

CHAPTER 20: CULVERT & DITCH STANDARDS

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20.00 INTRODUCTION AND GOALS

The purpose of this chapter is to provide information on the design and construction of culverts and ditches. This chapter does not address the design of large culverts (greater than 10 ft. diameter) or bridges. Culverts larger than 10 ft. diameter and bridges shall be designed to IDOT standards by a structural engineer registered in the State of Illinois.

Culverts and ditches may be used to route stormwater runoff on a limited number of streets without storm sewers when approved in advance by the City Engineer. Culvert / ditch systems shall not be used for storm flow management in subdivision or other residential developments.

Swales (a shallow, wide, grassed ditch) are typically used for emergency overflow routes when a storm's runoff exceeds the storm sewer capacity. Streets may also serve to a limited extent as part of a designed emergency runoff route. Swales may also be used for stormwater routing in subdivisions between houses and in backyards.

20.01 ADMINISTRATION

- A. This chapter applies to culverts and ditches within the City limits and the 1-1/2 mile extra territorial jurisdiction.
- B. Culvert or ditch design shall be reviewed by the City of Champaign through one of the following:
 - 1. subdivision plan review
 - 2. grading and drainage plan review
 - 3. alternate construction plan review (typically public improvements).

20.02 STANDARDS

The following standards apply to culvert and ditches:

- A. **Referenced Standards:** Design standards for culvert and ditch design shall comply with the provisions of the following, unless otherwise stated by this manual:
 - 1. IDOT Drainage Manual, latest edition.
 - 2. City of Champaign Stormwater Management Regulation, latest edition.
- B. **Design:**
 - 1. General:
 - a. Use Chapter 19 of this Manual - Hydrologic Design, to determine design storm and hydrologic method of determining peak flows. Culvert sizing shall follow the methodology in IDOT Drainage Manual.
 - b. Ditches and swales shall be in the right-of-way or an easement. See Chapter 15 - General Utility Requirements, for location information.
 - 2. Culverts:
 - a. Minimum culvert sizes shall be 15 in. diameter for entrance culverts and 18 in. diameter for cross-road culverts (or equivalent non-circular sections).

- b. Reinforced concrete culvert end sections or headwalls are required.
 - c. End section grates or other structures that control debris and restrict entry to the pipe shall be used for all culverts.
 - d. A minimum 15 ft. wide maintenance access path shall be provided to debris grates. The maintenance access path shall be accessible during a design storm event.
 - e. Culvert entrance and exit velocities shall be evaluated for erosion protection needs per the IDOT Drainage Manual. Erosion protection, if indicated, shall consist of grouted riprap or other form of anchored system that resists displacement by vandals.
 - f. Culvert cover shall be sufficient to provide a minimum of 1 ft. between the top of the culvert pipe and the bottom of the road pavement section. Stabilized subgrade is considered to be part of the pavement section in this case.
2. Ditches / Swales:
- a. Ditch / swale sizing shall follow the methodology in the IDOT Drainage Manual.
 - b. Minimum ditch / swale running slopes shall be 1%. Slopes may be reduced to as low as 0.5% if underdrains are installed. Maximum ditch / swale slopes shall not exceed requirements for grassed ditches for the soil type present per IDOT Drainage Manual.
 - c. Ditch / swale cross-sections shall be trapezoidal with a minimum bottom width of 2 ft.
 - d. In ditches, a minimum of 1 ft. freeboard shall be maintained between the design storm hydraulic grade line and the top of ditch bank (30-year culverts, ditches and swales; 100-year emergency overflow.)
 - e. Ditch / swale side slopes shall be mowable. Minimum side slope shall be 10H:1V and maximum side slope shall be 4H:1V unless otherwise approved in writing by the City Engineer. This side slope maximum shall also apply to the slope from the road surface to the culvert end section or headwall.
 - f. Ditch / swale alignment shall minimize bank erosion by avoiding abrupt changes in direction (greater than 45 degrees). Tributaries shall be aligned to join the main ditch at an angle or 45 degrees or smaller.
 - g. Maintenance access, minimum 15 ft. wide, shall be provided along all ditches and swales on at least one side.

C. Construction:

- 1. Culverts:
 - a. Installation and backfill shall be in accordance with IDOT Section 542, Pipe Culverts.

- b. Under and within 2 ft. of pavement, flowable fill backfill shall be used, after initial backfill to the pipe springline (rigid pipe) or 1 ft. above the top of the pipe (flexible pipe).

2. Ditches / Swales:

- a. Erosion control shall be required per Chapter 22 of this Manual.
- b. Ditch / swale construction shall be in accordance with IDOT Section 202, Earth and Rock Excavation, and Chapter 21 of this Manual - Earthwork.

D. Materials:

1. Culverts:

- a. Culverts shall be IDOT Class C, except that the following material types shall not be allowed: Precoated Galvanized Corrugated Steel Culvert Pipe or Precoated Galvanized Corrugated Steel Pipe Arch.
- b. End sections or headwalls shall be reinforced concrete.

2. Ditches / Swales:

- a. Ditches / swales shall be grassed or otherwise lined.
- b. Ditches / swales shall be provided with a minimum topsoil thickness of 6 in.

E. Testing and Inspection:

Deflection testing for flexible culverts may be required at the option of the Engineer in accordance with IDOT Section 542.