Temporary Diversion Channel (TDC) SM-8

Description

A temporary diversion channel diverts water from a stream to allow for construction activities to take place underneath or in the stream. Diversion channels are often required during the construction of detention ponds, dams, in-stream grade control structures, utility installation and other activities that require working in waterways.

Photograph TDC-1. Use of a temporary diversion channel (right side) to enable installation of a grade control structure (left side). Photo courtesy of WWE.

Appropriate Uses

Temporary diversion channels vary with the size of the waterway that is being diverted. For large streams, a temporary diversion may consist of berms or coffer dams constructed in the stream to confine flow to one side of the stream while work progresses on the dry side of the berm. For smaller streams and often for construction of dams and detention basins, a temporary diversion channel may divert the entire waterway, as illustrated in Figure TDC-1. For very short duration projects (typically less than 4 weeks) during dry periods with low base flows, a pump and bypass pipe may serve as a temporary diversion. Whenever a temporary diversion is used, construction should be scheduled during drier times of the year if possible (October 1 through April 1), and construction in the waterway should progress as quickly as possible to reduce the risk of exceeding the temporary diversion channel capacity.

Some construction activities within a waterway are very short lived, namely a few hours or days in duration, and are minor in nature. These are typically associated with maintenance of utilities and stream crossings and minor repairs to outfalls and eroded banks. In these cases, construction of temporary diversion channels can often cause more soil disturbance and sediment movement than the maintenance activity itself. If it can be reasonably determined based on area and duration of disturbance that channel work will result in less disturbance and movement of sediment than would be done through installation of a temporary diversion channel, it is reasonable to exempt these activities from the requirement to construct a temporary diversion.

Design and Installation

Temporary Diversion Channel sizing procedures typically include the following steps:

- Using the tributary area, A (in acres), determine the design peak flow rate according to Figure TDC-2. Note: For long duration projects, or where the consequences of diversion failure warrant, a larger design flow may be necessary.
- Determine depth of flow, 1-foot maximum for flows less than 20 cfs and 3 feet maximum for flows less than 100 cfs. (Flows in excess of 100 cfs should be designed in accordance with the *Major Drainage* chapter in Volume 1).

Temporary Diversion Channel	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	No

- Determine channel slope based on existing and proposed site conditions.
- Perform initial channel sizing calculations using Manning's Equation. Determine maximum permissible velocities based on lining material.
- Determine the channel geometry and check the capacity using Manning's Equation and the "n" value given in Table TDC-1. The steepest side slope allowable for a temporary channel is two horizontal to one vertical (2:1), unless vertical walls are installed using sheet piling, concrete or stacked stone. Temporary diversion channels should have a minimum freeboard of 0.5 feet above the design water surface elevation.

Figure TDC-2 may be used to estimate the design discharge for the sizing of temporary diversion channels and pipes. The curves in this figure were developed using annual peak flow data collected from 17 watersheds within the UDFCD boundary. These data were collected over extended periods of time (up to eleven years) and, as a result, provide a sound statistical basis for the figure. The data supporting Figure TDC-2 were taken during the high flood potential period of April through September. The values from Figure TDC-2 represent approximately the 95^{th} percentile event that can occur, on the average, any given year, which means that it is likely that about 95 percent of runoff peaks during an average year will be less than values from this chart. This may not be the case in wetter-than-average seasons. Figure TDC-2 provides estimated 2-year peak flow rates based on watershed imperviousness for small waterways (< 12 square miles). Because Figure TDC-2 was developed using data from small watersheds, it is not appropriate to extrapolate from this figure for larger, more complex watersheds. For larger waterways (e.g., South Platte River, Sand Creek, Bear Creek, etc.), including ones controlled by flood control reservoirs (e.g. Chatfield Dam, Cherry Creek Dam, etc.), site specific risk assessment may be necessary to evaluate the appropriate level of protection to be provided by the temporary diversion. It is also important to recognize that larger floods can and do occur. It is the responsibility of the designer and the contractor to assess their risk of having the temporary diversion being exceeded and to evaluate the damages such an event may cause to the project, adjacent properties and others. Consider larger capacity diversions to protect a project if it will require a temporary diversion for more than one year.

Because temporary diversion channels typically are not in service long enough to establish adequate vegetative lining, they must be designed to be stable for the design flow with the channel shear stress less than the critical tractive shear stress for the channel lining material. This stability criterion applies not only to diversion channels, but also to the stream-side of berms when berms are used to isolate a work area within a stream. Unlined channels should not be used. Table TDC-1 gives Manning's "n" values for lining materials. Design procedures for temporary channels are described in detail in the Hydraulic Engineering Circular No. 15 published by the Federal Highway Administration. The methods presented in this Fact Sheet are greatly simplified and are based on information developed using the most commonly used erosion control materials.

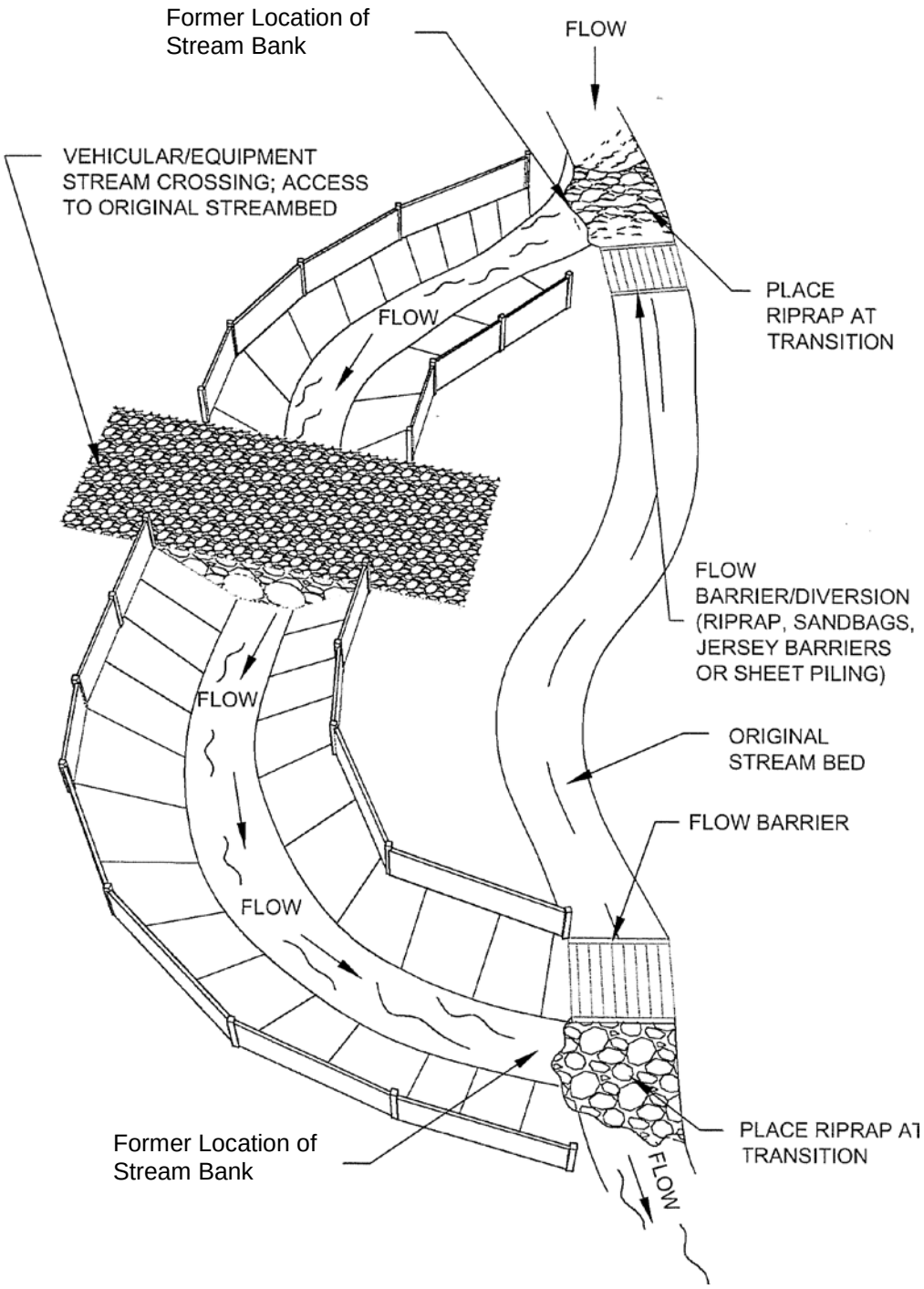


Figure TDC-1. Typical Temporary Diversion Channel

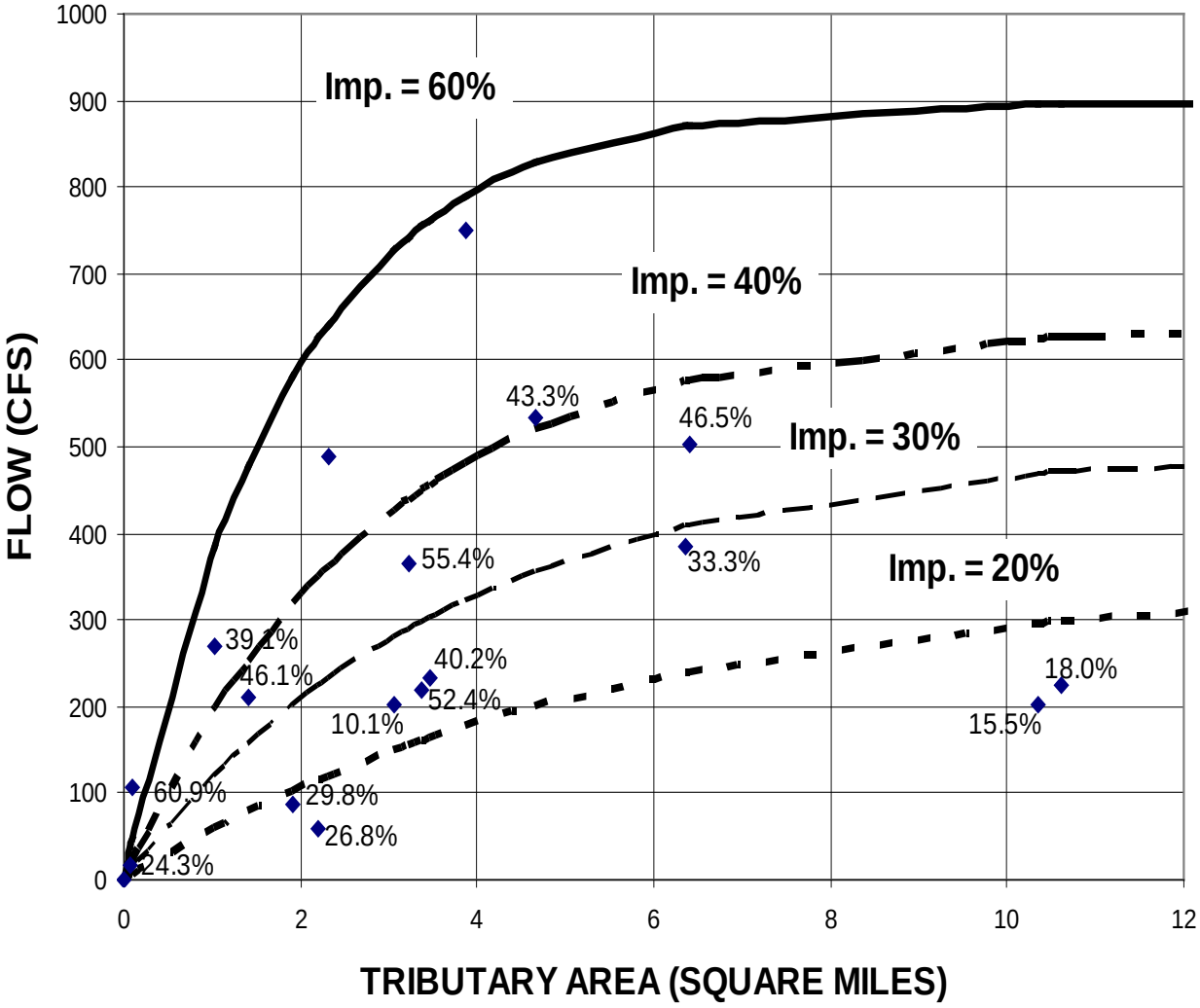


Figure TDC-2. Temporary Diversion Facility Sizing Nomograph Based on 2-year Peak Flows - Denver Metropolitan and Adjacent Areas

Table TDC-1. Temporary Diversion Channel Design Criteria

Lining Material	Manning's n for Flow Depth 0 ft to 1.0 ft	Manning's n for Flow Depth 1.0 ft to 3.0 ft	Manning's n for Flow Depth 3.0 ft to 5.0 ft
Plastic Membrane	0.011	0.010	0.009
Straw or Curled Wood Mats	0.035	0.025	0.020
Riprap, Type VL	0.070	0.045	0.035
Riprap, Type L	0.100	0.070	0.040
Riprap, Type M	0.125	0.075	0.045

Notes: Use manufacturer's Manning's n when available.

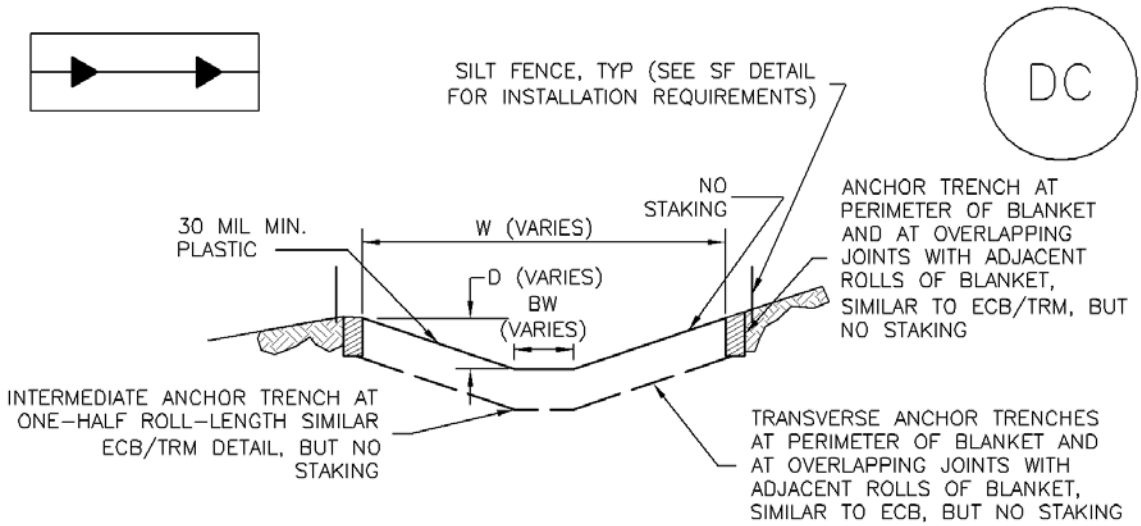
See the *Major Drainage* chapter of Volume 1 for riprap gradation.

Erosion protection should extend a minimum of 0.5 feet above the design water depth.

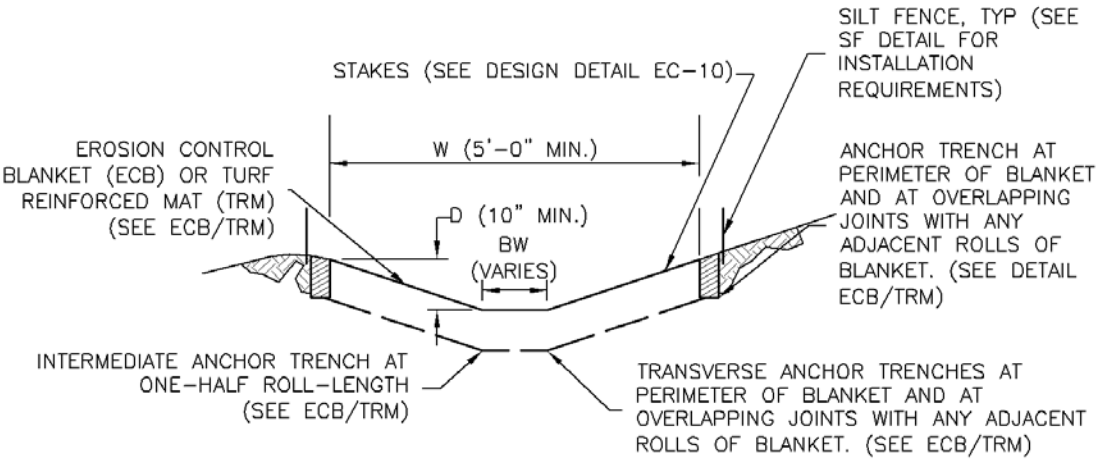
Maintenance and Removal

Because temporary diversion channels are one of the most critical BMPs for work in waterways, they must be inspected and maintained frequently to remain in effective operating condition. Flow barriers should be inspected at the start and end of each workday and at any time that excess water is noted in dry work areas. The diversion channel itself should be inspected for signs of erosion, and the lining should be repaired or replaced if there are signs of failure. Check armoring at the diversion return point to the waterway, and add additional armoring if erosion is noted.

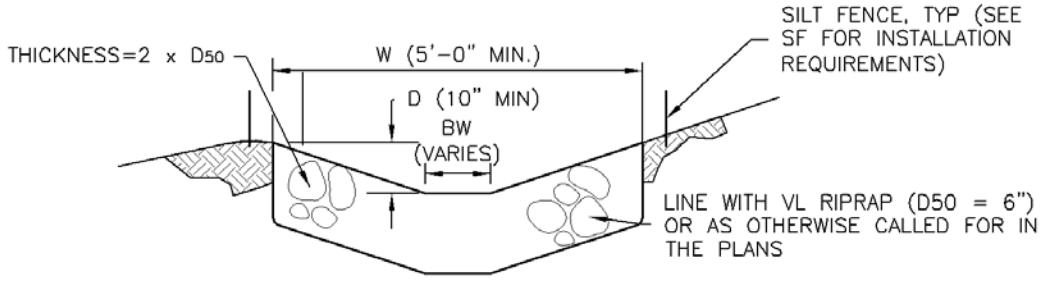
Water should not be allowed to flow back through the natural stream until all construction is completed. After redirecting the flow through the natural channel, lining materials should be removed from the temporary diversion channel. The diversion channel should then be backfilled and stabilized. Points of tie-in to the natural channel should be protected with riprap sized in accordance with the *Major Drainage* chapter in Volume 1.



DC–1. PLASTIC LINED DIVERSION CHANNEL



DC–2. GEOTEXTILE OR MAT LINED DIVERSION CHANNEL



DC–3. RIPRAP LINED DIVERSION CHANNEL

CHANNEL DIVERSION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATION OF DIVERSION CHANNEL
   - –TYPE OF CHANNEL (UNLINED, GEOTEXTILE OR MAT LINED, PLASTIC LINE, OR RIPRAP LINED).
   - –LENGTH OF EACH TYPE OF CHANNEL.
   - –DEPTH, D, WIDTH, W, AND BOTTOM WIDTH, BW.
   - –FOR RIPRAP LINED CHANNEL, SIZE OF RIPRAP, D50, SHALL BE SHOWN ON PLANS.

2. SEE DRAINAGE PLANS FOR DETAILS OF PERMANENT CONVEYANCE FACILITIES.

3. DIVERSION CHANNELS INDICATED ON THE SWMP PLAN SHALL BE INSTALLED PRIOR TO WORK IN DOWNGRADIENT AREAS OR NATURAL CHANNELS.

4. FOR GEOTEXTILE OR MAT LINED CHANNELS, INSTALLATION OF GEOTEXTILE OR MAT SHALL CONFORM TO THE REQUIREMENTS OF DETAIL ECB, FOR PLASTIC LINED CHANNELS, INSTALLATION OF ANCHOR TRENCHES SHALL CONFORM TO THE REQUIREMENTS OF DETAIL ECB.

5. WHERE CONSTRUCTION TRAFFIC MUST CROSS A DIVERSION CHANNEL, THE PERMITTEE SHALL INSTALL A TEMPORARY STREAM CROSSING CONFORMING TO THE REQUIREMENTS OF DETAIL TSC.

DIVERSION CHANNEL MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. DIVERSION CHANNELS ARE TO REMAIN IN PLACE UNTIL WORK IN THE DOWNGRADIENT AREA OR NATURAL CHANNEL IS NO LONGER REQUIRED. IF APPROVED BY LOCAL JURISDICTION DIVERSION CHANNEL MAY BE LEFT IN PLACE.

5. IF DIVERSION CHANNELS ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.