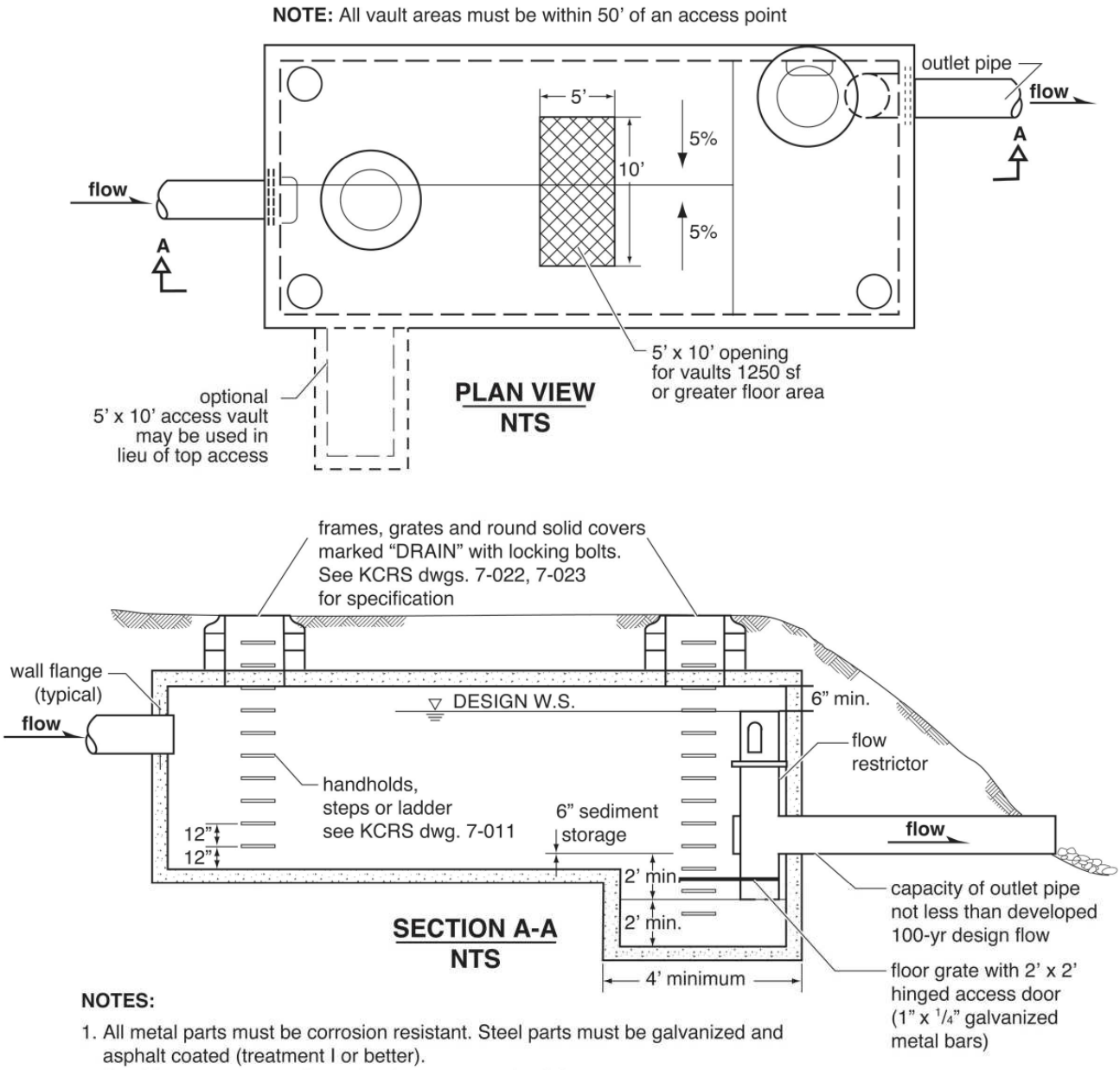
FIGURE 5.3.3.A TYPICAL DETENTION VAULT



NOTES:

1. All metal parts must be corrosion resistant. Steel parts must be galvanized and asphalt coated (treatment I or better).
2. Provide water stop at all cast-in-place construction joints. Precast vaults shall have approved rubber gasket system.
3. Vaults ≤10' wide must use removable lids.
4. Prefabricated vault sections may require structural modifications to support 5' x 10' opening over main vault. Alternatively, access can be provided via a side vestibule as shown.

5.3.4 CONTROL STRUCTURES

Control structures are catch basins or manholes with a restrictor device for controlling outflow from a facility to meet the desired performance. The restrictor device is typically a tee section with an orifice plate welded to the bottom (called a "FROP-T"). To meet performance requirements, one or more elbow sections with orifice plates may need to be mounted on the side of the tee section. The restrictor device may also be a weir section sized to meet performance requirements.

Standard control structure details are shown in Figure 5.3.4.A (p. 5-39) through Figure 5.3.4.C (p. 5-41).

5.3.4.1 DESIGN CRITERIA

Multiple Orifice Restrictor

In most cases, control structures need only two orifices: one at the bottom and one near the top of the riser, although additional orifices may best utilize detention storage volume. Several orifices may be located at the same elevation if necessary to meet performance requirements.

1. **Minimum orifice diameter is 0.25 inches**. *Note: In some instances, a 0.25-inch bottom orifice may be too large to meet target release rates, even with minimal head. In these cases, the live storage depth need not be reduced to less than 3 feet to meet performance.*
2. Orifices shall be constructed on a **tee section** as shown in Figure 5.3.4.A (p. 5-39) or on a baffle as shown in Figure 5.3.4.B (p. 5-40).
3. In some cases, performance requirements may require the **top orifice/elbow** to be located too high on the riser to be physically constructed (e.g., a 13-inch diameter orifice positioned 0.5 feet from the top of the riser). In these cases, a notch weir in the riser pipe may be used to meet performance requirements (see Figure 5.3.4.E, p. 5-43).
4. Consideration shall be given to the backwater effect of water surface elevations in the downstream conveyance system. **High tailwater elevations** may affect performance of the restrictor system and reduce live storage volumes. *Note: The KCRTS program, version 4.0 and later, supports the design of a partially tailwatered control structure by using a headwater/tailwater (HW/TW) data file generated using the KCBW program. The user can specify the use of a HW/TW file within the "Point of Compliance Setup," located within the "Edit Facility" menu screen.*

Riser and Weir Restrictor

1. Properly designed **weirs may be used as flow restrictors** (see Figure 5.3.4.C and Figure 5.3.4.E through Figure 5.3.4.F). However, they must be designed to provide for primary overflow of the developed 100-year peak flow discharging to the detention facility.
2. The combined orifice and riser (or weir) overflow may be used to meet performance requirements; however, the design must still provide for primary overflow of the developed 100-year peak flow assuming all orifices are plugged. Figure 5.3.4.H (p. 5-47) may be used to calculate the head in feet above a riser of given diameter and flow.

Access Requirements

1. An **access road** to the control structure is required for inspection and maintenance, and shall be designed and constructed **as specified for detention ponds** in Section 5.3.1 (p. 5-20).
2. **Manhole and catch basin lids** for control structures shall be **locking**, and rim elevations shall match proposed finish grade.