4.5-d CLEAN WATER DIVERSION

Alternative Names: Clean Water Separator

BMP DESIGN APPROACH
■ Pollutant Source Control
■ Hydrologic Source Control
□ Stormwater Treatment
SCALE OF APPLICATION
■ All SFR and MFR < 1 acre
■ MFR 1-5 Acre and CICU < 5 acres
■ MFR and CICU > 5 acres and all WQIPs
TYPE OF APPLICATION
■ Temporary
□ Permanent

DESCRIPTION

Clean water diversions are used to minimize water quality degradation by keeping clean water away from active construction sites. These diversions temporarily intercept and reroute water to 1) isolate surface waters from a construction area that is in or adjacent to water, or 2) divert upslope runoff around an active construction site or one that is newly constructed, unstable, unprotected, or recently seeded, and discharge downstream or down gradient to a protected outlet. They will divert surface waters until the construction is completed, permanent BMPs are installed, and/or slopes are stabilized with vegetation and mulch.

Clean water diversion isolating a section of stream for project work.

APPLICABILITY

- Temporarily isolate and dewater project areas located in streams, lakes, or other water environments.
- Temporarily intercept and divert upslope runoff around construction areas and discharge to stable point downslope.
- Suitable for conveying runoff down steep slopes, particularly cut-and-fill slopes.
- Useful for diverting, removing, and treating sediment-laden water encountered during construction.

Advantages

- Prevents or minimizes contamination of clean surface waters due to construction activities.
- Maintains a dry construction area.

- Allows for active construction in a live stream or water body when done as part of a permitted project in conjunction with other best management practices.

Disadvantages

- Concentrates surface upland runoff by converting overland or sheet flow to channel flow, thereby increasing water velocity and erosive forces downstream.
- Impacts waterways during installation and removal of structures.
- Severe erosion could occur if clean water diverters fail by clogging, overtopping, or pipe separation.

DESIGN CONSIDERATIONS

For construction sites:

- Plan in advance for stable discharge of runoff collected in diversions. Discharge points must have outlet protection or energy dissipaters.
- Reduce diversion gradient to reduce water velocity.
- Size clean water diverters adequately for the catchment drainage size.
- Ensure that all diversion pipe connections are completely sealed and conduits are staked securely to the slope. Pipes are preferred to flumes for spill control.
- Ensure that any substance used to assemble or maintain diversion structures (e.g. form oil) or used to minimize seepage beneath these structures (e.g. grout) are non-toxic, non-hazardous, and neutral pH to minimize contamination of clean water.

For streams:

- Schedule construction for periods of low flows, or when the stream is dry. Consider seasonal releases of water from dams, fish migration and spawning seasons, and water demands due to vegetation irrigation.
- Always allow sufficient flow to pass to maintain aquatic life downstream. Never completely dam stream flow during isolation of a stream reach for construction.
- Never harm or remove riparian vegetation, unless approved by the permitting authority.
- Consider potential impacts to the stream channel or water body before installing diverters. Select less intrusive methods.
- Do not park equipment below the high water mark of a water body, unless approved by the permitting authority.
- Stabilize embankment slopes and diversion ditches with liners such as geotextiles, erosion control blanket systems, rock slope protection, or other slope stabilization materials in areas where erosion is anticipated.
- Avoid disturbing aquatic species during installation, dewatering, maintenance, or removal of clean water diverters. Maintain adequate flow downstream to support aquatic life.

- Key-in or stabilize diversion inlet sections to prevent movement. Consider installing a screen or grate on the inlet structure to reduce plugging by trash and debris.
- To prevent downstream erosion, provide velocity and energy dissipation at transitions in the diversion, particularly where the stream is diverted to the natural channel and where the diverted stream is returned to the natural channel. Refer to Section 4.3-d for more details regarding Outlet Protection. If the runoff is sediment laden, install a sediment trap below the outlet protection.

INSTALLATION CONSIDERATIONS

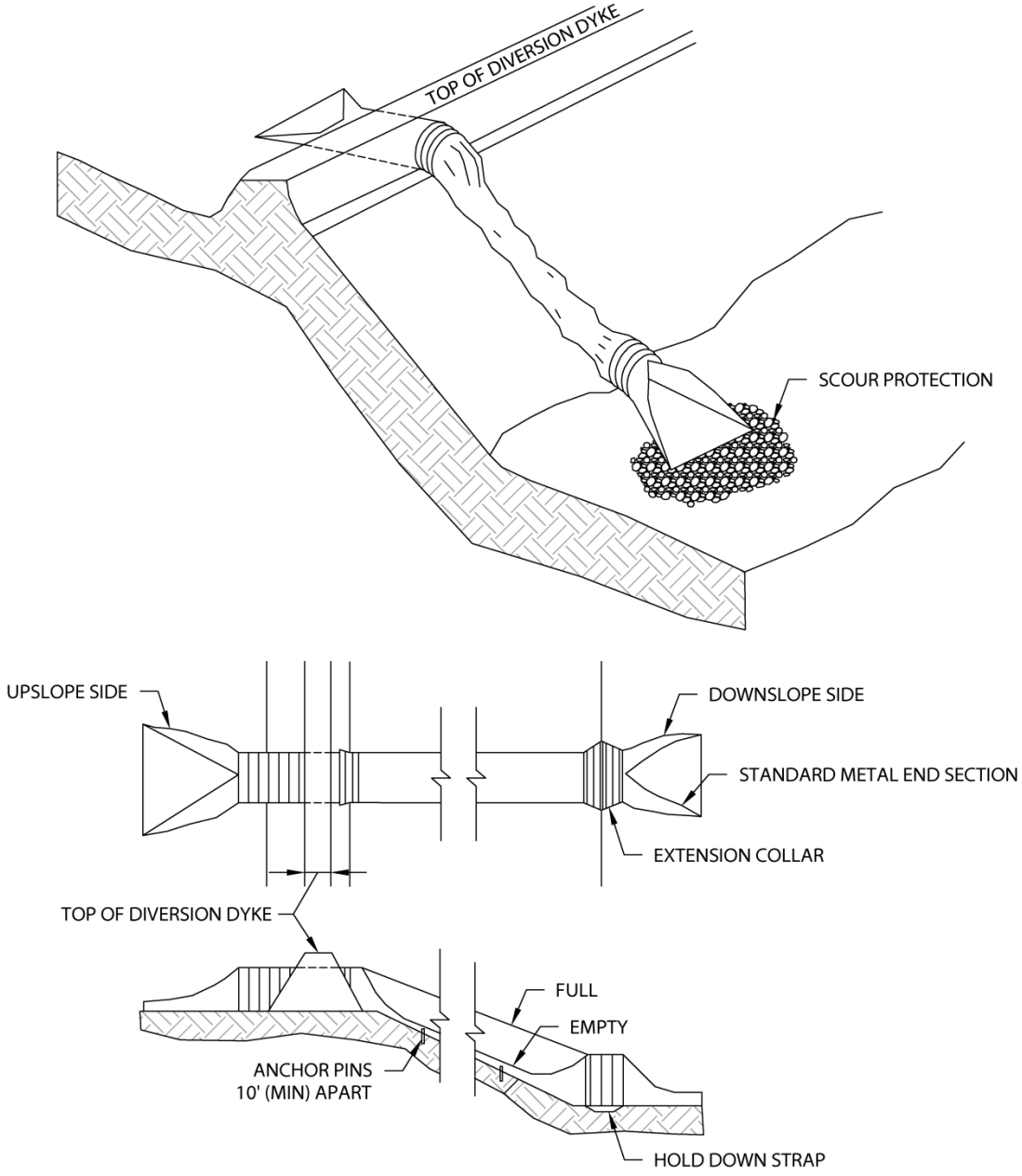
There are two types of clean water diversions: the diversion method involves intercepting clean runoff water from upslope, diverting it around a construction area, and conveying it by various means to a stable discharge point down slope. The isolation method, on the other hand, uses various techniques to isolate and dewater a construction area that exists in a stream, lake, or other water environment.

Diversion Techniques for Upland Areas:

Flexible downdrain: A flexible conduit of heavy duty fabric or other flexible material used to convey water from the top to the bottom of a slope, bypassing cut-and-fill. Use flexible tubing having the same diameter as the inlet pipe and with hold-down grommets and anchor pins/stakes at 10-foot intervals. Do not place any material on top of a flexible downdrain that may collapse it and prevent water from flowing through.

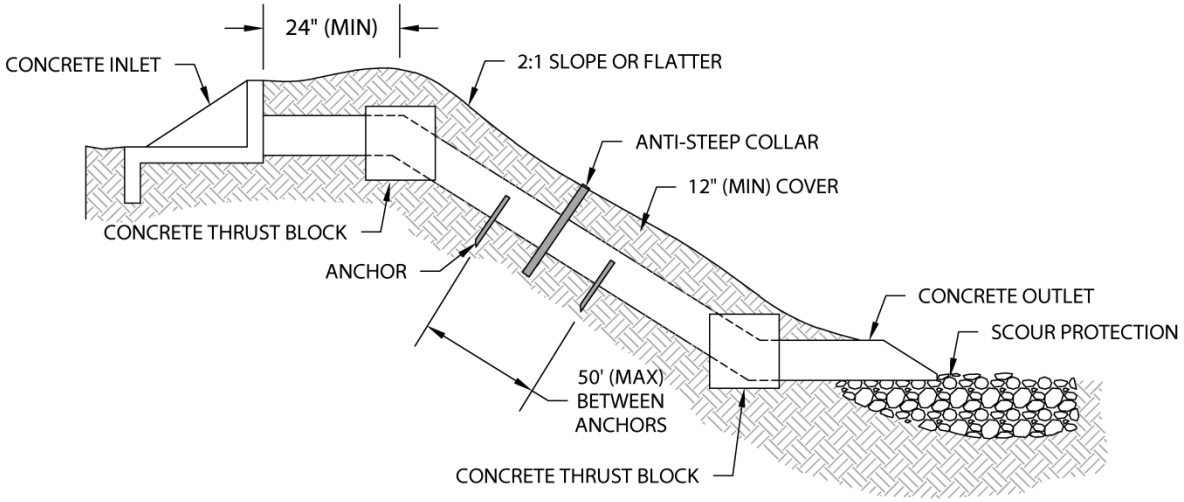
Flexible downdrain diverting upstream runoff through a construction site during installation of BMPs.

Flexible Downdrain Figure

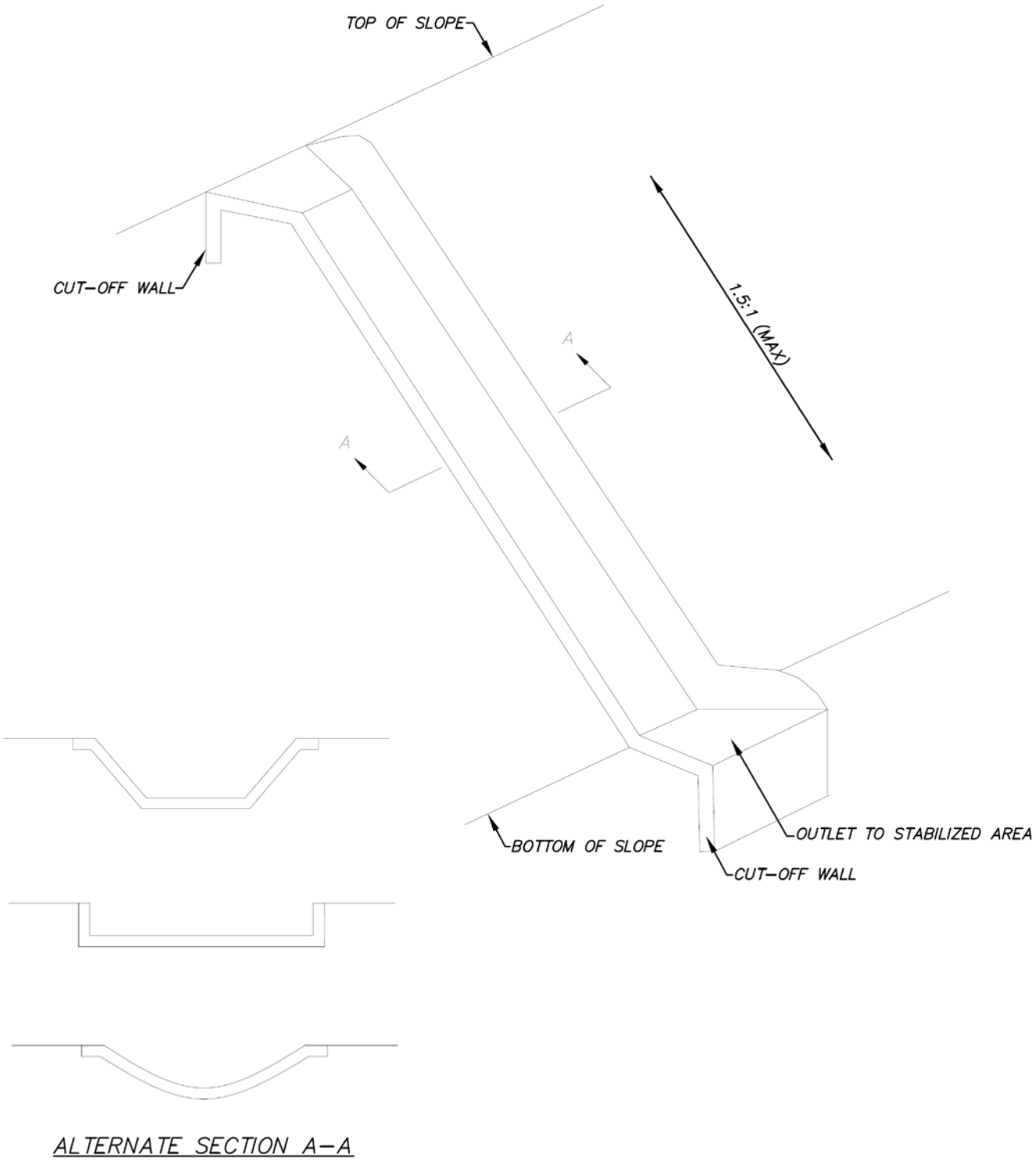


- Pipe slope drain: A rigid pipe, usually corrugated metal, extending from the top to the bottom of a slope. Bury these pipes if needed to prevent any movement on the slope. This practice causes additional disturbance but may be useful on construction sites where flexible downdrains are not suitable. Anchor drains to the slope.
- Sectional downdrain: A prefabricated, sectional conduit of half-round or third-round, non-erodible material which can perform as a chute. Correctly size downdrains so that runoff cannot spill over edge and cause gully erosion, especially at the inlet structure.
- Chutes, flumes, or spillways: Paved open structures used for conveying runoff down unstable slopes to stable discharge areas, with a lining usually made of concrete or asphalt. Use these structures to temporarily convey runoff down steep slopes until permanent BMPs are installed and the slope stabilized. They may also be used as permanent drainageway down steep slopes where no other solution is feasible, for an emergency spillway. Avoid bends in chutes to preclude overtopping during high flows. Correctly size these structures so that runoff cannot spill and cause gully erosion, especially at the inlet structure. Install with slope at least 2:1 but not steeper than 1.5:1 (run to rise). Consider use of energy dissipaters in chutes to slow the velocity of the water.

Pipe Slope Drain Figure



Chute or Flume Figure



Stream Isolation Techniques:

- Turbidity Curtain: (Refer to Shorezone Chapter for more details regarding Turbidity Curtains).
- K-rail River Isolation: K-rails are shaped concrete barriers that can be used to isolate an in-stream or near bank construction area or to form a sediment deposition area. The method can be used in streams with higher water velocities than allowable with many other isolation techniques, but it does not allow for full dewatering.
- Sheet Pile Enclosures: Sheet metal piles are installed in water to provide a waterproof area for full dewatering. This technique is useful in large streams and lakes. This technique is relatively expensive and staging and heavy equipment access areas are necessary.
- Water-Filled Geotextile (Aqua Dam): This technique allows for partial dewatering of in-stream/lake or near bank construction areas and can be used for small streams to large rivers. An aqua dam consists of a geotextile bag with two separate sections that is placed in water. Each section is then filled with water to reach above the high water level, preventing movement of the bag. Aqua dams are lightweight, easy to transport, reusable, and easy to install.
- Gravel Berm with Impermeable Membrane: This technique, designed for small streams, allows for partial dewatering of in-stream/lake or near bank construction areas. At the upstream end of the project area, clean washed gravel is placed into the stream to hold in place an impermeable membrane. The area can then be dewatered.
- Gravel Bag: Overlapping clean and washed gravel filled bags are placed into the water until they reach the height of the high water level. The work area downstream of the gravel bags can then be dewatered. Installation and removal of the gravel bags is labor intensive. Leaks between the gravel bags can also make dewatering an area difficult.
- Coffer dams: Coffer dams are watertight structures of steel, timber, earth, or other materials built in place to block off the construction area which is normally submerged. These dams are used in a variety of settings, including small to large streams, lakes, and coastal areas.

Stream Diversions Techniques:

In conjunction with isolating and dewatering the work area in a stream reach, surface water upstream may be diverted around the work area and discharged downstream. There are three types of stream diversions. The stream diversion technique to use depends upon the type of work involved, physical characteristics of the site, and the volume of water flowing through the project. The three stream diversion techniques are:

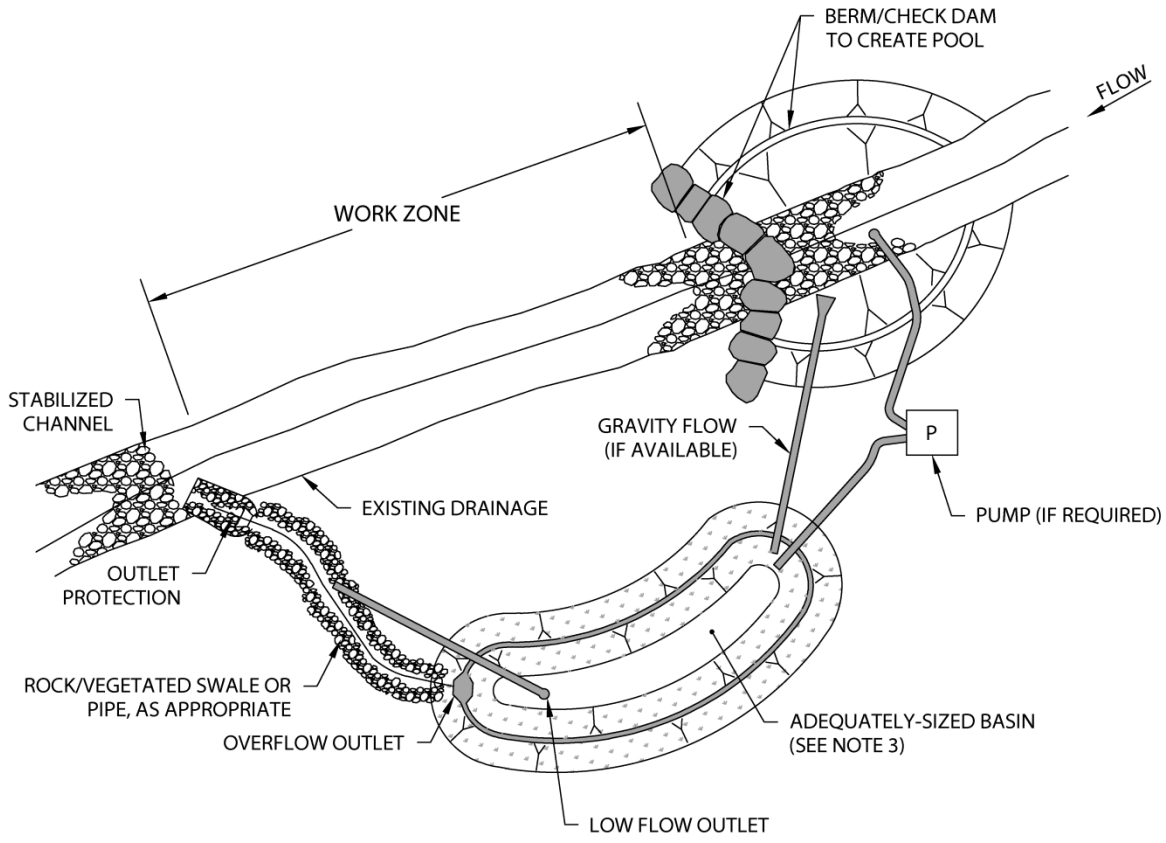
A. Pumped diversions: Effective for de-watering in relatively flat terrain. Pump capacity must be sufficient for design flow. Pumps require frequent monitoring.

B. Pipe/Flume diversions: Requires moderate slope to generate adequate stream velocity to move water through the pipe/flume to the discharge area.

C. Dam-type or excavated diversions: Water is diverted by temporary dams constructed above and below the work site. Dams must be constructed of erosion resistant materials such as steel plate, sheet pile, washed gravel bags, continuous berms, inflatable water bladders, and similar.

- When constructing a diversion channel, begin excavation of the channel at the downstream end and work upstream. Once the watercourse to be diverted is reached, and the excavated channel is stable, breach the upstream end, and allow water to flow down the new channel. Once flow has been established in the diversion channel, install the diversion weir in the main channel; this will force all water to be diverted from the main channel.
- All stream diversions will need to have a barrier installed to block the water and force it into the diversion (Refer to Stream Isolation Techniques above). Carefully evaluate site conditions to select type of diversion to use and installation specifications. Size diversions to convey design flood flows. Provide adequate energy dissipation at the outlet to minimize erosion.

Water Diversion Figure



NOTES:

1. ANY TYPE OF WATER DIVERSION REQUIRES SPECIAL PERMITTING. CONTACT TRPA AND LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD AND/OR NEVADA DIVISION OF ENVIRONMENTAL PROTECTION.
2. WATER DIVERSIONS ARE CUSTOM DESIGNED FOR UNIQUE SITE SPECIFIC CONDITIONS. CONTACT SYSTEM SUPPLIERS OR DESIGN ENGINEERS FOR ASSISTANCE.
3. SETTLING BASIN MAY BE OMITTED IF UPSTREAM CONDITIONS ARE UNDISTURBED.

INSPECTION AND MAINTENANCE

- Inspect clean water diversions (barriers/dams/embankments /diversion channels, etc.) before and after large storms, and inspect daily during construction. Inspect for clogging, damage to linings, accumulation of debris, and adequacy of slope protection. Remove debris and repair linings and slope protection as required. Repair holes, gaps, or scour.
- Remove built-up sediment from all clean water diverters.
- Check for any erosion and/or undercutting around the inlet and outlet structures, repair as needed.
- Winterize structures if work will resume next construction season. BMPs may need to be inspected in the winter (e.g. Check flexible downdrains to ensure that the sides of the downdrains are not collapsed and frozen together.)
- Upon completion of work, remove the diversion or isolation structure and redirect flow back into the original stream channel.