

**PC-29 SLOPE DRAINS/CHUTES/FLUMES**

Refer to: ITD Standard Specifications, Sections 208, 212, 409, 606, 607, and 609.  
ITD Standard Drawings D-1-A, D-1-B, and P-2-D.

**BMP Objectives**

- |                                     |                       |
|-------------------------------------|-----------------------|
| <input type="checkbox"/>            | Perimeter Control     |
| <input checked="" type="checkbox"/> | Slope Protection      |
| <input type="checkbox"/>            | Borrow and Stockpiles |
| <input checked="" type="checkbox"/> | Drainage Areas        |
| <input checked="" type="checkbox"/> | Sediment Trapping     |
| <input type="checkbox"/>            | Stream Protection     |
| <input type="checkbox"/>            | Temporary Stabilizing |
| <input checked="" type="checkbox"/> | Permanent Stabilizing |

**Definition and Purpose**

A slope drain is a device used to carry concentrated runoff from the top to the toe of a slope that has already been damaged by erosion or is at high risk for erosion. The slope drain may be used to convey runoff from offsite around a disturbed portion of the site or may be used to drain around or over saturated slopes that have the potential for slides.

- Pipe slope drains are made of flexible tubing or rigid pipe and may have prefabricated inlet and outlet sections. The drain discharges into a stabilized watercourse, sediment trap, or stabilized area. Pipe slope drains can be either temporary or permanent, depending on the method of installation and the material used.
- Chutes and flumes are channels that are designed to conduct runoff down a slope face and discharge the water to a stable outlet area without causing erosion. Chutes and flumes may be constructed of rock, concrete or asphalt liners, or half-round pipe. Chutes and flumes can convey runoff from diversion dikes, infiltration trenches, slope steps, benches, or other runoff control facilities. Chutes and flumes discharge into a stabilized watercourse, sediment trap, or stabilized area.

**Appropriate Applications**

- Pipe slope drains are used whenever it is necessary to convey water down a slope without causing erosion. Pipe slope drains may be used with other devices, including diversion dikes or swales, sediment traps, and level spreaders. Permanent slope drains may be placed on or beneath the ground surface.
- Pipe slope drains are appropriate in the following general locations:
  - On cut or fill slopes where permanent stormwater drainage structures are to be installed.

- Where earth dikes or other diversion measures have been used to concentrate flows.
- On any slope where concentrated runoff crossing the face of the slope may cause gullies, channel erosion, or saturation of slide-prone soils.
- As an outlet for a natural drainage way.
- Chutes and flumes may be used on slopes 2H:1V or flatter to convey water down the face of erodible slopes, usually from runoff collection devices at the top to stable discharge areas at the bottom. Chutes and flumes are permanent structures that are effective in many situations where concentrated runoff would otherwise cause slope erosion.

### **Limitations**

- Pipe slope drains are not suitable for drainage areas greater than 10 acres.
- Chutes and flumes must be 2H:1V or flatter.

### **Design Parameters**

- All designs should handle the peak runoff for the 50-year storm event. Detailed design, that includes a hydraulic analysis by a licensed professional engineer, is required.
- Dikes or other diversion devices should be graded to direct water to the invert at the inlet structure.
  - Slope drains drainage area may be up to 10 acres for each slope drain. Accessories to the slope drain (inlets, outlets, and collars, etc.) shall be specified in accordance with the manufacturer's recommendations.
  - Chutes and flumes must be placed on undisturbed soil or well-compacted fill. Energy dissipaters within the chute or flume or at the outlet end should be provided to protect against scour when necessary. Riprap at the outlet may be needed as appropriate. Slopes should be no steeper than 2H:1V or flatter.

### **Construction Guidelines**

#### **Pipe Slope Drains**

Install slope drains with inlets at points where water is discharged from ditches, berms, or other points of concentrated flow. Anchor all pipe slope drains to the slope to prevent disruption by water or other forces. Install the inlet section of the drain to properly funnel the flow into the drain. Cross berms may be necessary to direct the flow into the inlet.

- Place pipe slope drains that are located on the surface on firm well-compacted soil.
- Compact soil around and under the inlet section to prevent piping failure or undercutting around the inlet.
- Position erosion control geotextile under the inlet, extend it 3 to 6.5 feet in front of the inlet, and key it in 6 inches on all sides to prevent erosion. Secure the pipe slope drain to the slope at intervals of 10 feet or less. The method of accomplishing this should be as specified or as approved by the Professional Engineer. Securely fasten all slope drain sections together with watertight fittings.

- Extend the pipe beyond the toe of the slope if possible. Discharge water into a stabilized area or to a sedimentation trap or basin. Use riprap outlet protection or energy dissipaters if necessary. Another option is to “tee” the pipe slightly up from the toe to disperse and dissipate the flow.
- Situate the finished grade at the inlet a minimum of 6 inches above the top of the slope drain.
- Protect the outlet structure against scour with energy dissipaters and/or riprap.
- Stabilize all areas disturbed by the installation of the slope drain.

### **Chutes and Flumes**

- Locate the chute or flume on soil compacted in accordance with the Standard Specifications with the discharge going only to a stabilized area or stable drainage system.
- Coordinate installation of the chutes and flumes with construction of the slope and completion of upslope runoff collection devices. Locate control measures so that exposed slopes are not damaged by concentrated flows from gullies or drainage outlets above the slope.
- Compact suitable aggregate around the inlet to ensure that good contact is attained at the interface of the structure and diversion dikes to prevent failure. Refer to the Standard Specifications for further information on inlet structures.
- Protect the outlet structure against scour with energy dissipaters and/or riprap.

### **Maintenance and Inspection**

#### **Pipe Slope Drains**

- Conduct inspections as required by the NPDES permit or contract specifications during construction.
- Periodic inspection and maintenance will be required based on post-construction site conditions.
- Make any repairs necessary to ensure the measure is operating properly.
- If a sediment trap has been provided, clean when the sediment level reaches one-half the design volume.

#### **Chutes and Flumes**

- Conduct inspections as required by the NPDES permit or contract specifications during construction.
- Periodic inspection and maintenance will be required based on post-construction site conditions.
- Make any repairs necessary to ensure the measure is operating properly.
- Repair all damage promptly, as needed.