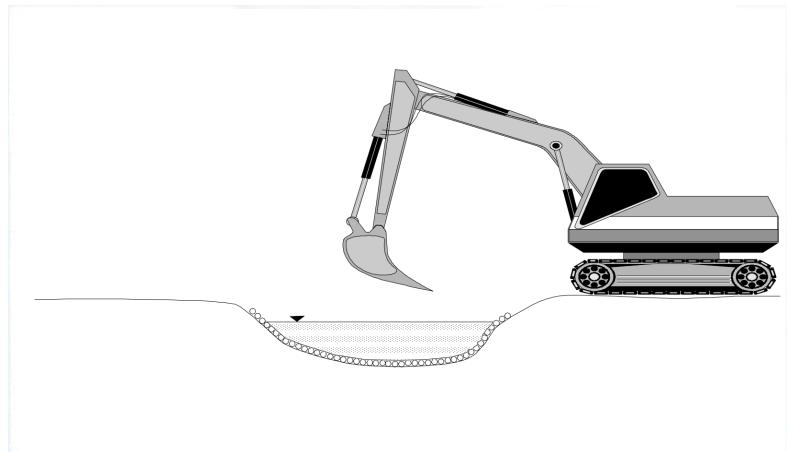




Chapter 10: Environmental Guidelines for General Construction Practices



**Water Resources Management Division
Water Rights, Investigations, and
Modelling Section
November 29, 2018**



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Chapter 10
Environmental Guidelines For
GENERAL CONSTRUCTION PRACTICES

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10.0 GENERAL CONSTRUCTION PRACTICES

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10.0 GENERAL CONSTRUCTION PRACTICES

10.1 General

All too often construction sites are a significant source of pollution to natural waterways. Soil erosion from the site can result in stream degradation and turbidity miles downstream. Stream channels may become unstable because of higher rates of runoff from surrounding land stripped of vegetation. Toxic wastes from construction materials and equipment can impair water quality and thereby interfere with downstream uses. For these reasons, properly planned and implemented controls are essential during the construction period, if detrimental changes to the surrounding water bodies are to be minimized. Proper site preparation procedures are required to minimize sedimentation and eliminate the need for costly remedial actions.

Many serious construction problems arise because important drainage and water-related factors were overlooked or neglected in the location and planning phases of the project. Adequate soils, geologic and hydraulic studies will provide much guidance in solving erosion, drainage and landslide problems as well as being helpful in minimizing or avoiding these problems during construction. Risk of damage by siltation of ponds and reservoirs during construction often can be reduced by studying flood and precipitation records and proper scheduling of work.

Time of construction is important. A structure or embankment is usually most vulnerable to damage from heavy rain or floods when partially complete. The onset of winter or spring break-up may pose unique difficulties, thus the timing of proposed construction requires due consideration.

10.1.1 Regulations and Regulatory Bodies

Alterations to bodies of water and construction adjacent to bodies of water are regulated under provincial legislation. Federal and municipal statutes and regulations also apply in most situations.

The Province has the mandate to protect all water resources from potential impact such as pollution, changes to domestic, municipal or industrial water supplies, flooding, aesthetic damages, changes in the flow regime, impact to wildlife or any other alteration. Prior written approval must be obtained from the Department for alterations because of the potential to adversely affect water resources or the environment in general. In addition to this, the Department of Fisheries and Oceans retains direct management of fisheries and, accordingly, their regulations apply, but only if fish habitat is affected; and the Canadian Coast Guard requires approval of all construction in navigable waters under the *Navigable Waters Protection Act*.

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A certificate of environmental approval for alterations and construction adjacent to bodies of water includes terms and conditions which are binding on the proponent and any persons working for the proponent. An application for approval must be completed by the proponent or the proponent's agent or consultant and submitted to the Department.

10.2 Culvert Location and Shape

10.2.1 Environmental Reconnaissance of Site

Early in the planning stages, a joint engineering and environmental reconnaissance of the site should be conducted to locate and identify all bodies of water which may require special attention during construction. All small feeder streams or intermittent watercourses must also be included in the assessment.

Specific mitigative and protective measures to be taken at particular locations should be identified. Naturally, the specific measures to be taken depend on the activity and their potential impacts. An example of a well laid out construction site can be seen in **Figure 10.1**.

10.2.2 Scheduling

The scheduling of work that deals with stream alterations is an important consideration in the implementation stage of an undertaking. Proper scheduling is important from the standpoint of environmental and fish habitat protection, and can be economically advantageous as well.

From the standpoint of the Department, the ideal time of year for construction near a body of water would be during:

- low flow (makes it easier to restore stream bank and the sediment will carry slower and settle out quicker)
- the low rain fall period (reduces the chance of flash flooding).

These guidelines roughly translate to a season lasting from June 1st to October 30th.

The amount of time spent on construction can have an increasingly adverse effect on water quality. The longer the stream bed is disturbed and left exposed, the larger the amount of sediment that will be introduced into the watercourse and the further the sediment will be able to travel within the watercourse.

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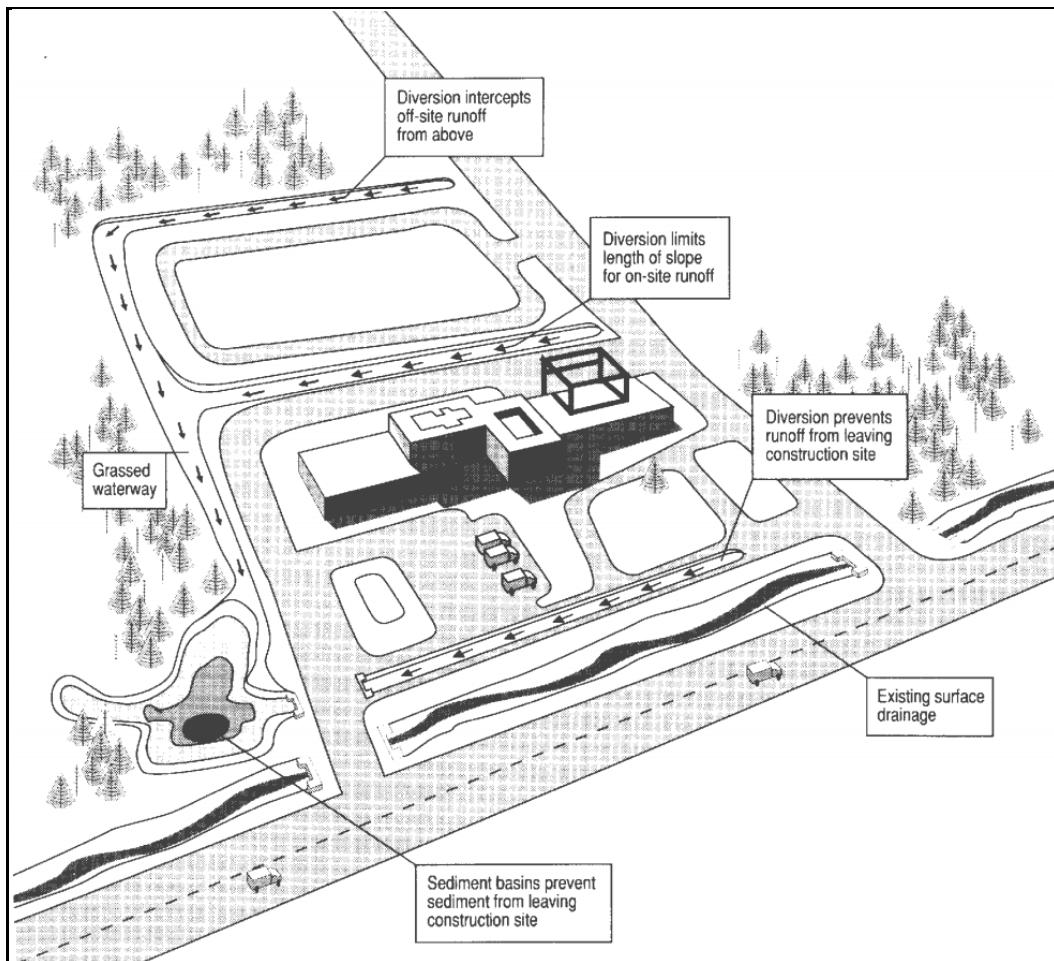


Figure 10.1 A Well Laid Out Construction Site

10.2.3 Construction Methodology

Prior to the operation of heavy equipment or deployment of labour forces at or near a body of water, the construction methodology and procedures to be used should be planned so as to minimize any impact of the project on the body of water and adjacent lands. This would include the preparation of clear instructions for the use of contractors and their equipment operators.

10.2.4 Conveyance of Regulatory Requirements

All important details or procedures which would be necessary to mitigate environmental impact or which are required by a municipal, provincial, or federal regulatory authorities must be clearly conveyed to site personnel and those actually carrying out the work.

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10.2.5 Site Access

Wherever possible, the site should be accessed via existing roads. Where no roads exist, fording of streams by vehicles other than one man ATV's should be limited to one trip in / one trip out. For further details on fording, refer to *Chapter 6, "Fording"*.

10.2.6 Site Layout

The construction site should be planned and "laid out" with prominent markers to clearly indicate designated areas such as:

- The outer boundary or limit of the project site or area to be cleared, stripped, grubbed or excavated.
- Spoil areas or areas where topsoil and other material may be stored for later use.
- Protected or no entry areas such as areas outside the designated site, buffer strips on bodies of water or on site features such as drainage ditches, culverts, settling basins, etc. which require protection.

10.3 Clearing and Grubbing

Before starting to clear and grub in preparation for construction, all environmental protection measures must be in place. To reduce the exposure of erodible soils, appropriate scheduling should be arranged so that grubbing, stripping and excavation will be quickly followed with the remainder of required construction work. All infilling, compaction, grading and surfacing must then be completed as soon as possible to stabilize and protect exposed soils

10.3.1 Salvage Useable Materials

Where extensive removal of tree cover is required, salvage of useful wood such as saw logs, pulp wood, and firewood should be carried out. Under no circumstances should wood or slash be dumped into or near a body of water.

All topsoil and/or organically rich soils which are stripped or removed, must be stored at or near the construction site and protected from erosion so that the material may be subsequently used to help revegetate disturbed areas.

If armour stone or rip-rap is required as part of the project, suitable rock which could be used for this purpose should be set aside for subsequent use.

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10.3.2 Equipment Operation

All vehicles and equipment working near a body of water must be clean and in good repair, free of mud and oil or other harmful substances.

Suitable measures must be taken to prevent or reduce the generation of silted or muddied water in the operation of heavy equipment. Heavily travelled areas must be kept well drained to prevent the formation of mud puddles which can contribute to siltation. Generous use of gravel or installation of roadside drainage culverts may be required.

Heavy equipment such as bulldozers, front end loaders, backhoes and cranes must be kept outside the high-water mark of all drainage courses and bodies of water. The operation of all heavy equipment must be confined to dry, stable areas to reduce the production of mud and silted water.

Fuels, chemicals or deleterious materials must not be stored near a body of water. No vehicles or equipment shall be serviced near a body of water.

10.3.3 Temporary Culverts or Bridges

Small streams or drainage courses which must be crossed frequently by heavy equipment should be provided with a temporary culvert or bridge at the proposed crossing location. *Chapter 3, “Watercourse Crossings”, Chapter 4, “Bridges”, Chapter 5, “Culverts”, and Chapter 6, “Fording”*, provide detailed information on stream crossings and the use of bridges and culverts.

10.3.4 Surface Water Diversion

Peripheral ditching should be provided to intercept surface water where such water would enter the site and then divert it around the area of construction. Keeping such water clean reduces the amount of silted water which will require treatment.

Separate peripheral ditching or a low basin should be provided along the lower boundary of the construction site to intercept and contain silted or muddied surface water from the site. Silt fences and/or straw or rock check dams (See **Figure 10.2**) must be used to slow the flow of water in the ditches, allowing the sediment to settle.

10.3.5 Dust Control

Measures must be taken to control dust that may impair the quality of an adjacent body of water. Water and wood chips are safe methods of controlling dust. Calcium chloride and oil based suppressants must not be used near a body of water.

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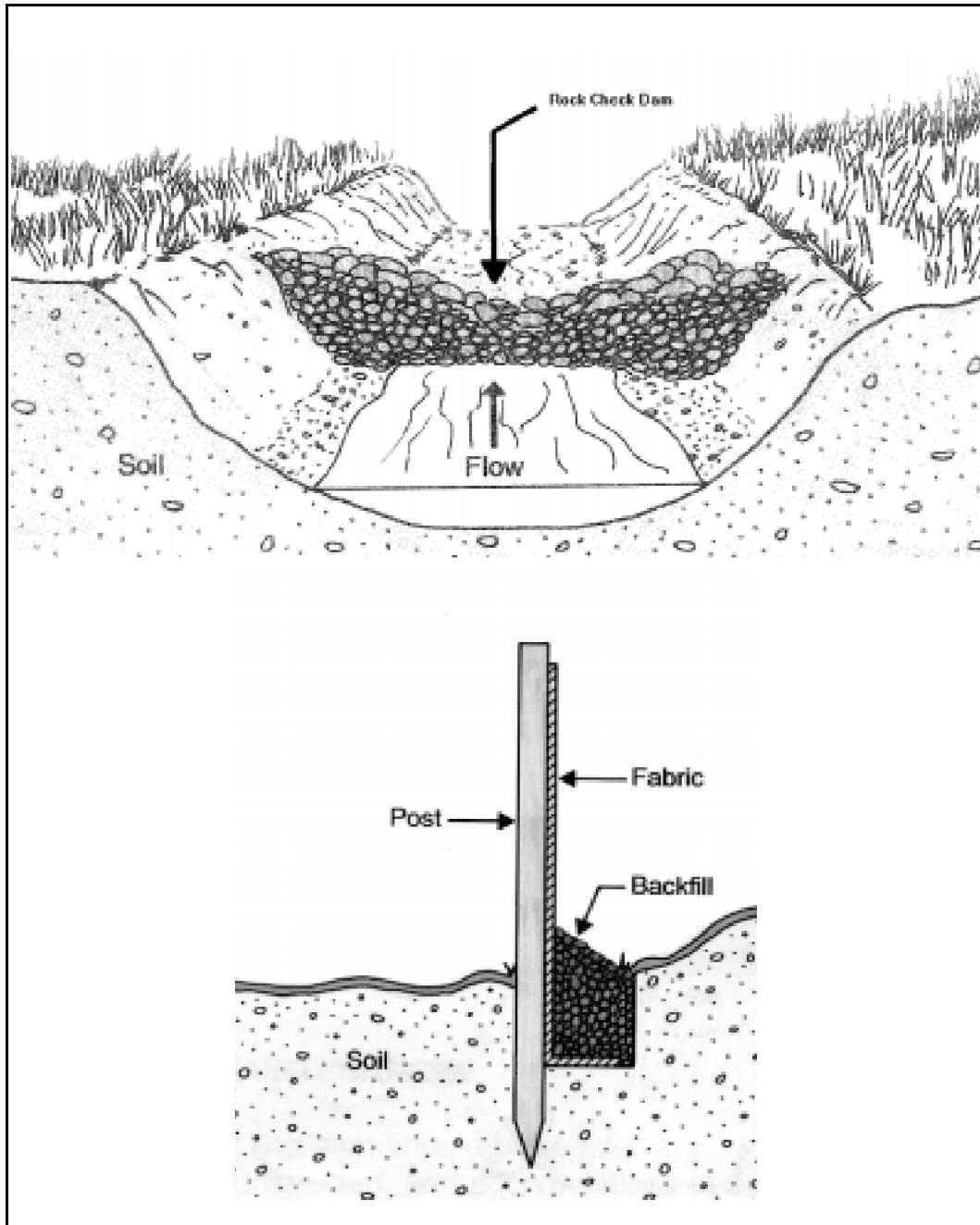


Figure 10.2 Rock Check Dam and Silt Fence Installations Reduce Flow Velocity Reducing Erosion and Allowing Silt to Settle

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10.3.6 Waste Material Disposal

All waste materials must be disposed of at a site approved by the Department.

Where slash and debris are burned, the location must be a sufficient distance from any body of water to prevent pollution by cinders or ash.

10.4 Working in the Dry

10.4.1 Use of Cofferdams

Where excavation or other extensive in-stream work is to be carried out, properly designed and constructed cofferdams must be used to separate the work area from the water so that work can take place in the dry, minimizing the generation of silt.

Cofferdams may be used to completely cut off flow through a section of a small stream or drainage course in order to isolate the construction area while the flow is diverted around the site by temporary culverting or pumping.

When a watercourse is too large to divert by pumping or temporarily culverting, part of the width of the stream may be blocked off to allow work to take place in the dry. Not more than one third of the width of a watercourse should be blocked at any time in order to ensure efficient remaining capacity in the channel to safely accommodate flow without causing excessive high velocity, erosion or overtopping of banks.

Cofferdams should be constructed of non-erodible material to prevent washout of the structure which may result in downstream deposition and siltation. Cofferdams must be constructed tightly to prevent or reduce the amount of seepage into the work area. This also reduces the amount of silted water and mud which would have to be pumped from the work area and be treated prior to release into bodies of water.

Sheet metal or wood panel cofferdams are preferred to cofferdam constructed of till or pit run material as they can provide a tighter structure and do not create problems of siltation and erosion. Sandbags are also a preferred method as they can be removed easily.

Upon completion of the instream work, the cofferdam structure must be removed from the channel carefully and completely, to prevent disturbance of the channel and downstream areas.

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10.4.2 Use of Pumps

Pumps may be used to divert very small streams or drainage courses around an area of construction to prevent the water from becoming silted by contacting disturbed areas and to maintain the site in a dry condition. Where pumps are used to divert flow, cofferdams must be maintained above and below the area of construction. The upper cofferdam should prevent any water from entering the construction area and should provide a sump area from which the water may be pumped. The lower cofferdam should prevent any silted water or mud in the construction area from draining directly into the watercourse as well as prevent clean water from entering the work area.

Pumps of adequate capacity must be maintained at all times, to safely accommodate the volumes of flow occurring in the stream. In the event of pump breakdown, back-up pumps must be immediately available or an alternate method to accommodate the flow around the construction area must be provided without causing siltation in downstream areas.

Pump intakes should be set just below the surface of the water in the sump area to avoid sucking up bottom sediments. This will prevent or reduce silt being transported to downstream areas. The discharge point should be located an area of vegetation or an area with rock where the flow can be returned to the natural channel without causing erosion or picking up further sediment.

Silted water which is pumped to receiving waters must comply with environmental regulations, with particular regard to suspended solids. All necessary measures such as settling and/or filtering must be carried out to remove suspended solids from heavily silted water prior to release into receiving waters.

10.4.3 Temporary Diversion of Channels

Another means of isolating the work area is to construct a temporary diversion channel. The channel should be large enough to handle the predicted flows and should be lined with plastic sheeting or another suitable material which will prevent erosion of the channel.

Upon completion of the instream work, flow should be reinstated to the original channel and the diversion should be backfilled. For further details on diversions, refer to *Chapter 7, “Diversions, New Channels, Major Alterations”*.

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10.5 Treatment of Silted Water

10.5.1 Water Quality Requirement

Where silted or muddied water has been generated, settling ponds, filtration or other suitable treatment must be provided to remove silt and turbidity before discharging into a body of water. Effluent discharged into receiving waters must comply with environmental regulations.

10.5.2 Settling Basins

A properly designed and constructed settling basin is preferred to other methods of silt removal because it provides more effective hydraulic parameters for the separation of heavier particles from the water.

Settling basins must be properly designed taking into consideration such factors as the loading of suspended solids in the water, the particle size gradation, the volume of water to be treated, the rate of inflow and outflow from the settling and the surface area available.

Settling basins should be located in low lying areas where they will not contribute to high ground water conditions and where the water may be either returned safely to the body of water or recharged to the water table. For treating heavily silted water or where large amounts of residual silt are anticipated, an area should be set aside which is accessible by heavy equipment for removal and disposal of the silt. The area may subsequently be upgraded and landscaped.

10.5.3 Use of Other Low Lying Areas or Wetland

For treating lightly silted water or smaller quantities of water, natural low lying areas with some minor modifications can be utilized. Very light organic materials and very fine sediments are more effectively settled in areas where there is active vegetation such as marsh land where biological processes provide natural separation. Such areas can often be utilized effectively with only minor modifications required and can be easily restored without significant detrimental impact on the natural flora and fauna of the marsh or lowland.

Pumping smaller quantities of water into such an area and allowing it to percolate into the ground or gradually make its way back to the body of water is a low cost method of filtering suspended solids.

10.5.4 Other Methods for Removal of Suspended Solids

In some circumstances chemical or mechanical processes may be used to separate suspended solids. The addition of alum (aluminum-potassium sulphate), or similar flocculating agent helps precipitate very fine or

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colloidal particles. Hydro-dynamic separators or similar mechanical processes can provide a fast method for separating heavy particles. Filtration may be used when the quality of water involved is small and adequate provision is made for periodically cleaning the filters.

10.6 Use of Concrete Near a Body of Water

Where cast-in-place concrete is required, all fresh concrete must be kept from coming in contact with the watercourse until adequate curing is achieved. The formwork must be constructed with tight joints to prevent leakage and all necessary precautions taken to prevent spillage of concrete in or near a body of water.

Tools and equipment which have been used for working fresh concrete must not be washed in any body of water or stream.

10.7 Control of Slumping and Erosion

10.7.1 Inspections

Inspections of the construction site and surrounding areas must be carried out periodically and after heavy rains to identify any areas subject to erosion.

10.7.2 Remedial Measures

Where erosion or slumping has already become evident, immediate and appropriate remedial measures are necessary to stabilize the area. Such action can often prevent more serious and extensive erosion problems before the erosive process becomes well established.

10.7.3 Embankment Grading

Final embankments, including roadside and stream embankments, must have finished grades no steeper than two horizontal to one vertical. More gradual slopes will be required where the type of material is extremely fine and subject to washout. Long slopes should be provided with intermittent benching to interrupt the flow of water and prevent cuts and surface erosion.

10.7.4 Protection Of Fill During Construction

Fill material should be placed in layers not exceeding 400 mm and each layer adequately compacted or consolidated to resist slumping or erosion. Exposed embankments or any unstable material which is vulnerable to soil erosion should be protected, as appropriate, by any of the various methods of temporary surfacing including but not limited to:

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- plastic sheets
- economical anti-erosion mats
- mulches (such as wood chips).

10.7.5 Site Restoration and Stabilization

Site restoration and stabilization must be carried out in accordance with the guidelines provided in *Chapter 11, “Restoration and Stabilization”*.

10.8 Energy Attenuation for Erosion Control on Water Courses

Streams which have a small channel capacity with steep banks, will have high flow velocities during storm runoff and are very susceptible to erosion. Streams which flow through areas of very erodible soil (common in low lying areas adjacent to watercourses) and streams having sharp meanders or bends are also prone to erosion. In general, whenever exposed erodible soil along a stream bank is found, especially in conjunction with a restricted channel, or sharp turns, corrective measures must be taken if the resulting construction will itself result in an increased peak flow.

Any mechanical technique that will slow the water velocity is an energy attenuation device. Common examples are the use of rip-rap in steep ditches and grass linings in ditches with a lower gradient. The rocks or the blades of grass serve to slow the velocity of water and prevent the transfer of energy to soil particles.

Where long, steep gradients are involved, energy attenuations are commonly constructed by imbedding bricks, concrete blocks or rocks into the natural stream bed or into concrete or asphalt ditch linings so that the force of water will be retarded and its energy attenuated. The use of check dams, weirs and drop spillways made of a variety of materials, both temporary and permanent, will reduce channel grade and dissipate the energy of flowing water.

10.8.1 Design of Energy Attenuation Structure

Special care has to be taken that the energy attenuation device will adequately dissipate the energy of the water so as not to damage banks or the toe of the structure. Energy attenuation devices frequently result in a concentration of the volume of the water flow with a consequent increase in water velocity at the structure, therefore, banks around grade control structures often require additional stabilization measures.

10.8.2 Reduce Slopes

In those circumstances where steep slopes will result in an unacceptable level of erosion, the flattening of those slopes should be considered as an erosion control practice. The use of retaining walls incorporated into a slope

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will allow the flattening of slopes above and below the structure within the same horizontal cross section. The use of a grade control structure in a stream not only provides energy attenuation but reduces stream gradient upstream and downstream of the structure. A major disadvantage of energy attenuating structures used to reduce channel grade is that they can obstruct the passage of fish. The Area Habitat Coordinator at the Department of Fisheries and Oceans should be contacted before a decision is made on the use of these devices.

10.8.3 Protection of Adjacent Properties

The protection of adjacent properties from accelerated erosion and sedimentation is an important concern. A developer has a legal, as well as a moral responsibility to ensure that his work is of sufficient high quality so as to not create erosion or sedimentation problems on adjacent properties.