G Specific activities

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Preface

This section outlines a number of construction activities where ESC measures need to be integrated into the works or activity. Each activity includes discussion on:

- The unique nature of the activity and the associated ESC issues
- Best practice ESC for the activity.

G1.0 Dewatering

G1.1 Unique nature of this activity

Dewatering is the removal of water from excavations, tunnelling, trenches and sediment control devices. It may be the removal of either surface water or groundwater and is generally undertaken by pumping. This process can generate fine textured material that is difficult to treat and retain on site, even through use of robust sediment control devices such as those described in this guideline.

G1.1.1 Conditions where practice applies

Dewatering devices apply:

- To dewater trenches, excavations and low-lying areas
- To dewater sediment control devices for maintenance, or at the decommissioning stage.

G1.1.2 Limitations

Dewatering has the following limitations:

- Care must be taken when pumping, as it produces fine textured sediment that can have adverse environmental effects
- Always try to minimise the volume of water that requires dewatering. This can be achieved by measures such as limiting the length of the open trench or providing diversions above excavations.

G1.2 Best practice ESC for this activity

G1.2.1 Key design criteria

When dewatering, consideration must be given to the following criteria:

- Minimise the volume of water and levels of sediment
- Retain sediment-laden water on site to maximise the settling of sediment on site (settling may be aided by the addition of flocculant treatment)
- Always dewater the cleaner water at the top first, and then pump the residual sediment-laden water to a sediment retention device, tank or truck. This water can be used as a dust suppressant or to aid compaction
- As a minimum, 100 mm clarity is required to allow water to be discharged offsite

- Small volumes of sediment-laden water can be pumped to a silt fence or decanting earth bund; however, care needs to be taken to ensure that these devices are not overwhelmed
- Larger volumes can be pumped to a sediment retention pond. Always pump to the forebay. Subject to the volumes pumped, the outlet may need to be blocked during pumping and the pond treated following pumping.

There are a variety of options for dewatering, including settling tanks/ skip bins (refer Figure 105); dewatering bags (refer Figure 106); and turkey nests (refer Figure 107).

Figure 105: Dewatering skip bin

Figure 106: Dewatering bag and pipe sock

Figure 107: **Example of a mobile 'turkeys nest'** used for dewatering

G1.2.2 Construction and operation

The following should be considered when constructing and/or operating dewatering devices:

- Plan for dewatering well before it is needed; the majority of excavation works will require some degree of dewatering
- Plan and organise works and construction to minimise dewatering volumes; e.g. by limiting the extent of trenching to that which can be worked and backfilled each day
- Recycle the water wherever possible (e.g. for dust suppression or earthworks conditioning)
- Pump from the top using a float, or similar, to keep the intake off the bottom of the excavation (the area to be dewatered). This will remove cleaner water while avoiding mobilisation of bottom sediments

- A minimum of 100 mm water clarity is required to pump directly off site. If there is not 100 mm water clarity, the water can either be:
  - Treated *in situ* until the clarity is achieved and then pumped off site
  - Pumped to a sediment retention device, tank or skip for settlement or flocculant treatment device before discharge offsite. (Note: If pumping to a decanting earth bund or sediment retention pond, the outlet should be blocked or otherwise prevented from discharging until it has been checked that 100 mm clarity has been achieved before the water is released.)
  - Pumped to a tanker and removed offsite
- Water clarity can be measured using a black target (such as a black disc). The further away the disc can be seen, the clearer the water
- Small volumes of water can be pumped via dewatering bags or pipe socks
- Larger volumes of water can be pumped to a turkey nest for treatment prior to discharge
- Ensure that the outlet to any pumped water is not creating any erosion issues. In some cases, an energy dissipater and a stabilised area may need to be constructed in the area where pumped flows exit into the receiving environment
- Monitoring the discharge is critical to ensure the pumped discharge is meeting the required discharge standards at all times
- Take particular care with pumping, as it produces fine-textured sediments that are very difficult to retain on site
- Sediment retention measures are far less effective for controlling dewatering than erosion control measures (i.e. those that reduce dewatered volumes)
- Ensure that any devices that receive pumped flows are suitably sized and appropriately located. Remember that these devices can hold a significant weight of water when full
- Ensure that pump outlets are securely connected or fixed to any device receiving these flows
- Dewatering requires close supervision and if not monitored, has potential to go wrong fast!

Due to the above limitations, all dewatering should be undertaken in accordance with a dewatering plan prepared by a suitably experienced and qualified professional. This dewatering plan needs to include the following details as a minimum:

- Specific dewatering procedures and methodology
- Dosing rates and batch dosing methodology if flocculant treatment is required
- Monitoring, and contingency measures (including a record sheet).

G2.0 Small sites

As with all earthworks, a combination of multiple ESC practices will be required to effectively manage a small site (a 'treatment train' approach). Further detail on those practices of particular relevance to small sites can be found in the following sections of this guideline:

- Erosion control practices:
  - Non-structural approaches (refer Section E1.0)
  - Clean and dirty water diversion channels and bunds (refer Sections E.2.1 and E2.2)
  - Stabilised entranceways (refer Section E2.6). (Note: Achieving the specifications detailed in Section E2.6 may be different on a small site. The dimensions of a stabilised entrance on a small site will be dictated by the available space. The stabilised entranceway should be designed to provide for likely vehicle movements to the site in accordance with the design purpose, and seek to achieve the outcomes detailed in Section E2.6.1).
- Sediment control practices:
  - Silt fences (refer Section F1.3) (refer Figure 108)
  - Super silt fences (refer Section F1.4)
  - Stormwater inlet protection (refer Section F1.6).
- Specific activities:
  - Dewatering (refer Section G1.0).

Figure 108: Silt fence

G3.0 Roads and utilities

G3.1 Roads

G3.1.1 Unique nature of roading works

Large roading projects, or roads constructed at the time of a new subdivision development, are not generally space-constrained. The conventional ESC methods and devices described in Sections E and F are generally applicable to these earthworks activities.

However, roading upgrades, repairs or realignments in an existing urban environment have unique challenges. ESC for such works is not always as straightforward as it is for general construction.

There are a number of aspects of roading projects that can be considered unique. These include:

- Road projects are linear projects that may cross a number of catchments
- Roading networks can be overland flows paths and works may alter existing drainage patterns
- Works within stormwater flow paths are immediately above, in and around, stormwater inlets
- The works are constrained in the amount of space they occupy
- Works are often undertaken within a 'live' traffic environment
- There may be numerous adjacent properties or land-use activities
- Earthworks areas and volumes associated with road upgrades are often not large in any one area; however, the long and linear nature of roading projects can have a cumulative effect.

For these reasons, roading construction can be more complicated from an ESC perspective relative to general construction projects.

G3.1.2 Best practice ESC for roading works

In existing urban environments, there is often limited space for construction of conventional sediment-control devices. The emphasis is on utilising a 'cut and cover' methodology and stabilising exposed areas at the end of each day's operations. Depending on the extent and nature of the works, they can often be limited to works within the subgrade or widening operations that allow for a cut to waste and replace with a stabilised product (aggregate).

Design

Consider the following points when planning and designing for roading activities:

- Plan works to minimise the extent and duration of site disturbance, particularly in high-risk areas such as close to watercourses and on slopes steeper than 18%
- Pumping groundwater and rainwater out of trenches or excavations generates sediment-laden water that can be difficult to treat in the roadway or limited berm areas. Refer to Section G1.0 for advice on dewatering
- Consider the limitations of space as a result of site-specific issues (Figure 109) including traffic management, pedestrian access, and access to commercial and residential properties
- In the urban environment, the location of buried services and proximity of trees can have an influence on the selection of ESC devices.

Figure 109: Progressive stabilisation in limited space

Construction and operation

Address these aspects when undertaking roading activities:

- There is often limited space for construction of conventional sediment-control devices. The emphasis is on utilising a "cut and cover" methodology and stabilising exposed areas at the end of each day's operations
- Focus on erosion control and stabilise areas as soon as possible (refer Figure 110). Consider material selection for filling operations (i.e. use of hardfill)
- Topsoil and spoil should be stockpiled separately
- Do not put stockpiles of topsoil, spoil or bedding material in overland flow paths or within 1 m of a hazard area such as kerb and channels, stormwater inlets, paved footpaths or driveways
- Any stockpiles that remain on site must be covered with a geotextile fabric at the end of each day or when rain is forecast
- Remove excess spoil and/or undercut material from the site as soon as possible, or immediately incorporate it into other works on site. Where possible, all excavated material that is not required as part of the backfill should be loaded directly onto a truck and removed off site

- Stabilise exposed areas as soon as possible (aggregate for carriageway and footpath areas and topsoil, seed and mulch/geotextile for landscaping and berm areas)
- Backfill and compact trenches or excavations as soon as possible in an immediate and progressive manner. (Note: Open trenches in an existing urban environment can also be a health and safety issue.)
- Dewatering of trenches or excavations must not pollute any stormwater system or downstream watercourse. Pump sediment-laden water to a retention device for treatment and/or removal, or direct it to a tanker for appropriate off-site disposal.
  Refer to Section G1.0 for more information on dewatering
- Take care with use of lime and cement to avoid discharges into stormwater or waterbodies.

Figure 110: Use of stabilisation products and progressive stabilisation

G3.2 Utilities

G3.2.1 Unique nature of utility works

Unless correctly planned and managed, installation of services and utilities such as electricity, gas, water, wastewater and telecommunications can result in significant disturbance to the ground surface. Soil erosion and sedimentation are common environmental impacts of trenching and dewatering of trenches.

During new subdivision development, installation of utilities and services generally takes place towards the end of the bulk earthworks phase. Trenching works may, therefore, traverse areas that have already been stabilised, and in some cases, areas where sediment control measures have already been decommissioned. The trenches are often long and can cut across different water catchments.

In addition, utilities are constantly being upgraded or installed across the existing urban environment within the city's berms and road reserves.

Earthworks associated with the installation of utilities are usually fairly minor in any one area, but can create a cumulative effect. The works are often undertaken along roads and close to stormwater inlets. Pumping groundwater and rainwater out of trenches generates sediment-laden water that can be difficult to treat in the roadway where these works are usually done. Section G1.0 provides advice on dewatering.

G3.2.2 Best practice ESC for utility works

Design

Consider the following points when planning and designing for installation of utilities.

New subdivisions

- Install reticulation systems for water supply, stormwater and wastewater services and for other services and utilities at the same time as road works
- Co-ordinate installation of services and utilities with all relevant service providers and authorities, and where possible, use common trenching
- Make sure that trenching operators working on a larger site are aware of the ESC Plan for the overall site. They should understand that they must comply with its provisions as well as with any specific ESC requirements for their work
- Trenching across flowing streams or watercourses should be avoided. Use an alternative methodology such as directional boring or aqueducts in these situations
- In areas where ephemeral water is likely to concentrate, a dam should be created above the site with sandbags or similar. Works can then commence, and the surface reinstated with a stabilised surface
- Plan the works to minimise the extent and duration of site disturbance, particularly in high-risk areas such as close to watercourses and on slopes steeper than 18%
- When trenching is completed independent of other activities on site, plan for progressive stabilisation and/or restoration of disturbed areas
- Trenches should not be open for any longer than three days; complete the stabilisation of all disturbance in high-risk areas within two days of backfilling, and within five days in all other areas.

Existing urban environments

- There is often limited space for construction of conventional sediment-control devices. The emphasis is on utilising a "cut and cover" methodology and stabilising exposed areas at the end of each day's operations
- Do not trench across flowing streams or watercourses. Use an alternative methodology such as directional boring or aqueducts in these situations
- Plan the works to minimise the extent and duration of site disturbance, particularly in high-risk areas such as areas close to watercourses and on slopes steeper than 18%
- When trenching has been completed independent of other activities on site, plan for progressive stabilisation and/or restoration of disturbed areas
- Trenches should not be open for any longer than possible; complete the stabilisation of all disturbed areas in an immediate and progressive manner. (Note: Open trenches in an existing urban environment can also represent a safety issue.).

Construction and operation

Address the following aspects when installing utilities (also refer Figure 111 below):

- If trenching works affect pre-existing ESC measures, those measures must be carefully removed and then immediately reinstated at completion of the works
- Additional ESC contingency measures will usually be needed for duration of the trenching activities, and until the original measures are reinstated or replaced
- Where practicable, plan and undertake works in appropriately sized stages so that trenching is not open for a period longer than three days and can be stabilised within the range specified above
- Do not open trenches when there is a risk of high rainfall. (Note: An open trench becomes a diversion drain; consider where it will discharge.)
- Divert above-site water away from work areas with temporary diversion drains (refer Section E2.1). Do not allow the trench excavation to concentrate or convey runoff
- Topsoil and spoil should be stockpiled separately on the up-slope side of the trench
- Do not put stockpiles of topsoil, spoil or bedding material in overland flow paths or within 1 m of hazard areas such as kerb and channels, stormwater inlets, paved footpaths or driveways
- Minimise soil loss by protecting all stockpiles with covers such as geotextile fabric
- Remove excess spoil and/or bedding material from the site as soon as work is completed, or immediately incorporate into other works on site
- Backfill and compact trenches within three days and stabilise the area as soon as possible
- Dewatering of trenches must not pollute any stormwater system or downstream watercourse; pump sediment-laden water to a sediment retention device or to a tanker for appropriate offsite disposal. Refer to Section G1.0 for more information on dewatering.

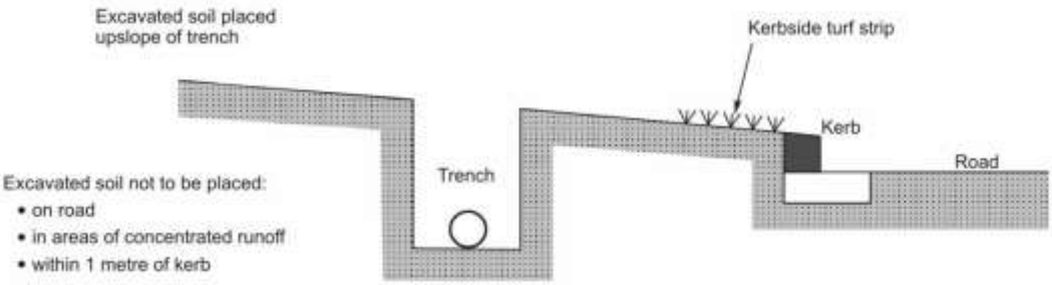

Figure 111: Typical trenching methodology

G4.0 Works within a watercourse

G4.1 Unique nature of this activity

Works in, or around, streams have potential to have a direct impact on watercourse habitat by habitat disturbance or destruction, and on watercourse ecology (such as through sediment and temperature-related effects).

Care is therefore required for works in and around watercourses to minimise potential effects as much as possible. Where this is unavoidable, specific construction methodologies and control measures are required to minimise potential adverse impacts.

Figure 112: Temporary stream diversion to allow for the installation of a new culvert

G4.2 Best practice ESC for works in a watercourse

Permanent crossings must be constructed in accordance with all relevant design and regulatory requirements.

When considering temporary works in watercourses, there are a number of different activities that need to be considered:

- Temporary watercourse crossings
- Dam and pump or dam and divert
- Temporary watercourse diversions (refer Figure 112 and Figure 113).

G4.2.1 Temporary watercourse crossings

Temporary watercourse crossings comprise temporary culverts or bridge structures installed across a watercourse for short-term use by construction vehicles.

Temporary watercourse crossings provide a means for construction vehicles to cross watercourses without moving sediment into the watercourse or directly affecting the streambed, generally while the new permanent crossing is installed.

Figure 113: Stabilised clean water diversion and temporary culvert to divert streamflows while a new culvert is being constructed

Design

The following design criteria apply to this practice:

Location

If a watercourse crossing is required, select a location where the potential effects of the crossing (including construction) are minimised. That is, the ESC measure should be located in a section of the watercourse that is proposed to be modified as part of the permanent design.

Timing

Plan watercourse crossings well before you need them. Construct them during periods of dry weather and outside fish migration seasons (unless other timing is stated in a resource consent condition). The Department of Conservation and Fish and Game New Zealand can help identify these periods for particular watercourses. Complete construction as rapidly as possible and stabilise all disturbed areas immediately during and following construction.

Bridges

Where available materials and site conditions are adequate to bear the expected loadings, bridges are preferred over culverts (refer Figure 114). Bridges provide less obstruction to flow and fish migration, cause little or no modification of the bed or banks, and generally require little maintenance.

Figure 114: A temporary bridge in the process of being installed

However, bridges can be a safety hazard if not designed, installed and maintained appropriately. Specific engineering design is required for all bridge structures.

Typically, control measures are placed between any soil disturbance needed to build the bridge or abutments and the steam channel. The control measures might consist of a super silt fence (refer Section F1.4) or bunds that drain to a decanting earth bund (refer Section F1.2).

Culvert crossings

Culverts are the most commonly used type of temporary watercourse crossing and can be easily adapted to most site conditions (refer Figure 115). However, the installation and removal of culverts causes considerable damage to watercourses and can also create the greatest obstruction to flood flows and fish passage. As far as practicable, the temporary culvert should be located in a section of the watercourse that is to be modified as part of the permanent design (i.e. a section of stream that may be filled as a result of a new culvert crossing).

When installing a temporary culvert, sizing is important as stormflows could cause erosion or overtop the culvert causing failure of the temporary access.

For temporary stream crossings, the cross-section of the culvert should be sized for approximately 85% of the channel cross-section.

To ensure minimal adverse impacts, scour protection is also required to ensure the integrity of the crossing in the event of overtopping.

Figure 115: In the process of constructing a temporary crossing

Consideration must be given to overland flowpaths to ensure that larger flows do not cause excessive safety or environmental impacts. This will typically include confirming that in larger floods, there is no increase in flood level upstream (up to the 1% AEP storm in flood-sensitive areas).

Even though culverts are temporary, ensure that fish passage is not impeded in permanent streams.

As well as ESC measures, structural stability, utility and safety must also be considered when designing temporary watercourse crossings. In addition, it is likely that consents will be required for the construction of the proposed crossing. Greater Wellington Regional Council planning staff can assist in determining whether this is the case. Any temporary crossing must comply with the conditions of consent or the Greater Wellington Regional Council planning rules.

Streamflows will need to be diverted during installation of the temporary culvert so that the works can be undertaken in dry conditions. Refer to Sections G4.2.2 and G4.2.3 for methodologies to complete streamworks in dry conditions.

Maintenance and decommissioning

Inspect temporary watercourse crossings after rain to check for any channel blockages, erosion of the banks, channel scour or signs of instability. Make all repairs immediately to prevent further damage to the installation.

When the structure is no longer needed, remove it and all material from the site. This will largely be undertaken in reverse of the installation methodology. Streamflows will need to be diverted while the removal and reinstatement of the stream is underway. Refer to Sections G4.2.2 and G4.2.3 for methodologies to complete stream works in the dry.

Immediately stabilise all areas disturbed during the removal process by revegetation or artificial protection as a short-term control measure. Keep machinery clear of the watercourse while removing the structure.

G4.2.2 Dam and pump or dam and divert devices

A dam and pump or a dam and divert are temporary practices used to convey surface water from above a construction activity downstream of that activity (refer Figure 116).

These diversion methodologies will assist in providing dry working conditions for culvert installation. Damming a stream and pumping the flows around the worksite back to the stream considerably minimises disturbance relative to constructing a new diversion channel. With high flow streams, diversions are sometimes the only option; however, with most small streams, damming and pumping are less harmful to the environment and relatively simple to carry out. A dam is also essential to temporary waterway diversions that are discussed in Section G4.2.3.

Figure 116: Water being diverted past a construction works area

Design

The dam is constructed across the stream with stabilised materials such as sandbags, sheet metal plate or other suitable construction materials. A pump is installed in the dam and sufficient hose length must be available to reach below the extent of in-stream works (refer Figure 117). The pump inlet should be placed in a drum with holes to minimise the possibility of sucking sediment from the bottom of the dam. Inclusion of a fish screen is recommended. The outlet should be directed to a stabilised area with an energy dissipater such as rip-rap boulders or similar.

Figure 117: Commencement of over pumping to allow for in-stream works

A dam and pump methodology can only be used for works with a short duration or where the site can be stabilised at the end of each work day, so that flows can continue through the stream channel. Generally, it is not considered appropriate to implement a dam and pump methodology where the pump is required to be operating day and night for the duration of the operation (due to noise and pump reliability issues).

Sizing the pumped diversion for a given storm event depends on the duration of the stream diversion. As a minimum, the temporary pumping should be sized for a one-year peak discharge from the contributing catchment. These design parameters are based on the assumption that full channel 5% AEP (20 year) capacity is made available overnight or when storm events are predicted.

Construction and operation

Consider the following when construction and/or operating these devices:

- The dam must be capable of holding back the incoming flows
- The pump must be capable of conveying the flows, as overtopping the dam will cause environmental and construction issues with flows passing through the work site.

G4.2.3 Temporary watercourse diversions

These short-term watercourse diversions allow work to occur within the main watercourse channel under dry conditions (refer Figure 118).

Temporary waterway diversions enable in-stream works to be undertaken without working in wet conditions and without moving sediment into the watercourse.

Temporary watercourse diversions are used as temporary measures to allow any works to be undertaken within permanent, intermittent and ephemeral watercourses.

Figure 118: Examples of temporary stream diversion installed to allow permanent culverts to be installed off-line

Design

These measures seek to divert all flow via a stabilised system around the area of works and discharge it back into the channel below the works to avoid scour of the channel bed and banks. Figure 119 to Figure 122 show the suggested steps to minimise sediment generation and discharge from works within a watercourse.

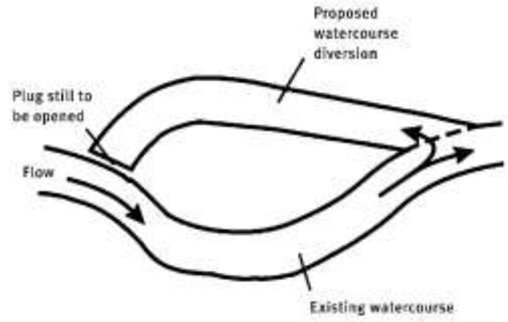

Figure 119: Diversion channel prior to plug removal

Step 1

The diversion channel should be excavated leaving a plug at each end so that the watercourse does not breach the diversion.

Size the diversion channel to allow for a 5% AEP rain event, but consider the implications for secondary flow paths and upstream flood effects of having a larger event, up to 1% AEP.

The diversion channel should be appropriately stabilised to ensure it does not become a source of sediment. Suitable geotextile cloth (as discussed in Section E3.5) should be anchored in place to the manufacturer's specifications, which will include trenching into the top of both sides of the diversion channel to ensure that the fabric does not rip out.

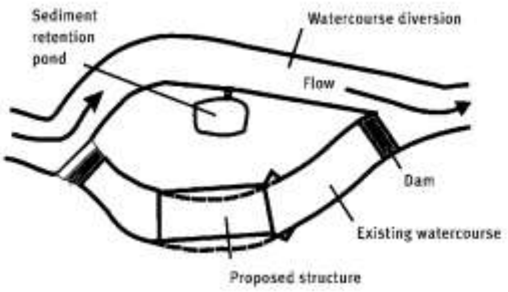

Figure 120: Dewatering construction area into a sediment pond

Once the channel is stabilised, open the downstream plug to allow water to flow up the channel, keeping some water within the channel to reduce problems when the upstream plug is excavated. Then open the upstream plug, allowing water to flow into the channel.

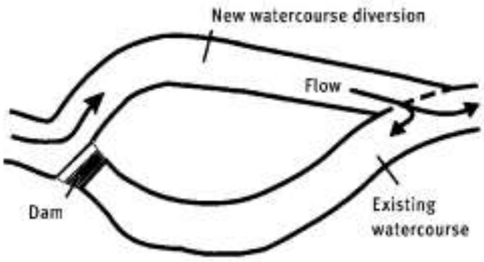

Figure 121: Opening up bypass channel and closing off existing one

Step 2

A non-erodible dam should be placed immediately in the upstream end of the existing channel. The dam should be designed as specified in Figure 123. Where a compacted earth bund is used, it must be stabilised with an appropriate geotextile pinned over the upper face and adjacent to the lower face for scour protection. In most cases, sandbag dams can be used to construct the dam.

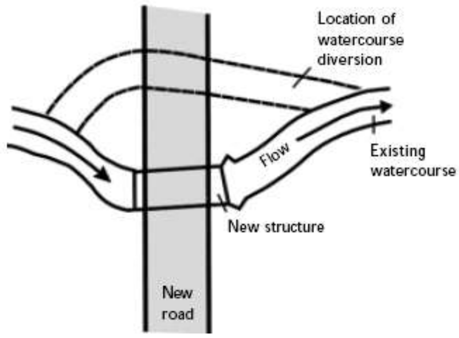

Figure 122: Re-establishment of flow in original channel

Step 3

A non-erodible downstream dam should then be installed to prevent backflow into the construction area. The existing watercourse is subsequently drained by pumping to a sediment retention pond, where the ponded water can be treated before it re-enters the live section of the watercourse. The structure and all channel works are then completed.

Step 4

The downstream dam should be removed first, allowing water to flood back into the original channel. The upstream dam is then removed, and both ends of the diversion channel are filled in with non-erodible material. Any sediment-laden water should be pumped to a sediment retention pond or dewatered (refer Section G1.0). The remainder of the diversion channel should be filled in and stabilised.

Coffer dam diversions

In some circumstances, partial diversion of a watercourse is required to allow for the construction of outfall structures or stream bank retaining works. In these situations, a coffer dam may be used to create a dry working environment to complete the works (refer Figure 123).

Generally, the coffer dam will be constructed within the streamflows. As such, it needs to be of non-erodible material such as sandbags, sheet piles or similar. Once complete, the water retained by the coffer dam within the work area is pumped out to provide the dry working area. Any dirty water within the coffer dam during the works will need to be pumped to a sediment retention device (refer Section G.10 – Dewatering).

Figure 123: Sandbag coffer dam installed to complete stormwater outfall

The coffer dam design will need to assess the height of water to be diverted including any likely increased flows within the construction period.

Maintenance

Any works within a watercourse require ongoing and vigilant maintenance to minimise sediment generation. To achieve this, identify and correct any signs that may indicate a potential problem. Take notice of the following signs and make repairs immediately:

- The geotextile lining ripping
- Scour occurring where the flow re-enters the channel
- Undercutting of the diversion lining.

G5.0 Winter earthworks

G5.1 Planning and management of winter works

While large rain events often occur during summer, the most frequent and overall greatest amount of rainfall in the Wellington region occurs from late autumn to early spring creating a greater risk of sediment generation and discharges from earthworks sites. In turn, there are greater challenges to adequately manage sites and minimise off-site effects. Winter also presents challenges in working, drying and compacting fill, and managing streamworks during periods of higher and more frequent flows. For these reasons, winter works require careful planning and management, based on the following principles:

- Plan the project to minimise earthworks and avoid streamworks during winter
- Be realistic about the works that can be achieved during the winter period
- Stabilise as much of the site by 31 May to minimise the works area over winter
- Design for topography considering that low gradients and short slopes will be easier to manage than long or steep slopes
- Understand what controls will be used to manage winter works areas and what additional controls can be implemented to further reduce the risk of sediment discharges from the site
- Ensure the controls can be accessed for maintenance during continued periods of wet ground conditions
- Design to progressively stabilise areas to minimise the area exposed to erosion
- Ensure winter works areas will minimally impact the receiving environment.

G5.2 Applying for winter works approval

Resource consents often include conditions that prevent earthworks occurring on the consented site between 1 June and 1 October, unless specific approval is given by Greater Wellington Regional Council. To obtain approval, contractors or consent holders must submit an application to Greater Wellington Regional Council to carry out winter works. The application is normally required to be submitted at least four weeks before 30 June and include supporting information. Before lodging the application, it is important to discuss the likely winter works requirements with an Greater Wellington Regional Council compliance inspector. This will provide a good lead time for site planning and the approval process. The Greater Wellington Regional Council compliance inspector will be able to provide useful guidance on the issues to consider, and the process to follow, and will be a key person in deciding if the winter works application is granted.

An application for winter works approval must address the matters listed in the following section. Applications for winter works approval are assessed on their merits. Do not assume that winter works approval will be given by Greater Wellington Regional Council and it is given as an exception.

Reason for winter works

- Be realistic. The intention of placing restrictions on winter works is to minimise the risk of erosion and sediment discharges to receiving environments. Accordingly, Greater Wellington Regional Council is unlikely to approve an application for extensive areas of earthworks through winter
- If bulk earthworks are to be undertaken during winter, the reason for that must be clearly described to Greater Wellington Regional Council. Poor planning or programming are unlikely to be considered acceptable reasons for winter works approval.

Avoid streamworks

- The highest average and continuous flows in streams occur during winter. Consented streamworks will be required to occur before winter and it is unlikely that Greater Wellington Regional Council will grant approval to undertake streamworks in winter. Plan to have streamworks completed by 30 June.

Track record and site management

- The request for winter works approval needs to consider the site's compliance history, and how any previous non-compliance issues have been addressed and will be avoided during winter. This may include upgrading controls or re-assigning management of erosion and sediment control to different personnel
- Describe the monitoring and maintenance programme that will be implemented during the winter works, weather forecasting, pre-storm preparation, pre- and post-event inspections, frequency of de-silting of treatment devices, disposal of excavated sediment, and emergency response procedures
- Provide names and contact details of the personnel undertaking that work, and who has overall responsibility for ensuring compliance with the requirements of a winter works approval.

Minimise exposed areas

- Plan and describe how the works areas will be minimised and progressively stabilised to minimise the area of exposure. This is a critical aspect of winter-works management and approval
- Identify the source and availability of stabilisation (e.g. mulch), including at short notice.

Soil type

- Consideration of soil type must be included in the winter-works request. Clay-based soils are considered to present an elevated risk, whereas sandy soils or rock have higher permeability and less erodibility. Understanding the site's soils will assist in identifying the correct management and controls.

Slope

- The site's topography is a key consideration in assessing applications for winter works. Flat or low gradient sites present a lower risk of sediment generation and discharge. Conversely, steep sites present a high risk. Likewise, longer slopes present a high risk of sediment generation, as they generate higher volumes of runoff and concentrated erosive flows
- Assess the slopes across the site, and the proposed staging (area and timing) so that works on the steepest and longest slopes are avoided or minimised.

Programming and risk

- Areas of highest potential risk must be identified, and the request must explain how works in these areas have been programmed to avoid, to the best extent practicable, adverse weather events. Such areas will include steeper and longer slopes and works immediately adjacent to water bodies or neighbouring properties.

Receiving environment

- Consider the proximity and characteristics of the receiving environment and explain how this has been addressed in planning and programming the works. Winter works should be avoided where they are located within close proximity of high-value receiving environments or present an increased risk of sediment effects on neighbouring properties.

Site access

- Identify how erosion and sediment controls will be accessed and managed throughout winter. It's critical that controls can be accessed and maintained, including removing sediment, when ground conditions are wet.

Chemical treatment

- Specify what additional treatment may be implemented and detail any increased monitoring and maintenance requirements for the treatment system
- An updated Chemical Treatment Management Plan may be required
- Ensure adequate quantities of the appropriate chemical are on site and easily accessible.

Erosion and sediment control plan

- An application for winter works approval must include an updated Erosion and Sediment Control Plan and Methodology Statement that specifically addresses the winter works areas, taking account of the factors discussed above. It may be necessary to provide a series of plans that reflect the various stages of winter works, and how areas will be completed and stabilised
- The winter works Erosion and Sediment Control Plan must include simple, clear instructions to personnel on how the works will be implemented and managed. Discuss the content of the winter works Erosion and Sediment Control Plan with the Greater Wellington Regional Council compliance inspector before it is prepared and submitted.

G6.0 Quarrying

G6.1 Unique nature of this activity

Quarries can present a major source of sediment, with activities such as overburden removal and aggregate handling identified as higher-risk tasks. Quarries are often long-term operations, with a point-source discharge from the site. Sediment-laden discharges from quarries have potential to affect receiving water quality if they are not adequately managed.

The following quarry activities can cause sediment generation, and are addressed in more detail below:

- Road establishment and access (including watercourse crossings)
- Overburden removal and disposal
- Quarry-product stockpile management
- Traffic management (tracking sediment onto public roads)
- Rehabilitation of worked out/completed areas.

This section provides a series of prompts to help quarry operators and their advisors understand and assess options for ESC. It should be read and implemented having regard to the principles of ESC (Section A2.0) and Sections E and F of this guideline, which detail specific ESC practices.

G6.2 Best practice ESC for this activity

G6.2.1 Quarry access

Many quarries in the Wellington region are serviced by all-weather metal roads. Establishing these roads and their use can generate a lot of sediment. Watercourse crossings need to be authorised as a permitted activity or by a resource consent. Quarry access roads are not always within the designated quarry area, but their maintenance and upkeep should be addressed in the Quarry Management Plan.

Standard ESC principles and planning (refer Section A2.0) apply to the construction of access tracks or roads. ESC measures need to be used where sediment is generated from the use of these tracks (refer Part 2, Sections E and F). Typical measures include the use of rock check dams in roadside drains (Section E2.4), and diversion of the dirty water to a storm retention pond (Sections E2.2 and F1.1) or decanting earth bund (DEB) (Section F1.2). Truck wash bays and run-out areas may be needed to ensure sediment is not tracked onto public roads. Where possible, incorporate site access into the Quarry Management Plan, including details of all maintenance requirements.

G6.2.2 Managing clean and dirty water

Refer to the key principles of ESC (refer Section A2.0) when developing the Quarry ESC Plan. Keep as much water clean as possible. This can be achieved by limiting the exposure of erodible surfaces and ensuring all dirty water is diverted to suitable treatment devices prior to discharge.

Clean water

Divert all clean (up-slope) water away from working and bare areas, if possible, to prevent it from entraining sediment. This will reduce the volume of contaminated runoff to be managed and treated. Channels to divert clean water around the working site, as outlined in Section E.2.1, are often the best means of managing these flows. Plan for these channels to be relocated, in the event that the quarry footprint changes over time.

Sediment-laden water (quarry water runoff)

Any runoff from bare soil areas, rock processing and aggregate wash processes must be managed and treated appropriately before discharge to the receiving environment. The ESC Plan should detail the methods for sediment control (refer Section F). Attention should be given to sensitive areas such as permanent watercourses, watercourse crossings (refer Section G4.0) and steep areas.

Due to the texture of Wellingtons soils and fine particles generated from quarrying activities, sediment retention ponds with flocculant treatment are likely to the most successful and reliable method of treating and retaining sediment (refer Sections F1.1 and F2.0), especially for sites with a water quality discharge standard. Ensure the structural integrity of any such pond is carefully planned for and fully engineered.

Similar to clean water management, proactively plan to manage flows to sediment retention ponds and associated water treatment (such as a flocculation plant), if the quarry footprint/sediment pond catchment changes over time.

Ensure that where catchment areas are anticipated to increase, the sediment retention pond is either initially constructed for the greatest anticipated catchment, or that there is sufficient space to allow the pond to be enlarged.

G6.2.3 Overburden removal and disposal

Overburden is the material that lies above the targeted rock or mineral resource. Overburden removal and disposal activities are generally the same as earthworks cut-and-fill operations and should comply with normal earthworks requirements. The ESC principles in Section A2.0 should be adhered to, with detailed ESC Plans prepared and implemented prior to and during the operation.

G6.2.4 Quarry product handling and stockpiling

Quarry product handling and stockpile areas can be a major source of sediment-laden runoff if not properly controlled. Incorporate these areas into the Site ESC Plan.

G7.0 Agriculture (farm tracking)

The construction and maintenance of farm tracks will generally require earthworks. While the volume of these earthworks will generally be low, as with all earthworks, the potential and/or actual effects of erosion and sediment discharge need to be minimised. The general principles of ESC in Section A2.0 should be applied to all farm tracking earthworks.

In addition, the following sections of this guideline provide further reference for ESC practices appropriate for use during farm tracking:

- Erosion control practices:
  - Non-structural approaches (refer Section E1.0)
- Sediment control practices:
  - Decanting earth bunds (refer Section F1.2 and Figure 124)
  - Silt fences (refer Section F1.3)
- Specific activities: Works within a watercourse (refer Section G4.0).

Figure 124: Decanting earth bund and diversion bund installed during a farm track construction

G8.0 Soil binders

G8.1 Unique nature of this activity

Soil-stabilising agents (also known as soil binders) are used to form a cohesive membrane or protective crust that reduces windblown dust generation.

The purpose of soil binders is to prevent, or reduce, the movement of dust from disturbed soil surfaces that may create health hazards, traffic safety problems and offsite damage. They may also reduce the effect of raindrop erosion and therefore, minimise sediment runoff. However, the effectiveness of their use for this purpose has not yet been verified.

Soil binders may be liquid or powdered products, either organic (e.g. guars, latex or various other timber resins) or chemical (e.g. acrylic copolymer or anionic bitumen emulsions or cementitious gypsum- or lime-based products). They are used to provide short-term protection of stockpiles, steep or relatively unstable slopes, compound areas, and inactive haul roads, etc. Some binders may also be included in hydroseeding or hydromulching operations to tack seed and/or wood fibre to the soil surface on steep slopes. A granular form of calcium or magnesium chloride may also be used to absorb atmospheric moisture and suppress dust on active haul roads and access tracks.

Soil binders can be used anytime where protection of the soil surface is desired; although the following conditions are generally applicable:

- Use soil binders and chloride dust suppression agents where short-term protection is required; generally less than 6 months
- Use soil binders and chloride dust suppression agents where almost instant dust protection is required
- Do not use soil binders where the established soil crust is likely to be damaged
- Do not use soil binders or chloride dust suppression agents in areas of concentrated flow or in areas where periodic inundation is likely to occur
- Do not use soil binders or chloride dust suppression agents immediately next to streams or other water bodies.

The following limitations apply to soil binders:

- If managed well as part of a treatment train approach to site management, they can provide good dust control and may also reduce the effect of raindrop erosion. However, the use of soil binders does not constitute stabilisation of the site. Sediment controls will still need to be retained until the site has been stabilised (i.e. vegetated, sealed, or covered with aggregate or cloth)
- For soil binders to be effective, their surface crust must remain intact. Keep construction equipment and site vehicles, pedestrians, wildlife and/or livestock out of all treated areas
- Hardy colonising species, such as woody weeds, can break through the crust

- Anionic bitumen emulsions, some acrylic copolymer emulsions and chloride dust suppression agents have potential to pollute some sensitive receiving waters. Generally, these should not be used immediately next to streams or waterbodies. In some areas, the use of bitumen emulsions may conflict with established community perceptions.

G8.2 Best practice ESC for this activity

G8.2.1 Design

There is no formal design procedure for soil binders, and products on the market are constantly changing. The following general principles should be followed:

- Confirm with Greater Wellington Regional Council which products are acceptable for use. Use of soil binders or products should be undertaken in accordance with a documented Soil Binder Management Plan
- Follow the manufacturer's recommendations for application rates and procedures.

G8.2.2 Construction, operation and maintenance

Construction and operation

For application of soil binders, use the following procedures:

- Intercept up-slope runoff water and divert it around areas to be temporarily stabilised with soil binders
- Follow the manufacturer's recommendations for the correct application procedure
- Best results are obtained on friable soils. If necessary, lightly scarify the soil to allow the binder to fully permeate the soil surface. (Note: Adding a wetting agent may also help this.)
- Soil binders are generally mixed with water before application. Stir or shake powdered products
- Apply the solution over the area to be protected via the spray bar on a water cart, a hose with a fine spray nozzle, or through the cannon on a hydroseeder unit
- Establish temporary exclusion zones around areas treated with soil binders and clearly identify and/or signpost these. Discuss exclusion zones in routine toolbox meetings and at site inductions.

Maintenance

Inspect soil binders after each rainfall event or periods of excessively strong winds. In addition, inspect weekly and:

- Check for damage to the soil binder membrane caused by earthmoving equipment, construction vehicles, slips or slumps, inundation, ultraviolet degradation, livestock, wildlife or vandalism (motorcycles, four-wheel drives, etc.)
- Repair any damaged areas immediately by reapplying the soil binder, or by covering the damaged areas with a temporary mulch or blanket
- If necessary, erect temporary barrier fencing and/or signage to restrict uncontrolled movement of equipment and vehicles onto treated areas

- Check soil binding agents have not been removed by excessive traffic movements, track runoff during wet conditions, routine grading or other haul road maintenance activities
- Reapply as required to minimise dust generation.

G9.0 Dust control

G9.1 Unique nature of this activity

Dust control comprises the control of dust movement on construction sites. It is important to prevent or reduce the movement of dust from disturbed soil surfaces that may create nuisance, health hazards, traffic safety problems and/or offsite damage and discharge to the environment (refer Figure 125).

Areas subject to dust movement include open earthworks areas exposed to wind, stockpiles of materials, bulk materials handling or vehicle movements.

The effectiveness of dust control depends on moisture content and particle size of the soil or material, temperature, humidity and wind velocity/direction.

The availability of sufficient water is also critical to effective dust control. This is required to maintain the moisture content of surfaces and materials.

Figure 125: Forward planning and management to minimise dust provide the best options for control

G9.2 Best practice ESC for this activity

G9.2.1 Design

Forward planning and management to minimise dust problems provide the best options for control. If dust management is only addressed after it has become a problem on site, it is very difficult to bring under effective control until the site has been stabilised.

The following methods for dust control apply:

Water sprinkling

The most commonly used dust control practice; water is normally applied for dust suppression via a water cart or sprinkler system (refer Figure 126 and Figure 127). Either system requires a minimum amount of water to achieve effective dust control.

Figure 126: Dust suppression using a water cart

The Ministry for Environment’s (2016) *Good Practice Guide for Assessing and Managing Dust* recommends 1 litre/m^2/ hour (or 1 mm/m^2/hour) of water is available on-site for this purpose. However, this is generally considered conservative as the minimum amount of water that should be available on site is 5 mm/m^2/ day. This should be applied incrementally so the ground surface remains moist.

Figure 127: Snow blowing machine to provide dust control during a liming operation

Water carts can carry various volumes; however, their use is limited by the ability of the vehicle to access the areas that require wetting.

A sprinkler system may also be used where large areas are open or where the terrain is too steep for water carts. Sprinkler systems may also be used where irrigation is useful to establish vegetation following earthworks completion.

A reliable source of water is required.

Soil binders

Soil-stabilising agents (also known as soil binders or polymers) can be used to form a cohesive membrane or protective crust that reduces windblown dust generation (refer Figure 128).

Figure 128: Dust suppression using soil binders/polymers

Follow the manufacturer’s recommendations for suitability of products for each situation, application rates and procedures.

Further detail on soil binders is provided in Section G8.0.

Mulching, grass establishment and gravelling (progressive stabilisation)

Refer to Sections E3.4 and E3.3 for specifications on mulching and grass establishment.

Surface mulching can be used as a temporary mulch (e.g. straw) to cover stockpiles, or other areas not worked for an extended period. Otherwise it can be progressively applied in conjunction with permanent revegetation works. Site coverage can be extended to include gravelling of compound areas, haul roads and access tracks.

Temporary vegetative cover can be used on stockpiles or other areas not worked for an extended period. Otherwise, permanent vegetative cover can be progressively applied to completed areas. Vegetation will reduce wind velocity at ground level and stabilise the surface.

Geotextiles

Geotextiles are discussed in detail in Section E3.5. Geotextiles can be used as a temporary cover (e.g. geotextile fabric) on stockpiles, or partially completed batter slopes. Otherwise, they can also be used as a permanent cover (e.g. vegetation promotion blanket) on completed areas.

Management practices

For a full description of recommended management practices for controlling dust, refer to the Ministry for the Environment's (2016) *Good Practice Guide for Assessing and Managing Dust.* Common practices include:

- Minimising the area of soil exposed to the wind by staging works across the site
- Limiting traffic to established haul roads and minimising travel distances by optimising site layout
- Controlling vehicle speeds
- Maintaining the surface of roads
- Minimising track out of dirt on vehicle wheels onto paved surfaces
- Minimising drop heights when loading and unloading vehicles
- Limiting the height of stockpiles
- Providing shelter from the wind for stockpiles
- Consolidating loose surface material.

G9.2.2 Construction, operation and maintenance

Construction and operation

The following specifications apply to installing dust controls:

- During periods of low moisture conditions, apply enough water to prevent dust generation without causing runoff (refer Figure 129)
- Once areas are damp enough to prevent dust generation, regularly apply enough water to replace that lost through evaporation. This will often be an ongoing operation
- Where dust suppressants, 'sealing off' areas or isolating areas are used as control measures, adequate controls are needed to isolate these areas from construction traffic or activities. This may include fencing, signage or bunding.

Figure 129: Water truck dampening down the works area

Figure 130: Regular wetting of the haul road

Maintenance

For maintenance of dust controls:

- As a minimum, monitor dust emissions daily. In windy, dry conditions, review dust emissions continuously
- Reapply water as required to effectively manage levels of dust generation, especially when soil moisture conditions become low during hot and windy conditions (refer Figure 130).