# SECTION 7
# ACCESS ROADS AND DRIVEWAY RUNOFF

This fact sheet addresses the impacts improper road construction and maintenance can have on water quality and how *you* can make a difference with *Best Management Practices (BMPs).* BMPs are actions you can take to protect our natural resources. **The ultimate goal of this information is to provide *general* guidelines on proper road construction and maintenance for private roads to avoid negative impacts to water quality.**

1. Read the facts and information in the following pages.
2. Fill out the Risk Assessment Worksheets in order to analyze your property's specific needs.
3. Fill out the Action Worksheet, then **take action!**

## Why are Roads an Issue?

Most private roads and driveways are constructed of compacted native soils. These dirt roads, if not properly managed, can become damaged by erosion after just a single storm. If a road is not designed with runoff control practices, water runs freely downhill picking up speed and scouring away the road, creating huge ruts, gullies, washouts, and flooding. As this stormwater runoff speeds its way downhill, it picks up tons of soil (sediment) and other pollutants from the road. Eventually this water and all that it carries, finds its way into streams, rivers, and lakes. This can be detrimental to water quality by covering fish spawning beds, creating muddy waters, adding excess nutrients, and causing algae blooms and weed growth. The erosion of roads can also be costly to landowners, both in repair and property value.

## Quality Construction … *The Bottom Line*

High quality road design by engineers and heavy equipment operators is invaluable for the safety and longevity of roads and driveways, as well as the protection of our natural resources. Unfortunately, there are many examples of private roads constructed by an operator who has insufficient knowledge and experience in this area. As a result, ruts, gullies, washouts, and flooding become expensive and dangerous problems. Having your road constructed properly is an excellent long term investment.

Water runoff can be slowed by numerous control measures and diverted into vegetated drainage areas, where the dirt it carries is captured, and the water is filtered back into the ground. These drainage control methods may include open-top box culverts, water bars, road sloping, and rolling dips. The guidelines in this section should help to ensure that roads on your property are built for the long term, saving time, money, and water quality.

### *Public Access Vs. Private Residential Roads*

Many roads around the area were once used as logging roads. They were often constructed without much consideration to alignment or grade, due to their short term use and controlled access. Unfortunately, these same roads are now used for continuous residential access without making the necessary grading and drainage changes. Today this discrepancy is the cause of increased erosion and is often a source of sedimentation into surface water.

Maintenance of our public roads will depend on who owns the property and the activities taking place, such as a timber sale. Maintenance may involve the United States Forest Service, Idaho Department of Lands, your local highway district, or County or City road departments. Unfortunately, because there are so many public access roads, maintenance can be left unattended. If you observe a hazardous road, report it to one of these agencies, and get it on the radar. Homeowners, however, are responsible for their private driveways and roads. Opportunities for design improvements on existing roads often exist. Each road and site is unique and should be evaluated on the ground by a private engineer or other professionals from agencies like the Natural Resources Conservation Service (NRCS) or the Idaho Department of Lands (IDL). The guidelines below are designed to provide property owners with a basic understanding of access road and driveway maintenance.

# Road Design and Layout

When designing a new road, implement these Best Management Practices into your road design before beginning construction, and make sure your contractor is experienced in these practices. Check with your county, state, or city regulations regarding road and driveway standards and permit requirements. Requirements may vary depending on where your property is located (Resources, page 7-12).

- During road layout, avoid slopes over 8% and road segments longer than 200 feet.
- Vary the grade as much as possible between uphill and downhill to facilitate travel and drainage.
- Place roads as far away from surface waters or wetlands as possible.
- Incorporate drainage features and structures.
- Obtain appropriate permits for stream crossings. Contact Idaho Department of Water Resources for more information (Resource Directory page 7-12).
- Design drainage features to intercept runoff before it reaches road-stream crossings.
- Design roads to balance cuts and fill (Figure 7-1).
- Preserve existing trees, shrubs and grasses at the base of fill slopes.
- Plan to stabilize exposed soil by seeding, benching, mulching, or other suitable means. **Stabilize before fall or spring runoff!**

# Cut and Fill Guidelines

**During the process of cut-and-fill, it is critical to avoid letting side-cast or waste material from entering streams or placing it on unstable areas where it might erode. Make sure that organic material such as tree limbs, stumps, logs and even ground cover such as sod are not incorporated into road fill. Over time, these will deteriorate leaving voids that can cause severe drainage and erosion problems.**

Design roads to balance cuts and fills whenever possible (Figure 7-1). Use full bench construction (Figure 7-2) on slopes over 55% where stable fill construction is not possible. In full-bench construction, the entire road surface is excavated into the hill and excavated material is pushed or hauled to an area needing fill or to a disposal area.

Minimize sediment production from borrow pits and gravel sources through proper location, development, and reclamation. Road fill is used to cover culverts and build up flat areas. Since road fill must support traffic, it needs to be spread and compacted in layers (lifts 12 inches or less) to develop strength.

| Soil/Rock Condition | Slope Ratio (Hor:Vert) |
|---|---|
| Most rock | ¼:1 to ½:1 |
| Very well cemented soils | ¼:1 to ½:1 |
| Most in-place soils | ¾:1 to 1:1 |
| Very fractured rock | 1:1 to 1 ½:1 |
| Loose coarse granular soils | 1 ½:1 |
| Heavy clay soils | 2:1 to 3:1 |
| Soft clay rich zones or wet seepage areas | 2:1 to 3:1 |
| Fills of most soils | 1 ½:1 to 2:1 |
| Fills of hard, angular rock | 1 1/3:1 |
| Low cuts and fills (<2-3 m. high) | 2:1 or flatter (for revegetation) |

**Table 7-1** *Common stable slope ratios*

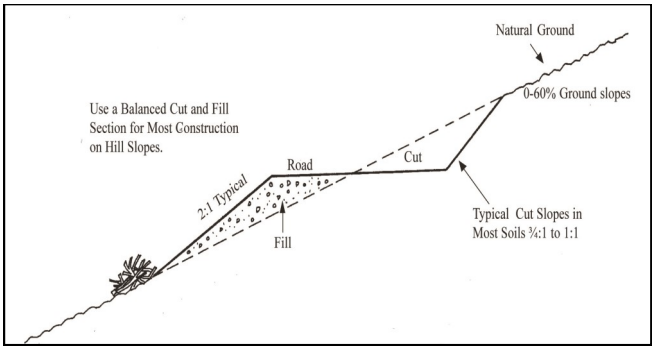



**Figure 7-1** *Balance cut and fill*

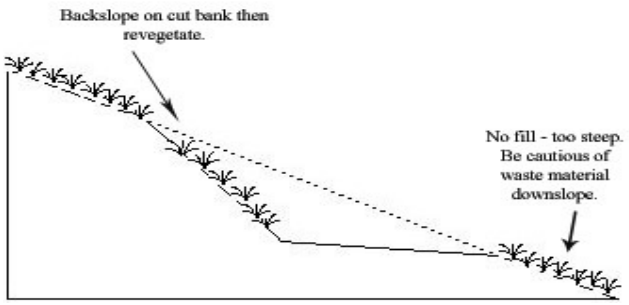



**Figure 7-2** *Full bench cut and fill*

# During Construction

The following Best Management Practices (BMPs) are used to control erosion during and after the construction process. Make sure you and your contractor are familiar with these practices.

- Construct roads in a manner that prevents sediment, debris, and excess materials from entering streams. Deposit excess materials outside of stream protection zones (See Section 8: Riparian, Forest and Pasture Management for more information on stream protection zones).
- Clear drainage ways of all debris generated during construction.
- Construct drainage features to intercept runoff before it reaches road-stream crossings.
- Care should be taken to protect trees and shrubs growing at the base of fill slopes.
- When constructing road fills near streams, compact the material in lifts less than 1 foot high. Reduce water flowing over fill. Prevent snow, ice, frozen soil, and woody debris from being buried in the fill. Limited slash and debris may be windrowed along the toe of the fill to provide a filter near stream crossings.
- Cover all bare soil with mulch, seed, or rock (Figure 7-4). For more information on erosion control, please see Section 6: New Construction.
- Construct the road with shallow, outward-sloping dips to collect surface runoff and convey it away from the road surface (Figure 7-5).
- During construction and maintenance, **do not create a gravel or snow berm on the outside shoulder**. This will eliminate all opportunities for runoff on the road surface to escape.
- Permanently mark road culverts to aid in location. If not correctly marked, snow plows are likely to crush culverts (Figure 7-6).

**Figure 7-3** *Poor placement of BMPs may result in sediments entering streams.*

**Figure 7-4** *Exposed soil has been mulched*

**Figure 7-5** *Road constructed with outward sloping rolling dips*

**Figure 7-6** *Crushed culvert cross drain*

# Drainage Improvement Methods

Road location, construction, and drainage have great potential to cause negative impact to water quality, erosion, and road costs. Drainage issues include roadway surface drainage, ditch water, culvert design, and natural stream crossings. The information below was gathered from numerous agencies and professionals, but is not meant as a technical guide. Please contact a design professional for more information (Resource Directory, page 7-12).

## Open-Top Box Culvert

This practice is often an acceptable substitute for pipe culverts on lightly used unpaved roads on steep grades of 6% or more. Construct a box-like frame (three-sided open-topped) using cedar or treated planks (Figure 7-7 and Figure 7-8). The trough should be 3-4 inches wide and 6-8 inches deep. Install it flush with the road surface skewed at a downgrade angle across the roadway. The slope of the culvert should be a minimum of 2%. The outflow end should extend 6-12 inches beyond the surface of the roadbed and should be directed onto vegetated ground, riprap, or another erosion control structure such as a sediment trap or catch basin. Maintenance is highly recommend. When these structures fill with too much runoff sediment, they become ineffective. Proper spacing for open-top culverts is outlined in Table 7-2.

**Figure 7-7** *Open-top box install*

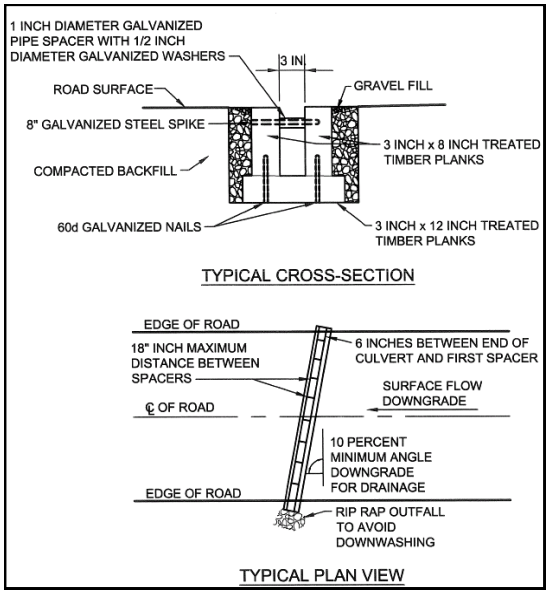



**Figure 7-8** *Open box culvert detail*

## Rolling Dip

Rolling dips are most effective on long inclines with a grade of 5% or less (Figure 7-9). They are ideal on low volume roads with low to moderate speeds. Rolling dips usually cost less, require less maintenance, and are less likely to plug and fail than culvert pipes. Construct rolling dips perpendicular to the road, with a 3-5% outslope (Figure 7-11). Stabilize soil at the low point of the dip (drainage outfall to fill slope) before final grading to direct surface water discharge from the dip. Outflows should be kept free of debris to prevent ponding. In soft soils, armor the mound and dip with gravel or rock, as well as the outlet of the dip.

- Road must be at least 150 feet long.
- Align the dip across the road at nearly a 90-degree angle and slope it outward 3-5 percent.
- Dip should be 1 foot below the road surface.
- For spacing recommendations please see Table 7-2.

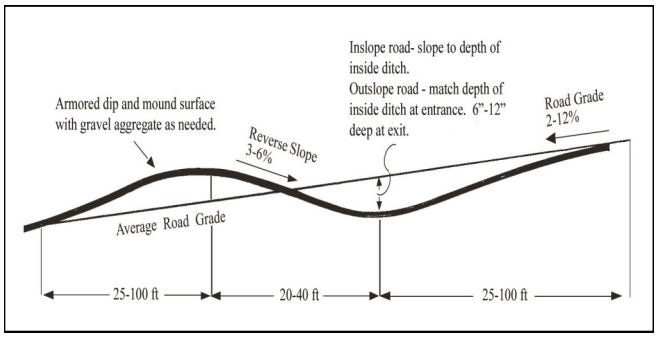



**Figure 7-9** *Rolling dip cross section*

| Road Grade (percent) | Spacing Between Open-Top Culverts and Rolling Dips |
|---|---|
| 2 to 5 | 300 to 500 |
| 6 to 10 | 200 to 300 |
| 11 to 15 | 100 to 200 |
| 16 to 20 | <100 |

**Table 7-2** *Recommended open-top culvert spacing and rolling dip spacing (feet)*

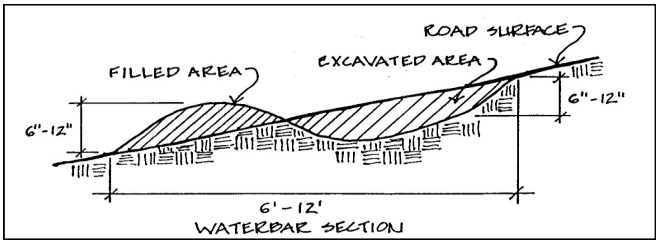



**Figure 7-10** *Water bar cross section*

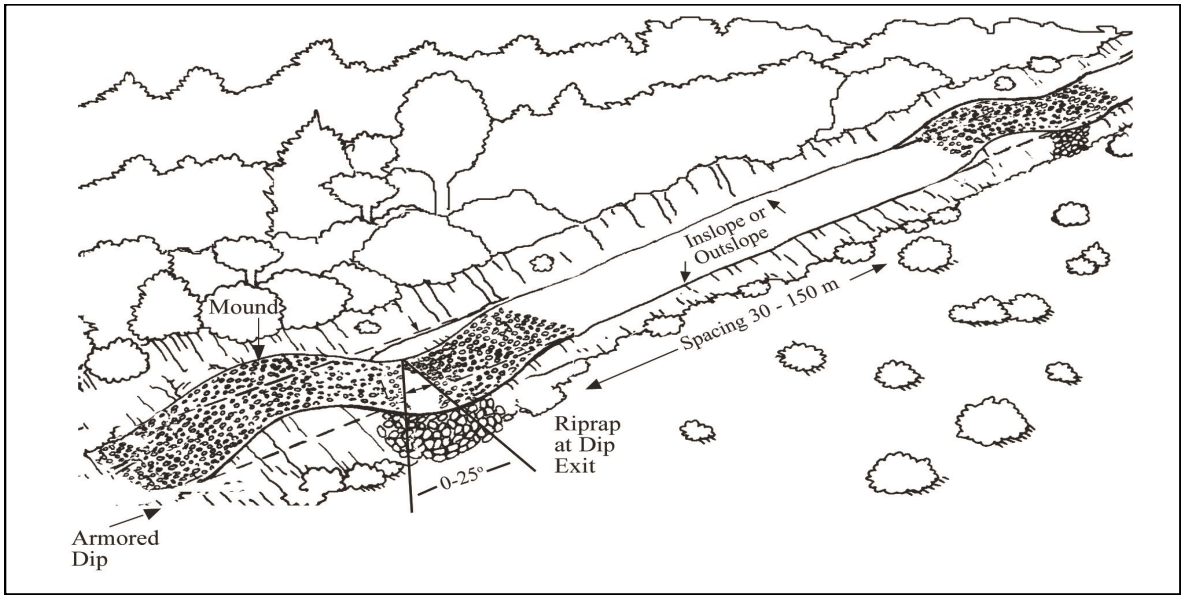



**Figure 7-11** *Rolling dip and road sloping perspective*

## Water Bars

A water bar is a cut and berm built at a downward angle across the roadway (Figure 7-10). It extends from the cut bank to the opposite down hill shoulder. Installation of water bars should be done in areas with minimal or no fill. Install water bars for use as a temporary or permanent drainage practice on light-use, low-maintenance, unpaved roads. Ensure that reverse drainage from the crest of the water bar directs drainage back to the excavated area. This will keep uphill runoff from flowing through the water bar and continuing down the road surface.

- Berms shall be a minimum of 6-12 inches high, cut 6-12 inches deep, and skewed at an angle of 30º to 40º across road. Depth will be dependent on road grade percent.
- Construct low enough for traffic to pass over, and angle across road to direct runoff flow off the road.
- Proper spacing between water bars can be determined from Table 7-3.
- Discharge should never be directed onto fill mate-

| Road / Drive Grade % | Low to Non-Erosive soils(1) | Erosive Soils(2) |
|---|---|---|
| 0-5 | 250 | 130 |
| 6-10 | 200 | 100 |
| 11-5 | 150 | 65 |
| 16-20 | 115 | 50 |
| 21-30 | 100 | 40 |

Note:
(1) Low Erosion Soils = Coarse Rocky Soils, Gravel, and Some Clay
(2) High Erosion Soils = Fine, Friable Soils, Silt, Fine Sands

**Table 7-3** *Recommended water bar spacing*

## Road Sloping

This practice involves sloping the entire road or segments of road at a 3-5% slope in order for water to flow off entire surface. This can be done with **insloping, outsloping,** or **crowning (**Figure 7-12). Water should never be directed toward structures. The area where water is directed should have ample erosion control measures in place, such as, vegetation, rock, and mulch.

**Insloped** roads direct water toward a drainage ditch, and best control road surface water. Because water accumulates, a system of ditches, cross-drains and extra road width for the ditch is needed.

**Outsloped** roads avoid the need for an inside ditch. Outsloping is effective at dispersing water, minimizing the need for wide roads and decreasing the need for other diversion practices but may require roadway surface and fill slope stabilization. Outsloping should be avoided on grades 10% and greater.

**Crowned** roads are appropriate for high standard, two lane roads on gentle grades. They also require a system of ditches and cross drains. Crowned roads are difficult to maintain on narrow rural roads.

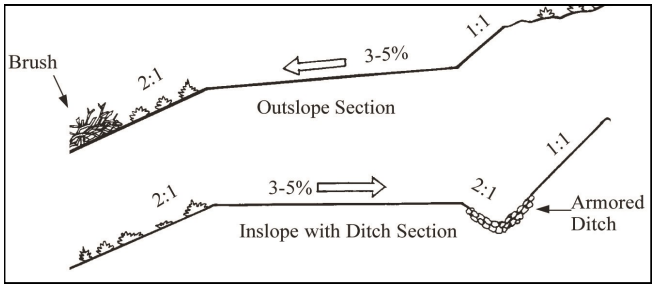



**Figure 7-12** *Road sloping*

## Ditch Relief Culverts /Culvert Cross Drains for Runoff Management

*For more information on culvert design for stream crossings, please see pages 7-8 and 7-9.*

Ditch relief culverts are used for runoff management by transferring ditch water to the other side of the road and releasing it into a stable area (Figure 7-13 and 7-14 ). They are the most commonly used practice for road surface drainage. Below are some general guidelines to follow.

- Bedding material should be free of rock or debris that might puncture the pipe or carry water around the culvert.
- Cover with soil, avoiding puncture from large rocks.
- Compact soil at least halfway up the side to prevent water from seeping around the culvert.
- Install culverts at least 12" in diameter at a 30-degree downgrade angle to enhance flow (7-13). Ensure proper slope of at least 5 inches every 20 feet.
- Protect cross-drain inlets and outlets with rock (riprap 6”-18” diameter), brush, or logging slash to dissipate energy and prevent erosion, or locate the outlet of cross drains on stable, non-erosive soils, rock, or in well vegetated areas. Refer to culvert outlet armoring (Figure 7-15).

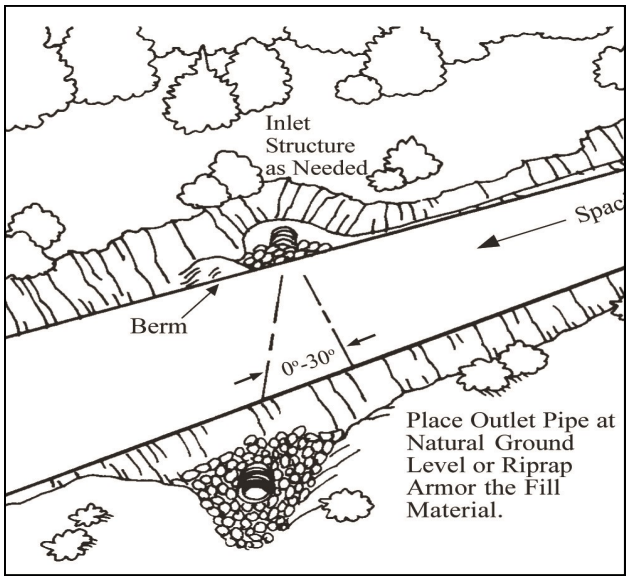



**Figure 7-13** *Ditch/culvert cross drain*


**Figure 7-14** *Bird’s eye view of ditch relief*

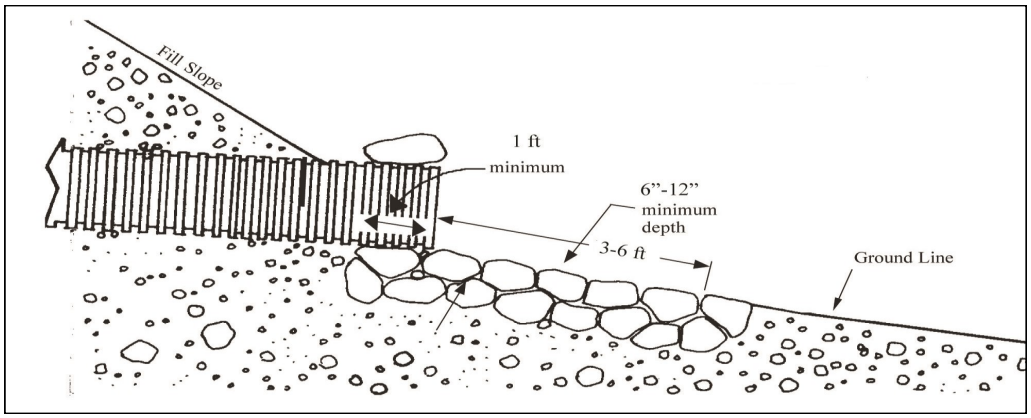



**Figure 7-15** *Culvert outlet armoring*

# Ditch Design

Ditches are constructed to transport water from storm runoff to an adequate outlet without causing erosion or sedimentation. A good ditch needs to be shaped and lined using the appropriate vegetative or structural material. Ditches are efficient in the removal of runoff from the road, helping preserve the road bed and banks. Well designed ditches provide an opportunity for sediments and other pollutants to be removed from runoff water before it enters surface waters. A ditch achieves this by controlling, slowing and filtering the water through vegetation or structures, such as check dams (Figures 7-16 and 7-17). In addition, a ditch must be stable to avoid further erosion.

## General Construction Guidelines

- Size ditches so they are large enough to handle runoff from the upslope drainage area.
- Design and grade ditch and bank side slopes at a maximum 2:1 slope (Figure 7-18).
- Excavate a ditch deep enough to drain the road base: 1.5 to 2 feet deep (Figure 7-18).
- Where possible, the ditch bottom should be a minimum of 2 feet wide to help slow and disperse water (Figure 7-18).
- Seed ditches which have a less than 5% slope with grass in order to filter sediments and stabilize soil.
- Line ditches that have a 5% slope or greater with 2-6 inch diameter rock or check dams.
- All ditches need an outlet; standing water saturates and weakens roads.

## Cleaning and Maintenance

- Clean ditches when they become clogged with sediments or debris to prevent overflows and washouts (Figure 7-19).
- Check ditches after major storm events for obstructions, erosion, or bank collapse.
- Re-grade ditches only when absolutely necessary and line with vegetation or stone as soon as possible.
- Deposit wastes at safe disposal sites, and stabilize these sites to prevent erosion. Avoid locations where erosion will carry materials into stream or back into ditch.

**Figure 7-16** *Straw/fiber wattles used as check dams in ditch to slow runoff*

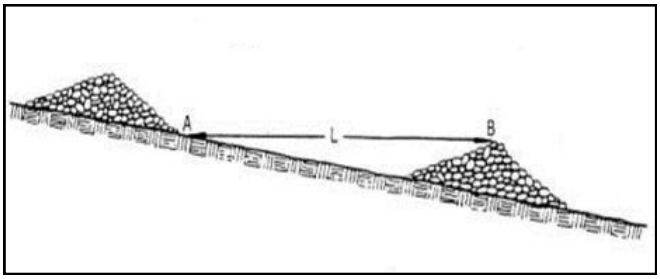



**Figure 7-17** *The height of the lower check dam (B) is at the same height as the bottom of the upper (A)*

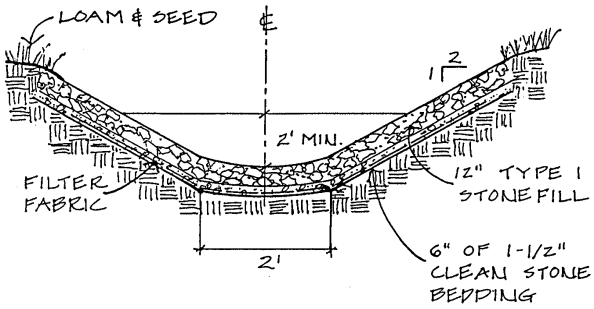



**Figure 7-18** *Recommended ditch design*


**Figure 7-19** *The result of an undersized/clogged ditch*

# Culvert Design for Stream Crossings and Fish Passage

The construction of stream crossings has the greatest potential to cause immediate sediment pollution. Proper design, installation,and maintenance of stream crossing structures, can protect both roadways and fish. Be sure all culvert installations on *Class I streams* allow for fish passage.

## Stream Crossings

- *The Stream Channel Protection Act of 1971 (Title 42; Chapter 38, Idaho Code)* requires that a permit be obtained from the Idaho Department of Water Resources (IDWR) for any alterations within the beds and banks of continuously flowing natural streams in Idaho.
- Make every effort to avoid stream crossings.
- Cross streams at right angles, directly in line with stream (Figure 7-22).
- Build and maintain structures to protect the stream bottoms and banks.
- Cross streams where the stream bottom is stable and banks have low gradient slopes (Figure 7-20).
- Only conduct construction activities when stream flows and expectancy of rain are low. Ideally, the entire process, from beginning to end, should be completed before the next rain event.
- If necessary, stabilize road and trail approaches to stream crossings with aggregate or other suitable material.

**Note:** Water bars, broad-based dips, and open top culverts should never be used to cross streams. These methods are used to improve drainage (see pages 7-4 thru 7-5).

**General Culvert Installation Guidelines**

- All existing or potential stream flows should be diverted while the culvert is being installed. This will help reduce or avoid sedimentation below the installation site.
- Minimize the use of equipment in stream bed.
- Complete downstream work first, such as energy dissipating devices and large rock riprap.
- A culvert inlet should be placed on the same level as the stream bottom or slightly below.
- Cover the top of culverts with fill to a depth of 1/3 the pipe diameter or at least 12 inches, whichever is greater, to prevent crushing (Figure 7-21).
- Compact and armor backfill material at inlet to prevent water from seeping around culvert.
- Culvert should extend at least 1 foot past fill material and be level with stream bottom.

**Figure 7-20** *Fish friendly arch culvert over low grade stream*

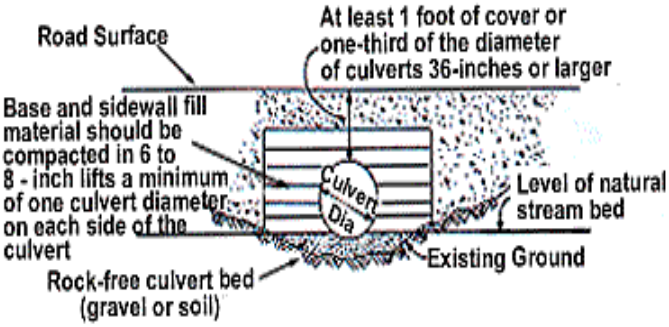



**Figure 7-21** *General installation guidelines for cul-*

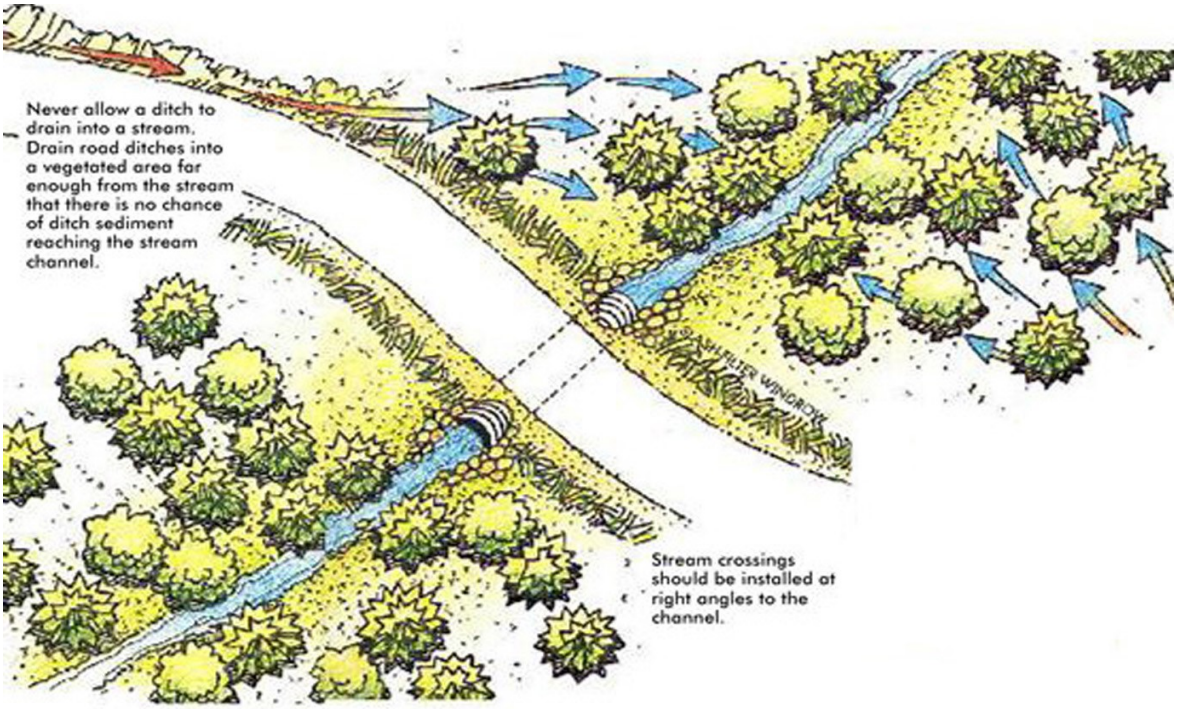



**Figure 7-22** *Culvert aligned at a right angle to stream, ditch water directed to vegetated and stabilized area*

## Risks of Culvert Washouts at Stream Crossings

The risk of culvert failure is high unless they are properly designed and maintained. For most crossings, failure is due to upland erosion, clogged culverts, or undersized culverts. When a washout occurs it is inevitable that sediment will enter the stream. However, keeping sediment pollution to a minimum is necessary. Ensure that road design and construction will accommodate excess flow or runoff events that exceed the standard culvert design (Figure 7-23). These considerations are always site specific and can save your culvert while preventing excessive erosion on the road surface and surrounding landscape. Request the consultation of an engineer or professional from the NRCS or IDL.

**High risk culverts include:**

- Culverts that become plugged where there is no overflow structure (Figure 7-24).
- Undersized culverts.
- A long, steady road grade above the stream crossing.

**Simple solutions:**

- Keep fills over culverts to recommended depth (Figure 7-21).
- Consider a bridge instead of a culvert (Figure 7-26).
- Create an armored overflow protection dip (Figure 7-23).
- Design stream crossing to handle 50 year peak flows.

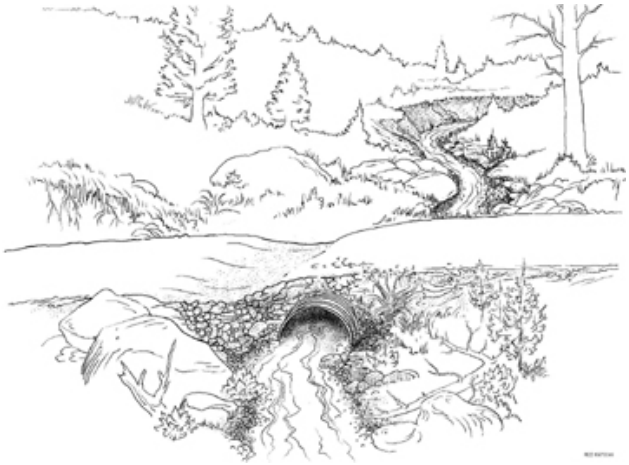


**Figure 7-23** *This sketch shows an armored overflow dip designed to insures only the loss of some road fill in the event of culvert failure.*

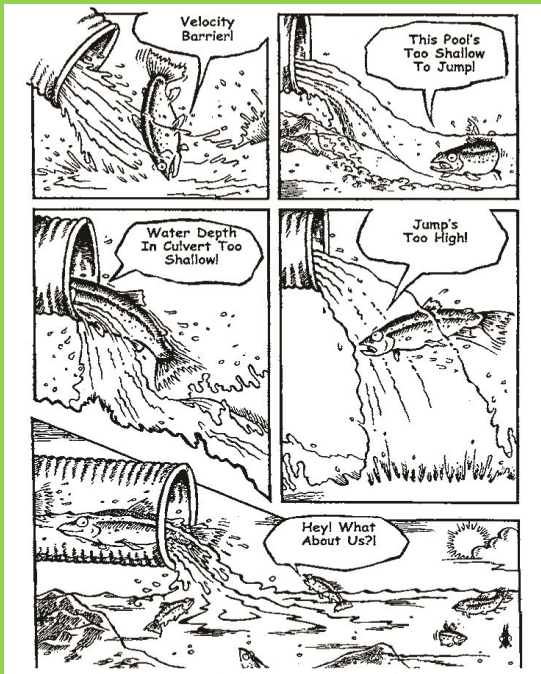
**Figure 7-24** *Culvert clogged with sedi-*

## Fish Friendly Culverts

Fish friendly culverts at stream crossings are essential where trout and other species move upstream and downstream to spawn and meet habitat needs. The information provided in this section is not meant as a technical guide. For technical assistance contact a natural resource and design professional (Resource Directory, page 7-12).

**Culverts Can Impede Fish Passage When:**

- ◊ **Water velocities are too powerful for fish to move through.**
- ◊ **Vertical barriers are too high for fish.**
- ◊ **Inadequate water depth prevents fish from being adequately submerged.**
- ◊ **Icing and debris caught in culvert prevent passage or trap fish inside.**
- ◊ **Overall culvert design does not accommodate the size and species of fish present in stream.**




Courtesy of Oregon Watershed Assessment Manual

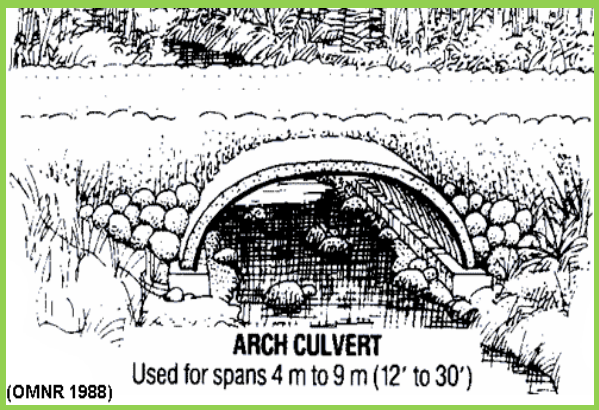



**Figure 7-25** *Arch culvert as alternative to whole*

## Culvert Design Recommendations

- Use bridges (Figure7-26), bottomless arches (Figure 7-25), or partially buried culverts in areas where fish passage is an important consideration.
- Make sure there is no sudden increase or decrease in gradient (Figure 7-27). Place culverts on natural stream bed grade or slightly below.
- Design culverts so that water velocities passing through the pipe are equal to water velocities in the stream.
- Cross streams are right angles, directly in line with stream (Figure 7-22).
- Provide resting pools at culvert inlet and outlet on streams with high gradients. Fish need a place to rest before they make the journey through a culvert.
- Place riprap securely at culvert inlet to prevent loose material around inlet from clogging the culvert.

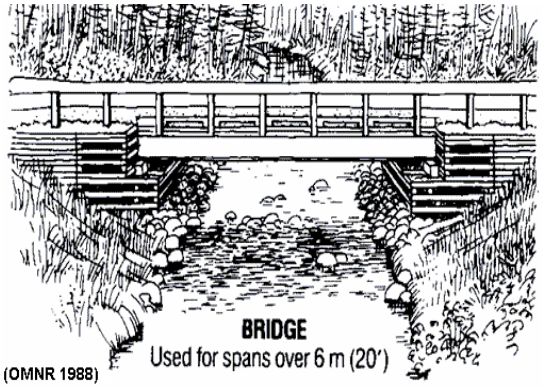



**Figure 7-26** *Bridge as alternative to cul-*

**Figure 7-27** *Culvert is too high, creating a vertical barrier for fish and scouring at outlet*

## Ditch/Culvert Maintenance & Inspection Chart

| Problem | Cause | Solution |
|---|---|---|
| Ponding/puddled water | Invert is too high.<br>Ditch grade is too flat. | Reset the pipe to match the invert to the channel bottom.<br>Re-grade ditch to maintain correct flow. |
| Dented/crushed ends | Traffic/snow plows are hitting the ends. | Fix pipe ends; use flared inlets and outlets; mark and protect. |
| Heavy corrosion | Water flowing through the culvert is acidic. | Install a sleeve of PVC in the existing pipe or replace the steel pipe with noncorrosive material (PVC, polyethylene, aluminum, concrete). |
| Piping around the outlet | Pipe is incorrectly installed, resulting in water flowing outside the pipe. | Reinstall pipe with proper bedding and compaction; install a headwall or anti-seep diaphragm. |
| Sediment build-up | Not enough slope. | Reinstall pipe with proper bedding and compaction; install a headwall or anti-seep diaphragm.<br>Reinstall pipe with a slope of at least 1/4 inch per foot. |
| Objects blocking the pipe | Debris traveling from the ditch to the culvert. | Remove blockage; install check dams upstream of the culvert. |
| Sagging bottom | Foundation material has settled or has low bearing capacity. | Reinstall pipe with suitable and properly compacted foundation material. |
| Crushed top | Not enough cover. Soil around walls not compacted. Traffic loads are too heavy. | Add cover. Reinstall pipe deeper with suitable and properly compacted bedding material. |

## Routine Road Maintenance

BMPs need to be regularly inspected. Inspection and maintenance will extend the life of the BMP and keep road maintenance costs low.

- Permanently mark road culverts to aid in location. If not correctly marked snow plows are likely to crush culverts.
- In the winter when snow berms block runoff from draining off road, cut channels into snow berm to release runoff from road surface.
- Clean and repair culverts on a regular basis. Keep water bars and box culverts free of debris and sediment for optimum performance.
- Avoid using roads during wet periods if such use would likely damage the road drainage features.
- Grade road surfaces only as often as necessary to maintain a stable running surface and to retain the original surface drainage.
- Rolling dips and other outflows should be kept free of debris to prevent ponding.
- Place all excess material removed by maintenance operations in safe disposal sites, and stabilize these sites to prevent erosion. Avoid locations where erosion will carry materials into a stream.

# Resource Directory

## Bonner County

**Bonner Soil and Water Conservation District**
1500 Highway 2, Suite 208
Sandpoint, Idaho 83864

**Independent Highway District**

## State

**Idaho Department of Lands**
* **Forest management plans**
3258 W. Industrial Loop
Coeur d'Alene, ID 83815
(208)769-1577
www.idl.idaho.gov

**Idaho Department of Water Resources**
7600 N Mineral Dr, Suite 100
Coeur d' Alene, Idaho 83815
(208)762-2800

**Idaho Department of Fish & Game**
2750 Kathleen Avenue
Coeur d' Alene, Idaho 83815
208-769-1414

**Idaho Department of Environmental Quality (IDEQ)**
2110 Ironwood Parkway
Coeur d'Alene, ID 83814
(208) 769-1422
www.deq.idaho.gov/

## Federal

**Natural Resources Conservation Service (NRCS)**
* **Forest management plans**
7830 Meadowlark Way, Suite C
Coeur d'Alene, ID 83815
(208) 762-4939

## Other Resources

**Stormwater Erosion Education Program (SEEP)**
www.panhandleseep.org

**Forestry for Idaho: BMPs - Forest Stewardship Guidelines for Water Quality.**
www.idahoforests.org/bmp.htm

**State of Idaho Catalog of Storm Water Best Management Practices for Idaho Cities and Counties.**
www.deq.idaho.gov/media/622263-Stormwater.pdf

**Low Volume Road Engineering Field Guide**
http://ntl.bts.gov

# RISK ASSESSMENT WORKSHEETS
## Access Roads and Driveway Runoff

The assessment table below will help you identify potential environmental risks related to the management of your property's access roads and driveways. For each question indicate your risk level in the right-hand column. Some choices may not correspond exactly to your situation. Choose the response that best fits. When finished turn to the **Action Worksheet** on page 7-14 and record your medium and high-risk practices. Your goal is to lower your risks. Use the BMP recommendations in Section 7: Access Roads and Driveway Runoff to help you decide how to best reduce pollution associated with water runoff.

| | LOW RISK | MEDIUM RISK | HIGH RISK | YOUR RISK |
|---|---|---|---|---|
| **Access road type, and slope of road to home.** | Road paved, or road has good gravel base. | Road compacted dirt, and slope is 0-15%. | Road compacted dirt, and slope is >15%. | ☐ Low<br>☐ Medium<br>☐ High |
| **Condition of unpaved road into home.** | Erosion low; no obvious gullies or road wash channels. | Some signs of erosion with loss of soil. | Erosion evident with deep gullies and wash channels. | ☐ Low<br>☐ Medium<br>☐ High |
| **Condition of road cut bank (above slope) and fill bank (below slope).** | Banks are relatively flat and well vegetated; no obvious signs of erosion. | Banks are steep but well protected with vegetation with only some signs of erosion. | Banks are steep, generally bare; erosion evident with gullies and soil slumps. | ☐ Low<br>☐ Medium<br>☐ High |
| **Condition or existence of structures for water runoff management.** | Drainage ditches deep and vegetated; culverts maintained; water bars or rolling dips present on steep slopes to slow runoff velocity. | Evidence that drainage ditches and culverts are not completely effective in runoff management. | Drainage ditches shallow or flat allowing road wash; culverts plugged or no culverts; road needs water bars or rolling dips. | ☐ Low<br>☐ Medium<br>☐ High |
| **Where does stormwater runoff from roads and road banks end up?** | Most water flows over forested land where sediment can drop out before reaching lake, river, or stream. | A good deal of water flows directly into surface water; water only slightly turbid (dirty). | Most runoff water is channelized and flows directly into streams or the lake; water is turbid. | ☐ Low<br>☐ Medium<br>☐ High |

# ACTION WORKSHEET

## Access Roads and Driveway Runoff

| High and medium risks | What can you do to reduce the risks? | Set a target date for action. |
|---|---|---|
| *Sample:* Runoff from driveway runs directly into a stream or the lake. | Slow movement of water running down the driveway with culvert boxes that divert storm water into heavily vegetated areas. | One week from today. |
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# References

Page 7-1. Photo of road erosion. Courtesy of http://www.fs.fed.us/GRAIP/photos.

Figure 7-14. Ditch cross drain diagram. Courtesy of http://www.aadnc-aandc.gc.ca/eng/1100100023568—canada.

Figure 7-20. Logging truck over arch culvert. Courtesy of http://www.wfpa.org/

Figure 7-23. Stream diversion. Courtesy of http://www.fs.fed.us/eng/pubs/html/wr_p/97771814/97771814.htm.

Figure 7-24. Culvert clogged with sediment. Courtesy of http://www.city-data.com/forum/tennessee/359683-going-off-grid-east-tennessee-82.html.

Low Volume Road Engineering Field Guide http://ntl.bts.gov/lib/24000/24600/24650/Index_BMP_Field_Guide.html.