

Site Sediment and Erosion Control Plan

For

The Remarkables Sugar Bowl project



Report Details:

Client: The Remarkables Ski Area

Site Location: Section 1-2 Survey Office Plan 22561 and Section 1 Block X Kawarau Survey District.

At an elevation of 1600m rising to 1868m asl comprises undulating alpine terrain – rock and native flora, intersecting drainage courses and isolated wetlands. Area of earthworks covers 120,000m².

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Introduction:

Purpose:

This site management plan is intended to outline the procedures and practices that are to be implemented by Base Contracting Ltd to manage, remedy and mitigate potential environmental effects caused by earthworks on site where up to 170,000m³ of material maybe moved about the site and adhere to all statutory requirements whilst undertaking the earthworks for The Sugar Bowl trail development, where 2 new trails will be developed over 2.1km.

Scope of Management Plan:

This site management plan has been designed as a management tool that will provide direction for the earthworks being undertaken at The Remarkables Ski Area by Base Contracting Ltd. It outlines the measures to be used during the earthworks contract to comply with the conditions of resource consent.

Objectives of Management Plan:

- To ensure compliance with all statutory requirements
- To ensure the protection of the surrounding environment; and
- To provide for environmental management and monitoring.

Specific issues to be addressed in this plan include:

- Description of site, compound areas and parking
- Storm water management
- Dust, Sedimentation and erosion control measures
- Noise and vibration control measures
- Minimisation and removal of waste
- Temporary Fire control
- Review of Site Management Plan

Overview of Project:

Base Contracting have been engaged to undertake bulk earthworks in relation to the trail development at The Remarkables Ski Area. All of the material will be shifted on site and remain on site.

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Context

The trail development once completed will add an additional 2.1kms of trail to the existing network in Sugar Bowl. The individual trails outlined south to north in **Figure 1** (Overall layout and Part Area Volume Plan) below are in the following lengths and quantities

Area A: 305m long, Trail width 50m wide, Cut – 33,000m³, Fill – 22,000m³ covering 17,000m²

Area B: 455m long, Trail width 50m wide, Cut - 39,000m³, Fill – 45,000m³ covering 32,000m²

Area C: 500m long, Trail width 30m wide, Cut - 33,000m³, Fill – 42,000m³ covering 28,000m²

Area D: 440m long, Trail width 30m wide, Cut – 45,000m³, Fill – 38,000m³ covering 28,000m²

Area E: 480m long, Trail width 30m wide, Cut – 12,000m³, Fill – 25,000m³ covering 18,000m²

Figure 1 below, differentiates the cut areas (in red) and the fill areas (in green). The scale up the side of the drawing indexes the gradients of cut/fill changing in colour with every meter in height movements either way.

Figure 1: Surveyed trail layout.



Site in relation to catchments

The area has a westerly aspect to it. The basin is enclosed by steeper faces (headwalls) circulating around two thirds of the upper reaches of the development.

The northern trail outlined as Area D & E, 30m wide, sits at the base of steeper faces rising another 100 vertical meters above it. The natural fall once at trail level is in a westerly direction. The ground is extremely porous along the toe of the steeper faces with water disappearing into the open and fractured rock at surface. The bulk of this area is open and fractured rock which has established over many years falling from the faces above. There is less than 1% vegetation in this area apart from lichen on rock faces.

The Area marked as Area C sits on a slope and has various drainage channels feeding away down the slope to the west. They do not always run depending on the amount of precipitation and intensity at the time. The vegetation in this area comprises mainly of Macra tussock, cushion fields and closer to the drainage areas wetland grasses and other flora.

Area A is predominantly on a ridge and does not have any common water courses established within or along it's transition. It has a mix of vegetation from tussock to fell fields and bare open surfaces.

Area B is mainly covered by cushion fields and small grasses, there are no known drainage channels established within it or along its path.

Soils area scarce across all areas and depths range from 0 to 20cm cover. Where there are soil deposits vegetation covers approximately 90% of the area.

Site Plan catchment:

Figure 2: Surface water direction of travel.

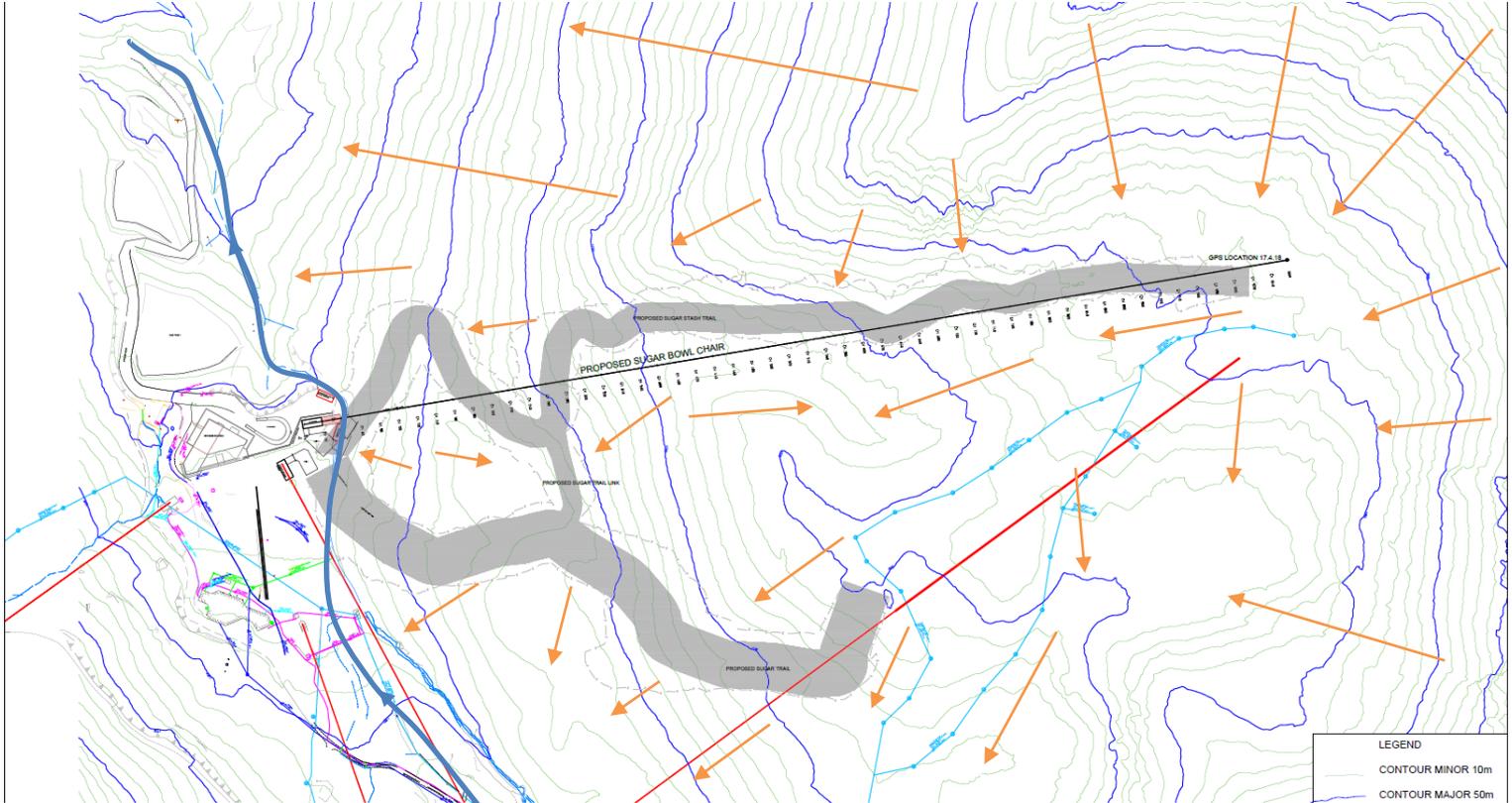
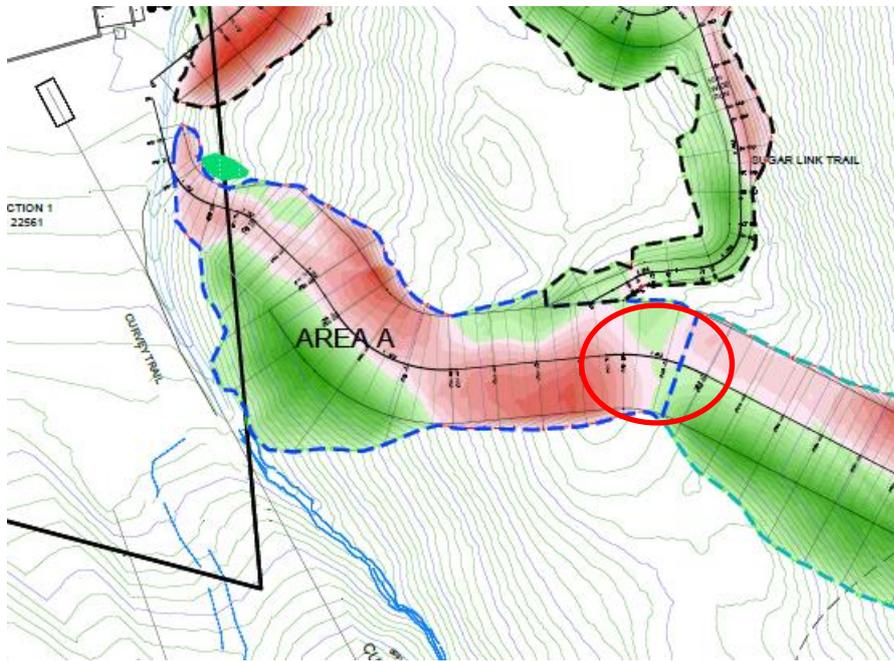


Figure 2 above shows the direction of fall in the lay of the land, signalling which direction any surface water will travel on the existing landscape.

Brown arrows indicate the approximate direction of runoff from the site.

The highlighted **Blue** line references to the Rastus Burn stream

Figure 3 Compound area.



The compound area is highlighted by a red circle on the above map (figure 3). Base Contracting will establish a lay down area for its site facilities, office and a 'go line' for heavy earthmoving machinery to be stored safely overnight and over weekends. Visitor parking for Base staff, subcontractors and visitors will be located at the compound area shown on the above map and signposted on site.

Further details are outlined below.

Construction Methodology:

The following is a summary of the construction methodology envisaged (please refer to the map on figure 1)

Site Establishment Works:

Initial works will be the site establishment. This will involve construction of a platform at the site compound. Light vehicle access will be by an already established road from the base lodge at The Remarkables ski area. This road at present is gravel type base. This road like all roads throughout the site will be monitored and if required reformed by grader to maintain a crown and prevent water running along the wheel tracks for any distance.

The compound area will then be established.

Opening up landscape to commence trail development will entail the following -

- Commence in Area A clearing a path on the gradient of the trail removing all vegetation (mainly Macra tussock primarily). All tussock to be located and stored in an area where it can be monitored and later relocated to the finished trail batters or trail surface.

- Create a clear area to commence cut to fill measures and as one area of 2,000m²+ is shaped take tussock from the next section and place them on the finished trail area, therefore minimising tussock disturbance.
- Initially the cut to fill measures for that area will be satisfied before replacement of tussock actioned. Some areas will require transportation of material to fill the quota while in other areas a bulldozer will move the material across/down the slope.
- During this process if any drainage areas are identified they will be directed along the outer edge of works to minimise machinery and vehicles passing through wet channels creating sediment disturbance.
- 'Sumps' will be created as necessary to slow water flow and settle sediment travel as often as required and no less than 20m intervals along the established channel. These sumps will be constantly monitored to make sure they are effectively catching sediment and deep/long enough to minimise sediment travel – a minimum 3m long x 1m deep x 1m wide. If
- There is very little if any top soil over laying over the rock across the Areas A & B. Where it can be gathered it will be stored separately for later relocation to areas where re-vegetation can be established. It will be heaped in a flat area and packed by digger bucket to minimise water formed furrows on the surface. A sump will be formed to eliminate travel of any soil mass away from the area.
- Area B will be the second stage of development. The same processes will be involved as in Area A.
- Area C will follow Area B. There are more drainage channels in this area which will be managed to retain flow in the direction it travels now. The same process as above will be carried out to manage sediment controls along the length of the trail development.
- Area D & E are 99% loose rock. The majority of works will require rock breaking and blasting to reduce the rock in this area to a manageable size. The ground in this area is very porous and it is not expected to carry surface water at all. Ponding areas will be established to collect any travelling sediment if noted
- Vegetation is only established in Areas A, B & C and every effort will be made to retain all vegetation to be re-established on completion of trail development, which also reduces the possibility of sediment travel once placed.
- Water flows and drainage channels will be retained to carry water in the direction already established.
- If a constant flow is identified within the area of works and along a path of regular vehicle access, a culvert will be installed to eliminate constant traffic picking up or disturbing sediment within the channel when passing through it.
- Once the trails have been constructed every 50m along their path there will be a cut off drain to capture surface water running down the fall line on the trail and feed it off into the natural lay of the land. A sump will be located at the edge of trail to capture any sediment travel & these will be monitored and cleared as necessary into the future.
- Trail B will be the permanent road access from lower ski area up into Sugar Bowl. Where cut off drains are located an open culvert will be inserted to keep vehicle wheels from contaminating the water flow off the trail.

All up, the bulk earthworks stage of this project is projected to run from 1 November 2018 to 30th April 2019.

Storm water Management:

Storm water will be managed onsite during the construction works in order to:

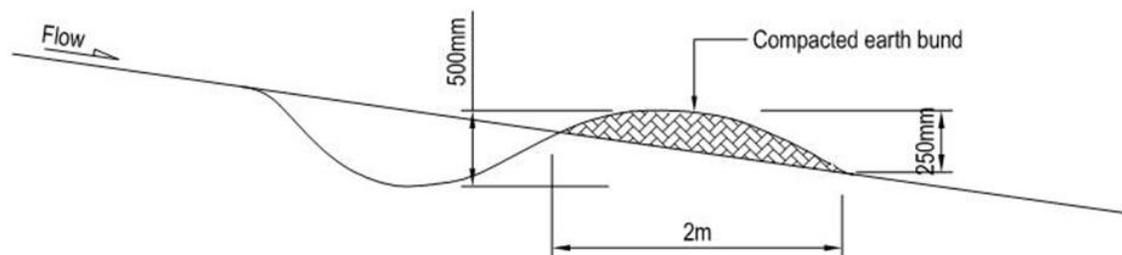
- Minimise the contamination directly to natural water sources
- Minimise silt entering the Kowarau River
- Minimise damage to other areas of the environment.

Storm water Controls:

The area identified as creating a risk of sediment runoff into the Rastus Burn Stream is mainly at the base of the proposed earthworks – Lower Trail A. Cut off drains above this will have sumps at their exit from the trail to settle any sediment travel prior to water continuing on and eventually into the Rastus Burn stream.

The following is the methodology proposed to avoid this:

- Cut off drains to be installed across the trails to divert any surface running water. Sumps located at the exit of the cut off drain will capture any sediment travel.
 - The diagram below is a typical cut off drain formation.



Cross - section

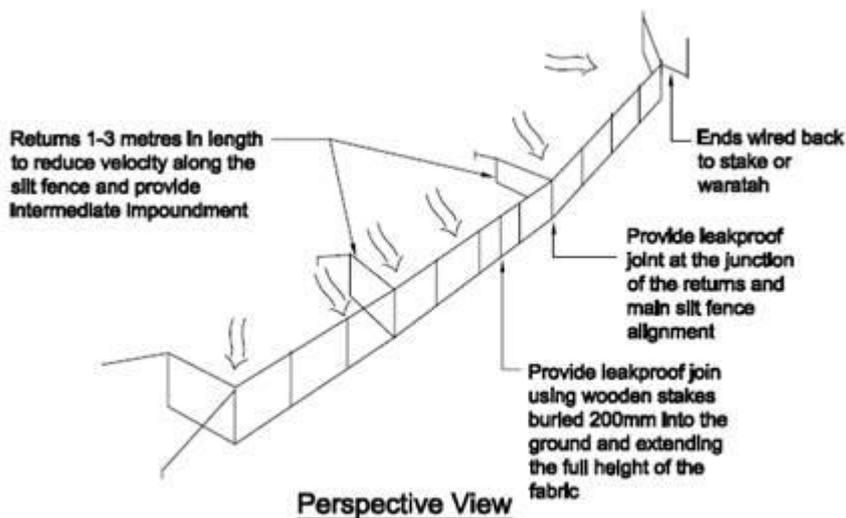
In larger events where there is expected to be less of a focus on sediment run off as opposed to preventing property damage, the flows will be allowed to overtop and run into the natural landscape where the ground is very porous and surface water does seep into outlying areas.

- If areas exposed and with greater volumes of fine silt on the trail surface silt fencing is to be erected alongside the existing area where surface water leaves the sumps from the cut off

drains. This will be constructed from a brand called “super silt fence” and will be dug into the earth and reinforced with top running wire and clips.

- These to be inspected weekly, prior to forecasted rain events and when on visual inspection there appears to be sediment in the sump they will be cleared prior to the next expected rain fall.

The entire area of works is located on terrain with an average slope angle of 14 degrees or 25% with very few flat areas to create ponding/settlement areas. This also makes fencing on slopes of this angle hard to maintain. Where possible and if required we will erect catchment fences with the following materials.



The site manager will be responsible for identifying other risks as they emerge during construction. The following additional measures are proposed to avoid sediment entering waterways:

- The site manager is to determine the effectiveness of silt fencing and replace or repair when appropriate. Where silt fencing is not working they shall devise a more appropriate plan. This may include the need for settling ponds, filter cloth and swales to be cut in and around the earthworks area.
- The Site Manager will note the environmental issues, concerns and control measures daily in the site diary. In addition environmental issues and risks will be discussed at weekly meetings with the wider project team.
- The Site Manager will constantly monitor weather conditions such as heavy rain, high winds and the presence of dust. He will be responsible for ceasing work if such conditions are experienced or expected at a level that is considered unsafe or an extended hazard to the environment.
- The Site Manager will have access to online information about future weather events. Forecasted events will be communicated to all onsite at the morning pre start meetings/ Site Client meetings and weekly Health and Safety Toolboxes. If action is required this will be

communicated to all onsite at the morning pre start meetings and tasks distributed to team member's onsite. If concern is raised from the Site Managers assessment of conditions and triggers that may result in environmental events, some or all of the following actions may occur;

- The site manager shall also be responsible to:
 - o Ensure cut off drains have a clear flow path, has enough depth and is flowing into the created sumps.
 - o Check levels of water in settling pond areas ensure soakage is occurring and there is no potential for water to escape. If the volume of water is deemed to be too great for any existing pond, remedial actions such as excavating another pond or a diversion channel to direct overtopping water appropriately shall be undertaken.
 - o Check silt fence condition, clean out any excess silt and sediment when required.

Dust prevention and control:

- Base contracting as per construction methodology will complete the earthworks in several stages to reduce the amount of disturbed earth.
- It is the responsibility of the contractor (specifically the site manager) to monitor dust during earthworks up until a time where earth worked areas have been re stabilised. It is important for all personnel to be aware that the site is susceptible to a high amount of dust being created.
- **Potential sources of dust emission** includes (not limited to):
 - o Topsoil stripping
 - o Trucks having loads that are not covered or are overloaded
 - o Vehicle movements on haul roads
 - o Windblown dust from exposed surfaces and stockpiles
- The contractor is to carry out a dynamic dust assessment during all phases of construction. The contractor is to review the daily forecast prior to works commencing to ensure suitable controls are in place. If wind strength reaches a point where construction activity is creating dust that is visibly leaving the site the contractor is to stop works. If additional controls can be put in place or the area of operation can be shifted to stop dust leaving the site then works can continue. Otherwise all works shall be suspended until wind strength drops to allow for works to commence without dust visibly leaving the site.
- As the change of wind speeds from different directions can have different effects on the site the contractor is to deal with each dust event on a case by case basis and not apply a blanket rule of allowable wind speed to the site. Further to this site induction and daily prestart meetings will be carried out to ensure all machine operators are aware of their responsibilities and the effects of excessive dust.
- Earthworks shall be staged, and areas shall only be exposed as required for active earth working. This helps to reduce the duration of exposure and minimise the risk of erosion or sediment discharge. Proposed staging is shown on the Site Plan in Figure 3 of this report.

- Suspension of works during high winds: During periods of high winds, vehicle movements and construction activities may need to be reduced or suspended to minimise potential dust nuisance.
- Roll and compact stripped surfaces, stockpiles and completed surfaces.
- Speeds on haul roads shall be kept low to reduce dust levels generated.
- Avoid steep cut faces: Steep cut faces disrupt the wind and cause swirling effects, which generate more dust than off a flat surface. The earthworks will be excavated down in layers rather than deeper cut faces.
- Use dedicated haul roads through site for utility vehicles and heavy machinery to reduce traffic which has the ability to create more dust. These will be regularly graded

Temporary Fire Control:

Fire Extinguishers are located in all Base Contracting marked vehicles and machinery. There will also be additional fire extinguishers in the site office. A number of Base Contracting staff on site are Fire fighters with the New Zealand volunteer fire service.

Fire and emergency procedures will be outlined in the site health and safety policy. The site emergency procedure will be displayed on the wall of site office. All persons inducted to site will be made aware of the first aiders on site and the means of fire control.

Site Security:

The main access to site will be via a formed up road above the base lodge and managed by The Remarkables ski area and signs will clearly mark the safe vehicle route to the compound and to parking within the compound.

The Base Contracting compound area will be marked by signs. The Base contracting site office will be locked at the end of each day and the Site Manager will be the only one with the access to the keys. All machinery will be parked on the designated 'go line 'and locked at the end of the day.

Deliveries will be made to the site office and the Site Manager will liaise with the delivery company to ensure appropriate drop off times. Documents of sensitive nature in regards to the project will be kept in the Base Contracting office in Arrowtown.