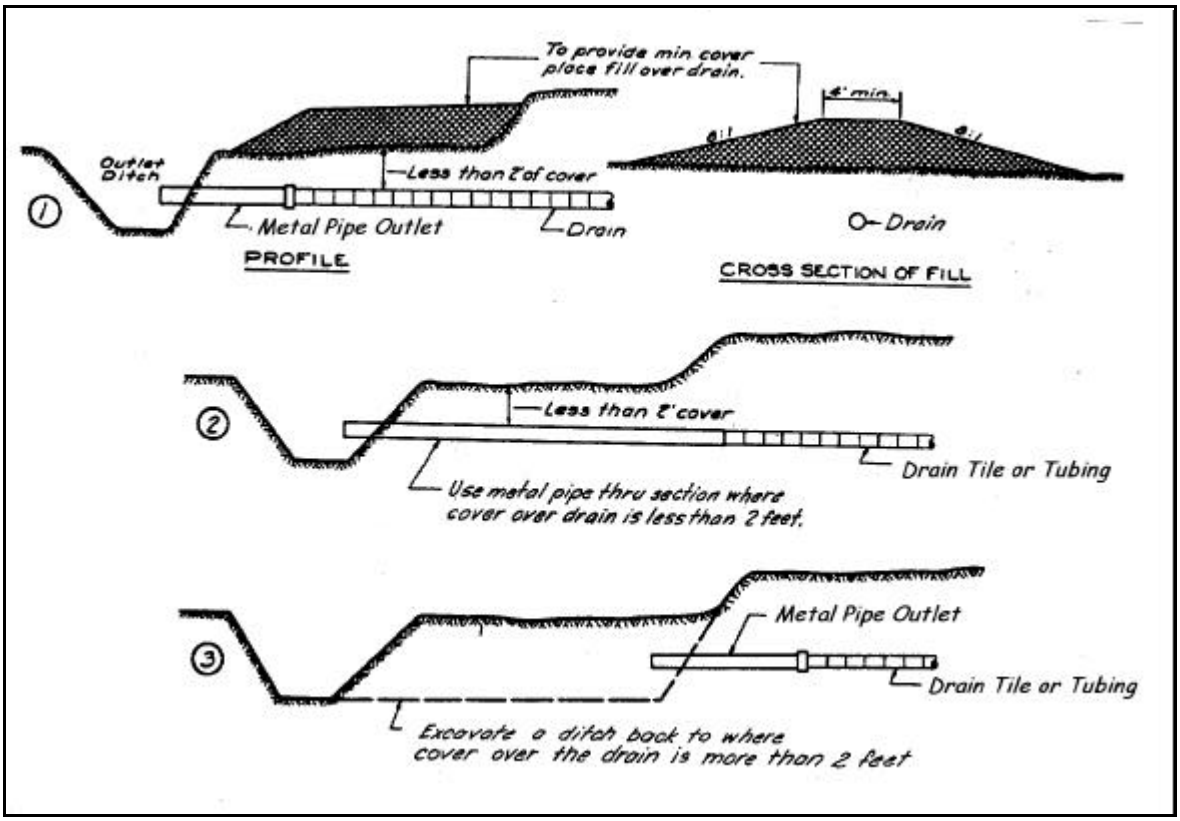

Exhibit 1001c: Methods for handling shallow depths at drain outlet (Source: NRCS Engineering Field Handbook)

Special Considerations

- If surface water enters the outlet at the same location as the drain, some type of structure is needed to discharge the surface water into the ditch without erosion and to provide protection for the outlet of the drain (Exhibit 1001d).

- A Tile Drain Outlet into a recessed area off the ditch minimizes the turbulence and provides protection from bank erosion, floating ice, and debris.

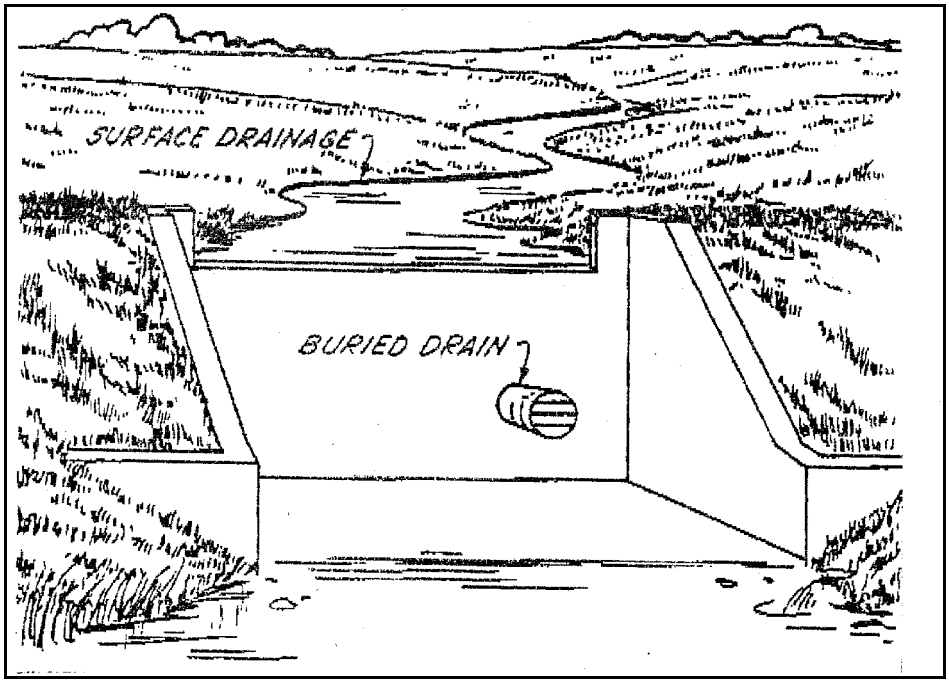

Exhibit 1001d: Drain outlet protection when surface water is present (Source: NRCS National Engineering Handbook)

MAINTENANCE

- Inspect the outlet often and repair or replace the pipe, as necessary.
- Inspect the swinging gate or screens for proper operation.

REFERENCES

Related Practices

- Practice 201 Tile Drain Installation.
- Practice 202 Tile Drain Repair/Replacement.
- Practice 705 Grade Transitions (Chutes).
- Practice 1002 Riprap-Lined Apron

Other Sources of Information

- NRCS Engineering Field Handbook.
- NRCS National Engineering Handbook.
- NRCS Files.

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PRACTICE 1002
RIPRAP-LINED APRON

DESCRIPTION

- Riprap apron placed at outlet end of culverts, conduits, or channels. (Note: this practice is also included as "Rock Chute" in the Indiana Erosion Control Handbook.)

Exhibit 1002a: Riprap-Lined Apron (Source: North Carolina Erosion Control Manual)

PURPOSE

- To reduce runoff velocity and prevent erosion at the outlet of a channel or culvert.

WHERE APPLICABLE

- Culvert outlets.
- Pipe conduits from all sediment basins, and dry as well as wet basin detention stormwater ponds.
- New channels constructed as outlets for culverts and conduits.
- Where outflows from conduits or channels do not exceed 10 feet per second.

ADVANTAGES

- Prevent scour erosion at stormwater outlets.
- Protects outlet structure.
- Minimizes the potential for downstream erosion by reducing the velocity or energy of concentrated stormwater flows.
- Reduces the effects of turbidity and sedimentation downstream.

CONSTRAINTS

- May require heavy machinery to install riprap.
- Not recommended for pipe outlets at the top of cuts, or on slopes steeper than 10%.
- Contributing drainage area should be $\leq$ 100 acres.
- Peak runoff from a 10-year frequency, 24 hour storm event should be accommodated.
- Length and width of apron are calculated based on pipe diameter, design flow rate, and the absence or presence of downstream tailwater.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Riprap.
- Geotextile fabric.

Installation

- Excavate the apron area subgrade below design elevation to allow for the thickness of filter and riprap.
- Compact fill used in the subgrade to the density of the surrounding undisturbed material, and smooth enough to protect fabric from tearing.
- Place geotextile fabric on the foundation. If more than one piece of fabric is needed, then upstream piece should overlap the downstream piece by at least one foot.
- Install riprap to the lines and elevations shown in the design.
- Make sure the top of the apron is level with or slightly below the receiving stream.
- A portion of the apron below the outlet may be shaped into a bowl or a plunge pool to act as a stilling basin.
- Blend the riprap smoothly to the surrounding grade.
- Stabilize all disturbed areas immediately following installation.

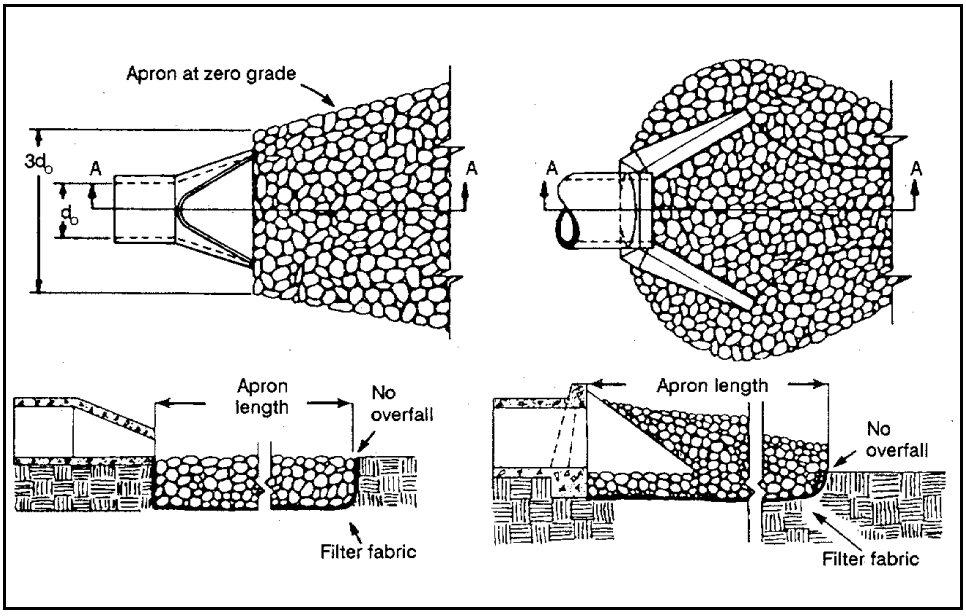

Exhibit 1002b: Pipe outlet aprons for a channel (left) that is not well defined and (right) that is well defined. (Source: Indiana Erosion Control Handbook)

Special Considerations

- Choice of materials should be based on the type of soil to be protected, season, and economics.
- Organic mulch materials such as straw, wood chips, bark, and wood fiber have been found to be the most effective.
- Chemical soil stabilizers and binders work best when used in conjunction with organic mulches.

MAINTENANCE

- Inspect and reapply mulch as necessary after storm events.

- Continue inspections until vegetation becomes established.

REFERENCES

Related Practices

- Practice 105 Silt Fencing.
- Practice 106 Straw Bale Filter.
- Practice 1102 Vegetative Stabilization.

Other Sources of Information

- Indiana Erosion Control Handbook.
- Illinois Urban Manual.
- North Carolina Erosion Control Manual.

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