Queenstown Lakes District Proposed District Plan

Section 32 Evaluation

Stage 2 Components October 2017

For:

Earthworks

And consequential Variations to Proposed District Plan 26 August 2015:

Chapter 2 Definitions

Chapter 27 Subdivision and Development

Chapter 41 Jacks Point

Report dated: 3 November 2017

File Reference: PDP Stage 2: Earthworks

Contents:

1. EXECUTIVE SUMMARY

1.1. The Stage 2 Proposed District Plan Earthworks Chapter (**Earthworks Chapter)** seeks to manage the actual and potential adverse effects of earthworks on the environment. The Earthworks Chapter applies to all the land notified in Stages 1 and 2 of the district plan review.

1.2. The earthworks Chapter will assist the Council to fulfil its statutory functions and responsibilities as required by the Resource Management Act 1991 ('**the Act'** or '**the RMA'**) through the following objectives, policies and rules:

(a) Objectives to minimise the adverse effects on natural and physical resources, including infrastructure and cultural values;

(b) Policies that address the variability of activities and potential adverse effects associate with earthworks;

(c) Rules that provide limitations on the volume, area and location of earthworks to ensure the adverse effects of earthworks are managed;

(d) Exempting certain earthworks or providing for resource consent applications to be processed on a non-notified basis where there is sufficient certainty that those processes are appropriate relative to the activity;

2. INTRODUCTION

2.1. Section 32 of the Act requires objectives in plan change proposals to be examined for their appropriateness in achieving the purpose of the Act, and the policies and methods of those proposals to be examined for their costs, benefits, efficiency, effectiveness and risk in achieving the objectives.

2.2. Earthworks are an often necessary component of land use and development but can have adverse effects on landscape, nature conservation values and amenity values in both rural and urban locations, and adverse effects on heritage and cultural values.

2.3. Earthworks can cause nuisance effects in the form of dust and vibration which can be appropriately minimised through management during construction. Earthworks can also cause safety issues for people and property and infrastructure.

2.4. Soil erosion, sediment generation and run-off may result in adverse effects on surface water bodies and damage, or adverse effects on stormwater infrastructure and also needs to be managed. If not properly managed this may have significant adverse effects on water quality and flow and can damage ecosystems of flora and fauna within those water bodies. Damage to these environments can also lead to a loss of cultural values.

2.5. The evaluation of the appropriateness of the Earthworks Chapter is based upon the following three issues

- Issue 1 – Earthworks and landscape, visual amenity and nature conservation values.
- Issue 2 – Earthworks and people, safety and cultural values.
- Issue 3 – Earthworks and soil erosion, sediment and generation of run-off.

2.6. This District Wide Earthworks Chapter 25 applies to all land notified in Stage 1[1] of the Proposed District Plan on 26 August 2015, and all additional land notified in Stage 2. This land collectively forms the geographic area currently subject to Volume A of the District Plan. The District Wide Earthworks Chapter 25 applies to all land identified as Stage 1 and Stage 2 land on the Planning Maps attached to the Stage 2 notification bundle. The District Wide Earthworks Chapter 25, forms part of Stage 2 of the Proposed District Plan.

2.7. For clarity, **Table 1** below identifies the land area (generally described by way of zone) and various components of the PDP that together comprise Volume A of the District Plan at Stage 2 of the District Plan review as it relates to the Earthworks Chapter 25. All other land within the District continues to fall into Volume B of the District Plan.

Table 1. District Plan Volume A components, showing Stage 2 components as related to the Earthworks Chapter.

Volume A	
Stage 1 **Proposed District Plan 26 August 2015**	**Stage 2 As it relates to the Earthworks Chapter only**
Introduction	
1. Introduction 2. Definitions	• New Stage 2 definitions and variation to Stage 1 Definitions Chapter 2, as related to Stage 2 Earthworks components.
Strategy	
3. Strategic Direction 4. Urban Development 5. Tangata Whenua 6. Landscapes	
Urban Environment	
7. Low Density Residential 8. Medium Density Residential 9. High Density Residential 10. Arrowtown Residential Historic Heritage Management Zone 11. Large Lot Residential 12. Queenstown Town Centre* (part withdrawn) 13. Wanaka Town Centre 14. Arrowtown Town Centre 15. Local Shopping Centres	

[1] With the exception of land formally withdrawn from the PDP (Plan Change 50 Queenstown Town Centre extension, Plan Change 41 Peninsula Bay North, Plan Change 45 Northlake Special Zone, Plan Change 46 Ballantyne Road Industrial and Residential extension).

16. Business Mixed Use Zone 17. Queenstown Airport Mixed Use Variation 1: Arrowtown Design Guidelines 2016	
Rural Environment	
21. Rural Zone 22. Rural Residential and Lifestyle 23. Gibbston Character Zone	
District Wide Matters	
26. Historic Heritage 27. Subdivision and Development 28. Natural Hazards 30. Energy and Utilities 32. Protected Trees 33. Indigenous Vegetation and Biodiversity 34. Wilding Exotic Trees 35. Temporary Activities and Relocated Buildings 36. Noise 37. Designations	• Stage 2 Earthworks Chapter 25. • Variation to Stage 1 Subdivision Chapter 27, as related to Stage 2 Earthworks components.
Special Zones	
41. Jacks Point 42. Waterfall Park 43. Millbrook	• Variation to Stage 1 Jacks Point Zone Chapter 41, as related to Stage 2 Earthworks components.

3. BACKGROUND

District Plan Review

3.1. The review of the Operative District Plan is being undertaken in stages. Stage 1 commenced in April 2014 and was publicly notified on 26 August 2015. Hearings on Stage 1 components comprising ten individual hearing streams for 33 chapters, 1 variation[2] and three separate hearing streams for rezoning requests and mapping annotations[3] were held from March 2016 to September 2017.

3.2. On 29 September 2016 the Council approved the commencement of Stage 2 of the review of the Operative District Plan. As part of the 29 September 2016 resolutions, the Council addressed what the plan outcome would be at the end of the partial review, and approved the separation of the District Plan into two volumes, Volume A and Volume B. Volume A (at the point in time of notification of Stage 2) consists of the Proposed District Plan chapters notified in Stages 1 and 2 of the proposed District Plan, which includes variations to Stage 1, and all the

[2] Variation 1 – Arrowtown Design Guidelines 2016

[3] Ski Area Sub Zones, Upper Clutha Area and the Queenstown Area (excluding the Wakatipu Basin).

land as identified in the Planning Maps forming the Stage 2 notification bundle, as discussed above.

3.3. All other land currently forms Volume B of the District Plan. This includes zones that have not yet been reviewed and notified (i.e. Township Zone, Industrial A and B Zones, Rural Visitor Zone), land that has been withdrawn from the district plan review (i.e. the land subject to Plan Changes 46 - Ballantyne Road Industrial and Residential extensions, 50 - Queenstown Town Centre extension and 51 – Peninsula Bay North) and the Frankton Flats B Special Zone and the Remarkables Park Special Zone. All Volume B land is subject to the Operative District Plan.

Earthworks

3.4. The Operative District Plan earthworks provisions were reviewed and notified for submissions in July 2014, the Council's decision on submissions was made on 8 July 2015. Several appeals were received and these were ultimately withdrawn or settled by way of Consent Order[4] and made operative in April 2016. Prior to this, the various Earthworks components of the Operative District Plan sat throughout each zone chapter, and the majority of these components had been operative since 2005.

3.5. It was the initial intention of Council that the Earthworks chapter was notified ahead of notification of Stage 1 of the PDP, on the basis that as the various Stage 1 PDP components became operative, they would replace those existing operative components of the Operative District Plan and integrate with the Operative District Wide Chapter 22 Earthworks Chapter. However, as a consequence of the separation of the District Plan into two volumes, each Volume requires a district wide earthworks chapter. The existing Operative Earthworks Chapter 22 sits in Volume B of the District Plan, Volume A of the District Plan, which will also encompass the vast majority of land in the District, requires an earthworks chapter. No 'broad options' have been assessed in this evaluation because there are not considered any other practicable options, other than to include earthworks rules in Volume A of the PDP by way of this Earthworks Chapter 25.

Jurisdictional Matters

3.6. No decision has been made on the Proposed District Plan 2015 (Stage 1 and Variation 1) at the time of notification of Stage 2, and therefore this Stage 2 Earthworks Chapter 25 cannot anticipate what Panel recommendations and subsequently the Council's decision might be, in terms of notifying zone specific standards. The chapter therefore refers to PDP chapters/zones as notified in Stage 1 and any statutory changes made since notification[5].

[4] ENV-2015-CHC-75 http://www.qldc.govt.nz/assets/Uploads/Planning/District-Plan-Changes/49/2016-04-13-Consent-Order.pdf

[5] For instance, Variation 1 Arrowtown Design Guidelines, withdrawal of land subject to PC 46, PC 50 and PC 51.

3.7. Therefore, for instance, the Stage 2 Earthworks chapter does not refer to the Council recommended "Airport Zone", which encapsulates the Wanaka airport (as well as the notified Queenstown airport), because the (Wanaka) Airport Zone is at this point in time is only recommended in response to Stage 1 submissions[6] and in the PDP at the zoning of Wanaka Airport at this point in time remains is Rural. Similarly, for example, the reference in the Council officers' post-hearing reply version of Chapter 30 Energy and Utilities refers to 'Electricity Distribution Corridor' with an associated definition. Because this concept is not in the notified PDP, and Council has not yet released decisions on submissions to Stage 1 topics, it cannot be referred to in the Stage 2 Earthworks Chapter. The latter matter is considered particularly important to earthworks and the Earthworks Chapter because earthworks within these electricity distribution corridors are managed in Chapter 30 Energy and Utilities.

3.8. This is a consequence of the staged approach to the review, and can be addressed through either interested parties lodging a submission, or the Council itself lodging a submission on the Stage 2 Earthworks Chapter 25 to ensure the Stage 2 Earthworks chapter ultimately includes any necessary standards for any new zones or issues, included in the PDP by Council Stage 1 decisions. It is acknowledged that before any submission by Council on the Stage 2 components is lodged, it will need to be passed by a resolution of Council.

4. PURPOSE OF THE REPORT

4.1. Section 32 of the Act requires objectives in plan change proposals to be examined for their appropriateness in achieving the purpose of the Act, and the policies and methods of those proposals to be examined for their efficiency, effectiveness and risk in achieving the objectives. This report fulfils the obligations of the Council under section 32 of the Act. The analysis set out below should be read together with the text of Proposed Chapter 25 Earthworks and the The QLDC Best Practice Environmental Management Guidelines.

5. STATUTORY POLICY CONTEXT

Resource Management Act 1991

5.1. Section 5 sets out the purpose of the RMA, which requires an integrated planning approach and direction to promote the sustainable management of natural and physical resources. Guidance as to how the overall sustainable management purpose is to be achieved is provided in the other sections, including sections 6, 7 and 8 of Part 2 of the Act:

6 Refer to submission of Queenstown Airport Corporation #433. Section 42A report Chapter 17 dated 2 November 2016- Hearing Stream 8 Business Zones.

5 Purpose

(1) The purpose of this Act is to promote the sustainable management of natural and physical resources.

(2) In this Act, sustainable management means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

5.2. Section 6 of the RMA sets out a number of matters of national importance. Depending on the circumstances such as the location, scale and the manner in which earthworks are undertaken, earthworks and land disturbance activities can be applicable to all matters in section 6:

(a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development:

(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development:

(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna:

(d) the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers:

(e) the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:

(f) the protection of historic heritage from inappropriate subdivision, use, and development:

(g) the protection of protected customary rights:

(h) the management of significant risks from natural hazards.

5.3. Section 7 lists “other matters” that Council shall have particular regard to and those most relevant to the Earthworks Chapter including the following:

(aa) the ethic of stewardship:

(b) the efficient use and development of natural and physical resources:

(c) the maintenance and enhancement of amenity values:

(d) intrinsic values of ecosystems:

(f) maintenance and enhancement of the quality of the environment:

(g) any finite characteristics of natural and physical resources:

(h) the protection of the habitat of trout and salmon:

(i) the effects of climate change:

5.4. Section 8 requires that Council take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi). The principles as they relate to resource management derive from Te Tiriti o Waitangi itself and from resource management case law and practice. They can be summarised as follows:

a) That there must be active protection of the partnership between the two parties;

b) That there is an obligation to act with reasonableness and good faith, with both parties being prepared to compromise;

d) That dialogue and consultation will be the main way in which to give effect to the three principles outlined above.

5.5. A number of provisions have been included in the Earthworks Chapter in response to the requirements in Part 2 (such as section 6(e) – the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga).

5.6. Earthworks are an important part of the sustainable use and development of land but the potential adverse effects need to be managed to ensure the Council in exercising its functions gives effect to sections 6 and 7 of the Act. If left unchecked or poorly managed earthworks can have adverse effects on the important resources of the District, including the Outstanding Natural Features and Landscapes, amenity landscapes and built resource such as infrastructure, buildings and roads. Sedimentation arising from poorly managed erosion and sediment management can also reduce the capacity of the Council's stormwater network and infrastructure. This is important as the District is progressively changed through human activities and the consequences of climate change.

5.7. Section 31 of the RMA states (relevant areas underlined to emphasise the provisions relevant to this evaluation):

31 Functions of territorial authorities under this Act

(1) Every territorial authority shall have the following functions for the purpose of giving effect to this Act in its district:

(a) the establishment, implementation, and review of objectives, policies, and methods to achieve integrated management of the effects of the use, development, or protection of land and associated natural and physical resources of the district:

(b) the control of any actual or potential effects of the use, development, or protection of land, including for the purpose of—

(i) the avoidance or mitigation of natural hazards; and
(ii) the prevention or mitigation of any adverse effects of the storage, use, disposal, or transportation of hazardous substances; and
(iia) the prevention or mitigation of any adverse effects of the development, subdivision, or use of contaminated land:
(iii) the maintenance of indigenous biological diversity:

(c) [Repealed]
(d) the control of the emission of noise and the mitigation of the effects of noise:
(e) the control of any actual or potential effects of activities in relation to the surface of water in rivers and lakes:
(f) any other functions specified in this Act.

(2) The methods used to carry out any functions under subsection (1) may include the control of subdivision

5.8. The proposed earthworks provisions help to achieve the integrated management of natural and physical resources by enabling earthworks, subject to controls to ensure the actual and potential adverse effects of earthwork are effective.

5.9. The council's management of earthworks in the PDP Earthworks Chapter is integrated with and complementary to the Otago Regional Council's functions pursuant to section 30 of the Act, associated with the following components of s 30 in particular:

(a) s30(c) (i) soil conservation;
(b) s30(c) (ii) the maintenance and enhancement of the quality of water in water bodies and coastal water;
(c) s30(e) the control of the taking, use, damming, and diversion of water, and the control of the quantity, level, and flow of water in any water body;
(d) s30(f) the control of discharges of contaminants into or onto land, air, or water and discharges of water into water.

5.10. While acknowledging the function of the Otago Regional Council to control the discharge of stormwater, contaminants to water or land, and the diversion of water, it is also a function of the QLDC as a territorial authority to manage the effects of land use from earthworks, including the adverse effects of soil erosion and sedimentation of water. The relationship between the respective Otago Regional Council statements and plans (Regional Policy Statement Operative 1998 and Proposed 2015) and Regional Plan: Water for Otago 2004 and the extent it is appropriate for the Earthworks chapter to manage the erosion and sedimentation are discussed in below and in **Appendix 1**.

Local Government Act 2002

5.11. Sections 14(c), (g) and (h) of the Local Government Act 2002 (LGA**)** are also of relevance in terms of policy development and decision making:

> *(c) when making a decision, a local authority should take account of—*
> *(i) the diversity of the community, and the community's interests, within its district or region; and*
> *(ii) the interests of future as well as current communities; and*
> *(iii) the likely impact of any decision on the interests referred to in subparagraphs (i) and (ii):*
>
> *(g) a local authority should ensure prudent stewardship and the efficient and effective use of its resources in the interests of its district or region, including by planning effectively for the future management of its assets; and*
>
> *(h) in taking a sustainable development approach, a local authority should take into account—*
> *(i) the social, economic, and cultural interests of people and communities; and*
> *(ii) the need to maintain and enhance the quality of the environment; and*
> *(iii) the reasonably foreseeable needs of future generations*

5.12. The LGA emphasises a strong intergenerational approach, considering not only current environments, communities and residents but also those of the future. They demand a future focussed policy approach, balanced with considering current needs and interests. Like the RMA, the provisions also emphasise the need to take into account social, economic and cultural matters in addition to environmental ones.

5.13. Section 14(g) is of relevance in so far as a planning approach emphasising that earthworks are an often essential prerequisite of land development but can also have adverse effects on natural and physical resources.

5.14. Having regard to these provisions, the approach through this review is to provide a balanced framework in the District Plan to manage these resources appropriately. Furthermore, no less important is the need to ensure the provisions are presented in a manner that is clearly interpreted to facilitate effective and efficient District Plan administration.

Other National Legislation or Policy Statements

5.15. When preparing district plans, district councils must give effect to any National Policy Statement (NPS) or National Environmental Standard (NES). Government has produced the following 5 National Policy Statements that are in effect:

(a) National Policy Statement on Urban Development Capacity 2016;

(b) National Policy Statement for Freshwater Management 2014;

(c) National Policy Statement for Renewable Electricity Generation 2011;

(d) National Policy Statement on Electricity Transmission 2008; and

(e) New Zealand Coastal Policy Statement 2010.

5.16. A National Policy Statement for Indigenous Biodiversity is in draft form. The National Policy Statements that are of most relevance to earthworks are the Freshwater Management and Electricity Transmission National Policy Statements.

Freshwater Management (NPSFM)

5.17. The NPSFM sets out the objectives and policies for freshwater management under the RMA. This national policy statement provides a National Objectives Framework to assist regional councils and communities to more consistently and transparently plan for freshwater objectives.

5.18. The NPSFM does not directly require specific provisions to be included within district plans, but the RMA requires district plans to give effect to national policy statements and regional policy statements. On 7 August 2017 the Government agreed to amend the National Policy Statement for Freshwater Management 2014. The amendments will come into force on 7 September 2017.

5.19. If a regional council adopts a policy in its regional policy statement directing the management of contaminants such as sediment or nutrients, and those contaminants could be associated with particular land uses (such as earthworks or urban development), the district council would need to give effect to those policies in rules controlling land use. An evaluation of the operative and proposed Regional policy Statement for Otago and the Regional Plan: Water for Otago 2004 are set out later in this report.

Electricity Transmission 2008 (NPSET)

5.20. The NPSET requires local authorities to provide for electricity transmission activities at the local level. The NPSET provides a regulatory framework, which works in tandem with the National Environmental Standards for Electricity Transmission Activities (NESETA), discussed below.

5.21. The NPSET has a single objective which is:

> *To recognise the national significance of the electricity transmission network by facilitating the operation, maintenance and upgrade of the existing transmission network and the establishment of new transmission resources to meet the needs of present and future generations, while:*

- *managing the adverse environmental effects of the network; and*
- *managing the adverse effects of other activities on the network.*

5.22. The NPSET is only applicable to the operation of the high voltage national grid as defined in the NPSET itself. The national grid is defined in that NPS as "the assets used or owned by Transpower NZ Limited".

5.23. The rules relating to earthworks to provide for the National Grid and to protect the National Grid are located within PDP Stage 1 Chapter 30: Energy and Utilities. The PDP Stage 2 Earthworks Chapter recognises this by cross referencing to Chapter 30 Energy and Utilities for earthworks associated with the National Grid. It is noted that the Council's reply version of the Utilities Chapter and PDP Stage 1 Subdivision Chapter 27 includes more refined rules associated with providing for the National Grid. It is not intended to replicate or locate those rules within the PDP Stage 2 Earthworks Chapter.

Iwi Management Plans

5.24. When preparing or changing a district plan, Section 74(2A)(a) of the RMA states that Council's must take into account any relevant planning document recognised by an iwi authority and lodged with the territorial authority, to the extent that its content has a bearing on the resource management issues of the district.

5.25. The following iwi management plans are relevant:

The Cry of the People, Te Tangi a Tauira: Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008 (MNRMP 2008)

5.26. Section 3.4 Takitimu Me Ona Uri: High Country and Foothills contains the following policy that is relevant to earthworks:

3.4.9 General Water Policy

> *Ngāi Tahu ki Murihiku recognise that the welfare of the people and the success of their activities within the environment depends on water being maintained in the best possible condition.*

3.5.7 Subdivision and Development

5.27. Policies 1- 18 contain a range of policies that are relevant to Subdivision and Development cover iwi involvement in planning processing and plan development, interaction with developers and iwi, particularly where there may be significant effects, long term planning and cumulative effects, avoiding adverse effects on the natural environment and advocating for the use of esplanades reserves.

Käi Tahu ki Otago Natural Resource Management Plan 2005 (KTKO NRMP 2005)

5.28. Part 10: Clutha/Mata-au Catchments *Te Riu o Mata-au* outlines the issues, and policies for the Clutha/Mata-au Catchments. Included in this chapter is a description of some of the Käi Tahu ki Otago values associated with the Clutha/Mata-au Catchments. Generic issues, objectives and policies for all catchments across the Otago Region are recorded in Chapter 5 Otago Region.

5.29. Part 10.2.2 Wai Mäori Issues in the Clutha/Mata-au Catchment, identifies sedimentation of waterways from urban development. Part 10.2.3 – Policies 5 to 8 are within the heading *'sediment and siltation'* and are:

> *5. To discourage activities that increases the silt loading in waterways or reaches of waterways.*
> *6. To encourage the preparation of a sediment management strategy for the Clutha/Mata-au that describes patterns of deposition, movement, removal and flushing of sediment within the Catchment. Sediment must be managed on a Catchment basis and must be able to move through the system from the headwaters to replenish coastal habitats that are highly valued by Kä Papatipu Rünaka. Ad-hoc proposals for sediment removal, gravel takes, engineering river reaches may not be supported if Kä Papatipu Rünaka cannot see how they are part of a sediment management strategy.*
> *7. To require Contact Energy and the Otago Regional Council to agree on flow levels at which the flushing of sediment is permitted in conjunction with Kä Papatipu Rünaka.*
> *8. To discourage any inappropriate flushing of sediment at times of low flow or where the impacts are not of a temporary nature.*

5.30. Policy 5 is directly relevant to district plans and the PDP Earthworks Chapter plays an important role in terms of managing the soil erosion and the generation of sediment and run-off from earthworks and land disturbance associated with land use activities, in particular subdivision and development. The iwi management plans have been taken into account as part of the preparation of the Section 32 report and Earthworks Chapter.

Regional Policy Statements

Operative Regional Policy Statement 1998

5.31. Section 74 of the Act requires that a district plan prepared by a territorial authority must "give effect to" any operative Regional Policy Statement. The operative Otago Regional Policy Statement 1998 (**RPS**) is the relevant regional policy statement to be given effect to within the District Plan.

5.32. The RPS identifies in Issue 5.3.3 (*Otago's water resources may be adversely affected by land activities*) sedimentation associated with a range of land uses and activities.

5.33. Policy 5.5.5(c) seeks to minimise the adverse effects of land use activities on the quality and quantity of Otago's Water resource through…*(c) Avoiding, remedying or mitigating the degradation of groundwater and surface water resources caused by the introduction of contaminants in the form of chemicals, nutrients and sediments resulting from land use activities*.

5.34. A range of methods are identified in the RPS to manage the effects of earthworks and sedimentation from land use activities, however, there is not a distinctly identifiable obligation for either regional or district plans.

5.35. Method 5.6.21 is identified as being of relevance in terms of managing erosion and sediment which is '*Consider including provisions and conditions in district plans and on resource consents to avoid, remedy or mitigate soil degradation resulting from the subdivision use, development or protection of land'*.

5.36. Method 5.6.23 states '*Consider including provisions or conditions in district plans and on resource consents which seek to avoid, remedy or mitigate the adverse effects of land use activities on water resources*'.

5.37. These two methods in particular are considered to give direction to territorial authorities to manage the effects of erosion and sedimentation arising from land use activities.

5.38. In terms of managing the overall stability, landscape and amenity effects of earthworks, Objectives 5.4.1 to 5.4.4 (Land) are also relevant because they promote the sustainable management of Otago's land resource by:

- Maintaining and enhancing the primary productive capacity and life supporting capacity of land resources;
- Meeting the present and reasonably foreseeable needs of Otago's people and communities;
- Avoid, remedy or mitigate degradation of Otago's natural and physical resources resulting from activities utilising the land resource; and
- Protect outstanding natural features and landscapes from inappropriate subdivision, use and development.

5.39. The proposed earthworks provisions are consistent with, and give effect to, the relevant operative RPS provisions.

Proposed Regional Policy Statement 2015

5.40. Section 74(2) of the RMA requires that a district plan prepared by a territorial authority shall "have regard to" any proposed regional policy statement. The Proposed Otago Regional Policy Statement (**PRPS**) was notified for public submissions on 23 May 2015, and decisions on submissions were released on 1 October 2016. The majority of the provisions of the Decisions

Version have been appealed and mediation is currently taking place. Accordingly, limited weight can be provided to the Decisions Version of the PRPS. However, the provisions of PRPS are relevant in highlighting the direction given toward local authorities managing the potential adverse effects of earthworks. The following is based on the PRPS Decision version: 1 October 2016

5.41. Policies 3.1.7 (Soil Values), 3.1.8 (Soil erosion) and 5.4.1 (Managing for urban growth and development) are to be given effect to by a range of Methods including via City and District Plans (Method 4.1.4).

5.42. In particular, the Methods for Policy 3.1.8 (Soil Erosion) do not identify any obligation through Regional Plans to manage erosion and sedimentation through land use activities.

5.43. Method 4.1.4 (District and City Plans) is:

> '*Policies 3.1.7, 3.1.8, and 5.4.1 by including provisions to manage the discharge of dust, and silt and sediment associated with earthworks and land use*'.

5.44. The PRPS places a clear obligation on territorial authorities to manage the potential effects of erosion and sedimentation from land use activities through district plans. The Otago Regional Council currently do not have a dedicated regional earthworks or soil conservation plan and the Methods of the PRPS indicate that it is intended that erosion and sediment is managed primarily by District and City Plans.

5.45. The Earthworks Chapter 25 implements Method 4.1.4 of the PRPS and is considered to have sufficient regard to that document. It is also considered that in the case of the PRPS being made operative with the structure and inclusion of Method 4.1.4 to implement Policy 3.1.8 as set above, the Earthworks Chapter 25 would give effect to that document.

Regional Plans

5.46. The Otago Regional Plan: Water for Otago (Operative 2004) contains the following provisions that relate to the discharge of water containing contaminants (including sediments) to water (Lakes/rivers/coast):

5.47. Rule 12.C.1.1 permits the discharge of water or any contaminant to water, or onto or into land which may result in a contaminant entering water is a permitted activity providing a range of qualifiers are met, including at (d) the discharge:

> *(d)(i) Does not result in:*
>
> *(1) A conspicuous change in colour or visual clarity; or*

(2) A noticeable increase in local sedimentation, in the receiving water (refer to Figure 5); and

(ii) Does not have floatable or suspended organic materials; and

(iii) Does not have an odour, oil or grease film, scum or foam; and

…

5.48. In terms of activities achieving compliance associated with sediment discharge, Figure 5 from the Regional Plan: Water for Otago, makes it clear that the measurement/compliance point is where the sediment entrained water enters the river or lake and that for permitted status it must not result in '*a noticeable increase in local sedimentation, in the receiving environment*'. Figure 5 is reproduced below:

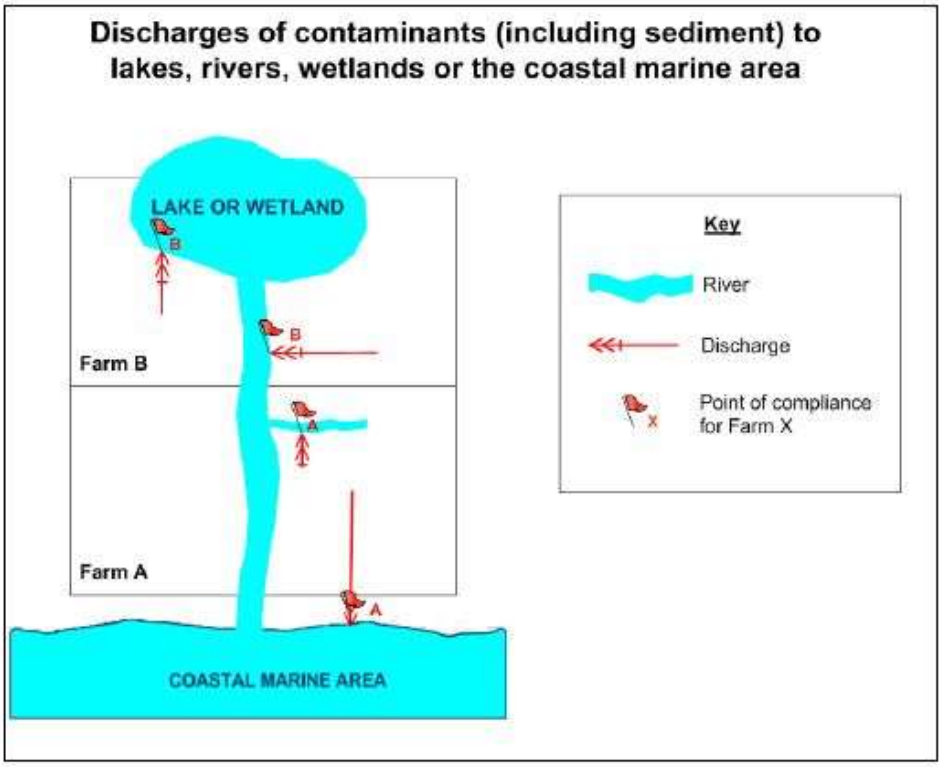


Figure 5: Implementation of Rule 12.C.1.1(d)(i)

5.49. Non-compliance would require a discretionary activity resource consent pursuant to Rule 12.C.3. Related Rule 12.C.0.3 holds a prohibited activity status for the discharge of sediment from disturbed land to water where no measure is taken to mitigate sediment runoff.

5.50. Typically therefore, run-off from a site with disturbed land is permitted providing any sediment laden water does result in either a conspicuous change in colour or visual clarity or a noticeable increase in local sedimentation in the receiving water.

5.51. If no measures are made the activity status is prohibited and no resource consent can be granted. Where there is non-compliance but where measures have been made resource consent is required as a discretionary activity.

5.52. While rules are in place in the Otago regional Plan: Water, these are suited to activities where it would be a pre-meditated action before the activity commenced to note that compliance with the permitted standards cannot be achieved and to apply for a resource consent. The prohibited limb of the rule framework makes it clear that no avenue is provided to discharge sediments to rivers and lakes without undertaking sediment management measures. Instances where a resource consent is applied for to discharge sediment laden water to a waterbody would be for works within or adjacent to a waterbody and while sediment management would expected to be employed it is not possible to avoid all sediments entering the water stream and noticeable sedimentation of the water could occur. The types of activities that fall under these circumstances are drain maintenance, culvert and bridge pile installation and repair.

5.53. It is considered that because the Otago Regional Plan: Water does not control land disturbance activities, only the effects of a discharge, the opportunity to proactively manage the potential adverse effects of sedimentation entering rivers; lakes or onto land arising from temporary construction activities associated with land use activities is not as clearly articulated as it could be through a district plan and land use framework. It is unlikely that the proponents of a land based subdivision and development would apply for a discretionary activity through the Otago Regional Plan: Water on the off-chance permitted status could not be achieved. It could also be likely to be the case that the Otago Regional Council would encourage compliance with the permitted standards to minimise effects on the receiving environment, rather than grant a discretionary activity resource consent where compliance with Rule 12.C.1.1 can be achieved.

5.54. The Otago Regional Plan: Water does not directly intervene with land use activities to manage soil conservation or the potential effects of erosion and sedimentation, compared to other Regional Councils water plans[7]. The Otago Regional Plan: Water does not specify controls on land uses that result in the disturbance of land, but controls adverse effects on the environment through managing discharges.

Regional land use plan earthworks

5.55. The Otago Regional Council does not have a land use plan to manage the effects of earthworks for soil conservation or sedimentation.

Relationship between district plans and Regional Plans/Policy Statements

[7] Refer to Appendix 1 and comparison between the Canterbury Regional Land and Water Plan and Otago Regional Plan Water for Otago.

5.56. The management of sediment generation and run-off on sites from land disturbance activities, and to ensure that runoff from these sites complies with Rule 12.C.1.1 of the Otago Regional Plan: Water is a permitted activity, is considered to fall in large part on district and city plans. This obligation for district plans is reinforced by Method 4.1.4 of the PRPS 2015.

5.57. As discussed above the NPSFM does not require specific provisions to be included within district plans, but the obligations indicated by the Regional Plan: Water for Otago 2004, the Operative RPS and especially the Proposed RPS at Method 4.1.4 requires district plan rules to manage the effects of land uses on soil erosion and sedimentation as part of the district plans being consistent with regional plans, giving effect to operative RPS's and having regard to Proposed RPS's, which in turn must give effect to the NPSFM.

Resource Management National Environmental Standards Regulations (NES)

5.58. National Environmental Standards (NES) are regulations made under the RMA that prescribe standards for specific activities. The NES have the effect of overriding district plans, unless otherwise stated within the NES. Section 44A(7) of the RMA states that every local authority and consent authority must observe national environmental standards.

5.59. Section 43A (5) of the RMA states:

(5) If a national environmental standard allows an activity and states that a resource consent is not required for the activity, or states that an activity is a permitted activity, the following provisions apply to plans and proposed plans:

(a) a plan or proposed plan may state that the activity is a permitted activity on the terms or conditions specified in the plan; and

(b) the terms or conditions specified in the plan may deal only with effects of the activity that are different from those dealt with in the terms or conditions specified in the standard; and

(c) if a plan's terms or conditions deal with effects of the activity that are the same as those dealt with in the terms or conditions specified in the standard, the terms or conditions in the standard prevail.

5.60. There are currently 5 NES in effect:

(a) National Environmental Standards for Air Quality
(b) National Environmental Standard for Sources of Drinking Water
(c) National Environmental Standards for Telecommunication Facilities
(d) National Environmental Standards for Electricity Transmission Activities
(e) National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health

5.61. In addition, the NES on Plantation Forestry has recently been developed and comes into effect on 1 May 2018.

5.62. Where the NES is relevant to earthworks they are discussed as follows:

NES Telecommunication Facilities 2016 (NES-TF)

5.63. The NES-TF contains standards relating to earthworks that enable earthworks with certain antennas (Subpart 6 - Earthworks) providing a range of standards are met, some of which include compliance with district plan rules for earthworks in certain locations, for instance at 'special places' as defined in the NES-TF. The permitted standards also require management plans that include measures to manage sediment run-off from the site, stability, dust and drainage[8].

5.64. Earthworks for utilities, which include telecommunication activities subject to the NES-TF are managed in Stage 1 PDP Chapter 30: Energy and Utilities. The PDP Stage 2 Earthworks Chapter recognises this by cross referencing to Chapter 30 Energy and Utilities for earthworks associated with utilities and the NES-TF. It is the jurisdiction of Chapter 30: Energy and Utilities and the respective hearing stream 5 of Stage 1 of the PDP that deals with ensuring specific provisions accord with the NES-TF. It is not intended to replicate or relocate the earthworks rules for utilities and activities subject to the NES-TF rules within the PDP Stage 2 Earthworks Chapter.

NES for Assessing and Managing Contaminants in Soil to Protect Human Health 2011 (NES-CS)

5.65. The NES-CS seeks to ensure that land affected by contaminants in soil is appropriately identified and assessed before it is developed to avoid risk to human health. This requires all territorial authorities to give effect to and enforce the requirements of the NES-CS. The PDP Stage 2 Earthworks Chapter recognises this by referencing to the NES-CS.

NES Electricity Transmission Activities 2009 (NES-ETA)

5.66. As set out above, the rules relating to earthworks to provide for the National Grid and to protect the National Grid are located within PDP Stage 1 Chapter 30: Energy and Utilities. The PDP Stage 2 Earthworks Chapter recognises this by cross referencing to Chapter 30 Energy and Utilities for earthworks associated with the National Grid. It is noted that the Council's reply

[8] NESTF 2016 Regulation 53 (4).

version of the Utilities Chapter and PDP Stage 1 Subdivision Chapter 27 includes more refined rules associated with providing for the National Grid. The majority of which where recommended by Transpower through their submissions on Stage 1 to the PDP[9]. It is not intended to replicate or locate those rules within the PDP Stage 2 Earthworks Chapter.

National Environmental Standard for Sources of Human Drinking Water 2005

5.67. The NES requires regional councils to ensure that the effects of activities on drinking water sources (natural water bodies such as lakes, rivers and groundwater used to supply communities) are considered in decisions on resource consents and regional plans. While this is primarily a regional council issue, performance standards around sediment control and limiting earthworks near water bodies including earthworks that expose groundwater aim to assist toward protect these drinking sources from contamination.

National Environmental Standard for Plantation Forestry (NES-PF)

5.68. The NES-PF was promulgated to reduce costs and operational complexity for the forestry sector. The NES-PF was confirmed in July 2017 and shall commence on 1 May 2018. The NES-PF permits forestry activities, subject to compliance with standards. The NES-PF covers 8 core plantation forestry activities:

- afforestation
- pruning and thinning-to-waste
- earthworks
- river crossings
- forest quarrying
- harvesting
- mechanical land preparation
- replanting.

5.69. The NES-PF will manage earthworks and erosion and sedimentation associated with plantation forestry. THE NES-PF enables district plans to impose stricter rules[10] where these relate to outstanding natural features and landscapes, significant indigenous vegetation and significant habitats of indigenous fauna.

5.70. Under the PDP as notified, forestry is a non-complying activity in the Outstanding Natural Features or Landscapes (Rule 21.4.1). The PDP is able to impose stricter rules than the NES-

[9] Submission 805 Transpower New Zealand Limited. In particular hearing streams 4 Subdivision Chapter 27, and Hearing Stream 5 District Wide.

[10] NESPF s 6 (2).

PF and the NES-PF within the ONF/L. Regulation 13 of the NESPF prescribes that forestry within amenity landscapes is a controlled activity.

5.71. On this basis, the Earthworks Chapter does not need to pre-empt any changes required to give effect to the NESPF when it commences on 1 May 2018.

Proposed District Plan

Notified PDP 26 August 2015

5.72. The following objectives and policies of the PDP (Part 2 Strategic) are relevant to earthworks, and the PDP Earthworks Chapter should take into account and give effect to these:

Strategic Direction Chapter 3

3.2.2.2 Objective *- Manage development in areas affected by natural hazards.*

Policies

3.2.2.2.1 Ensure a balanced approach between enabling higher density development within the District's scarce urban land resource and addressing the risks posed by natural hazards to life and property.

3.2.4.1 Objective *- Promote development and activities that sustain or enhance the life-supporting capacity of air, water, soil and ecosystems.*

3.2.4.5 Objective - *Preserve or enhance the natural character of the beds and margins of the District's lakes, rivers and wetlands.*

Policies

3.2.5.4.1 That subdivision and / or development which may have adverse effects on the natural character and nature conservation values of the District's lakes, rivers, wetlands and their beds and margins be carefully managed so that life-supporting capacity and natural character is maintained or enhanced.

3.2.4.6 Objective - *Maintain or enhance the water quality and function of our lakes, rivers and wetlands.*

Policies

3.2.4.6.1 That subdivision and / or development be designed so as to avoid adverse effects on the water quality of lakes, rivers and wetlands in the District.

3.2.5.1 Objective - *Protect the natural character of Outstanding Natural Landscapes and Outstanding Natural Features from subdivision, use and development.*

3.2.5.2 Objective - *Minimise the adverse landscape effects of subdivision, use or development in specified Rural Landscapes.*

3.2.7.1 Objective - *Protect Ngāi Tahu values, rights and interests, including taonga species and habitats, and wāhi tupuna.*

5.73. The Strategic Directions seek to enable development while protecting the valued natural and physical resources of the District. The Earthworks Chapter is inherently enabling and contemplative that earthworks is a necessary prerequisite of many land use and development activities. However, the Earthworks Chapter is required to impose controls to ensure protectionist components of the Strategic Directions are met, and in doing so will ensure the Strategic Directions give effect to the relevant RPS and ultimately, Part 2 of the Act.

Urban Development Chapter 4:

4.2.3 Objective – *Within Urban Growth Boundaries, provide for a compact and integrated urban form that limits the lateral spread of urban areas, and maximises the efficiency of infrastructure operation and provision.*

Policies

4.2.3.2 Enable an increased density of residential development in close proximity to town centres, public transport routes, community and education facilities.

5.74. The PDP encourages consolidation of urban growth within the urban growth boundaries and existing settlements. This approach is likely to result, in some instances, an increasing intensity of earthworks to facilitate higher density development. The management of earthworks is important to ensure the environmental objectives in Chapter 3 Strategic Directions are realised.

Tangata Whenua Chapter 5

5.4.3 Protect Ngāi Tahu taonga species and related habitats.

Policies

5.4.3.1 Where adverse effects on taonga species and habitats of significance to Ngāi Tahu cannot be avoided, remedied or mitigated, consider environmental compensation as an alternative.

5.4.5 Wāhi tūpuna and all their components are appropriately managed and protected.

Policies

5.4.5.1 Identify wāhi tūpuna and all their components on the District Plan maps and protect them from the adverse effects of subdivision, use and development.

5.4.5.2 Identify threats to wāhi tūpuna and their components in this District Plan.

5.4.5.3 Enable Ngai Tahu to provide for its contemporary uses and associations with wāhi tūpuna.

5.4.5.4 Avoid where practicable, adverse effects on the relationship between Ngāi Tahu and the wāhi tūpuna.

5.75. The Earthworks Chapter gives effect to the Tangata Whenua Chapter 5 by imposing limitations on earthworks within areas that are of significance to Māori and by ensuring suitable erosion and sediment management is undertaken where necessary.

Landscapes Chapter 6

6.3.3 ***Objective -*** *Protect, maintain or enhance the district's Outstanding Natural Features (ONF).*

Policies

6.3.3.1 Avoid subdivision and development on Outstanding Natural Features that does not protect, maintain or enhance Outstanding Natural Features.

6.3.3.2 Ensure that subdivision and development in the Outstanding Natural Landscapes and Rural Landscapes adjacent to Outstanding Natural Features would not degrade the landscape quality, character and visual amenity of Outstanding Natural Features.

6.3.4 ***Objective -*** *Protect, maintain or enhance the District's Outstanding Natural Landscapes (ONL).*

Policies

6.3.4.1 Avoid subdivision and development that would degrade the important qualities of the landscape character and amenity, particularly where there is no or little capacity to absorb change.

6.3.5 ***Objective -*** *Ensure subdivision and development does not degrade landscape character and diminish visual amenity values of the Rural Landscapes (RLC**).***

Policies

6.3.5.1 Allow subdivision and development only where it will not degrade landscape quality or character, or diminish the visual amenity values identified for any Rural Landscape.

5.76. The earthworks chapter gives effect to the PDP Landscape Chapter and sections 6(b) and 7(c) of the Act and 6 by managing the actual and potential adverse effects of earthworks where these could affect the District's landscape values.

Council Reply versions post hearings on submissions

5.77. Following the consideration of submissions and hearings, Council filed updated PDP chapters with recommended amendments where supported by Council officers. These version do not have any statutory status, however they are important in the context of whether the Council's position on a matter has moved from the notified PDP.

5.78. The respective 'reply' versions of the PDP chapters are not considered to give cause for a change in approach to the management of earthworks, or fundamentally different appraisal of the notified objectives and policies identified above.

Non-Statutory Context

5.79. Many Council's throughout the country use earthworks and erosion management guidelines and practice notes as a means of communicating the outcomes sought by managing the potential effects of earthworks, usually to avoid soil erosion, sediment generation and run-off. The Council are producing an erosion and sediment guideline to assist contractors and designers with information on small to medium scale erosion and sediment management. The guidelines are intended to assist those undertaking earthworks to comply with the standards that require sediment is retained on site, and does not cause run-off onto other properties or water bodies.

6. RESOURCE MANAGEMENT ISSUES

Introduction

6.1. The preceding discussion has identified that earthworks are an important component of land use and development, however the actual and potential adverse effects of earthworks need to be managed to ensure that sustainable management of natural and physical resources are promoted.

6.2. The following key issues have been identified as the central themes associated with earthworks in the Queenstown Lakes District.

Key Issues

Issue 1 – Earthworks and landscape, visual amenity and nature conservation values.

6.3. Earthworks can have adverse effects on the District's landscape resource, nature conservation values generally and amenity values in both rural and urban locations. It is important that earthworks are managed to ensure earthworks avoid adverse effects on landscape and where necessary for earthworks to be undertaken in visually sensitive areas, that earthworks are appropriately designed to be sympathetic and have regard to natural landforms and landscape values.

Issue 2 – Earthworks and people, safety and cultural values.

6.4. Earthworks can cause nuisance effects in the form of dust and vibration which can be appropriately minimised through management during construction. Earthworks can also cause safety issues for people and property and infrastructure. Earthworks on steep sites or areas affected by water can lead to slope instability, and earthworks undertaken near buildings, adjacent to neighbouring properties and existing subject to surcharge such as driveways or retaining walls can also have adverse effects if not appropriately managed.

6.5. Earthworks associated with cleanfill and landfill operations also require oversight because the effects from these activities are likely to be for a longer duration than earthworks undertaken on a site as a means to an end for the construction of subdivisions or buildings.

6.6. Earthworks can also damage both known and previously unknown heritage sites and sites of significance to Tangata whenua. Separate provisions apply for these resources within the PDP Historic heritage Chapter 26 and Part I of the Heritage New Zealand Pouhere Taonga Act 2014 states that no work may be undertaken on an archaeological site (whether recorded or unrecorded) until an archaeological authority to destroy, damage or modify a site has been granted by Heritage New Zealand Pouhere Taonga in accordance with that Act. However, earthworks itself and the applicable district plan chapter should be alive to the management of this issue and provide guidance as to the appropriate processes when heritage items are discovered.

Issue 3 – Earthworks and soil erosion, sediment and generation of run-off.

6.7. Some earthworks which do not control sediment generation and run-off may result in adverse effects on surface water bodies and damage, or adverse effects on stormwater infrastructure. This may have significant adverse effects on water quality and flow and can damage ecosystems of flora and fauna within those water bodies. Damage to these environments can also lead to a loss of cultural values.

6.8. As set out in in the statutory framework discussion and in Appendix 1 the higher order regional planning documents for Otago place an obligation on district plans to manage erosion and sediment. The issue of erosion and sediment management is particularly relevant for territorial authorities in the Otago region due to the absence of a regional land and water or land plan to manage the potential effects of earthworks on water bodies.

7. SCALE AND SIGNIFICANCE EVALUATION

7.1. The level of detailed analysis undertaken for the evaluation of the proposed objectives and provisions has been determined by an assessment of the scale and significance of the implementation of the proposed provisions. In making this assessment, regard has been had to whether the objectives and provisions:

- Fulfil the Council's role and functions under the Act as required by ss 31 and 74(1)(b);
- Impose increased costs or restrictions on individuals, communities or businesses;
- Result in a significant variance from the existing baseline in Operative District Plan Chapter 22;
- Have effects on matters of national importance;
- Adversely affect those resources overseen by special interests groups and statutory bodies, i.e. Tangata Whenua, Royal Forest and Bird Protection Society of New Zealand, Farming lobby groups, Gaurdians of Lake Wanaka;
- Involve effects that have been considered implicitly or explicitly by higher order documents; and
- Whether the proposed provisions are more appropriate than the existing.

7.2. The level of detail of analysis in this report is moderate-high. Earthworks are an anticipated component of many land uses but the effects of earthworks need to be managed, while ensuring efficiency and levels of intervention that are reasonable. Earthworks rules have the potential to affect a wide range of persons. Additional consenting information requirements can impose additional costs, however the costs to the environment could also be high if activities are not appropriately managed.

8. EVALUATION OF PROPOSED OBJECTIVES SECTION 32(1)(a)

8.1. The identification and analysis of issues has helped define how Section 5 of the RMA should be articulated. This has informed determination of the most appropriate objectives to give effect to Section 5 of the RMA in light of the issues.

8.2. Section 32(1)(a) requires an examination of the extent to which the proposed objectives are the most appropriate way to achieve the purpose of the Act. The following objectives serve to address the key Strategic issues in the District:

Proposed Objective	***Appropriateness***
25.2.1 **Earthworks are undertaken in a manner that minimises adverse effects on the environment and maintains landscape and visual amenity values.**	The objective is the most appropriate way to meet the purpose of the RMA because it recognises and provides the basis for a policy framework to implement the Council's function required under s31 of the RMA. In particular the management of effects of natural landscapes and resources and management of erosion, sediment and run-off. The objective gives effect to the Strategic Direction objectives identified in part 5 of this evaluation. The objective contemplates that earthworks are a necessary prerequisite of land use, however seeks an outcome that adverse effects are minimised, in particular on landscape and visual amenity values, and waterbodies. Recognises the interrelationship between part 5 of the Act and managing resources as required by sections 6 (a), (b), (c) and has regard to sections 7(b),(c), (f) of the RMA.
Proposed Objective	***Appropriateness***
25.2.2 **The social, cultural and economic well being of people and communities benefit from earthworks while being protected from adverse effects.**	The objective is the most appropriate way to meet the purpose of the RMA because it assists the Council to promote sustainable management through enabling earthworks, while ensuring adverse effects on people and their values are appropriately managed. As well as subdivision and development for construction, earthworks are necessary for a range of activities that communities in the Queenstown Lakes District benefit from including nationally and regionally significant infrastructure, tourism infrastructure, managing natural hazards, farming and recreation. The effects of these activities on people and on cultural values need to be managed. The objective gives effect to the Strategic Direction objectives identified in part 5 of this evaluation and will assist the

	Council to recognise and provide for the following: • Section 6(e) the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga. • Section 6 (f) the protection of historic heritage from inappropriate subdivision, use, and development.

9. EVALUATION OF THE PROPOSED PROVISIONS SECTION 32(1)(b)

9.1. The following tables consider whether the proposed provisions are the most appropriate way to achieve the relevant objectives. In doing so, it considers the costs and benefits of the proposed provisions and whether they are effective and efficient. The evaluation of the proposed provisions are grouped by the resource management issue, separate evaluations are set out for the provisions relating to the notification of applications:

- Table 1: Issues 1 and 3;
- Table 2: Issue 2;
- Table 3: Matters that will not be notified;
- Table 4: Matters that require an assessment to determine whether an application is processed on a notified basis.

Table 1:

Issue 1 - Earthworks and landscape, visual amenity and nature conservation values.
Issue 3 – Earthworks and soil erosion, sediment and generation of run-off.

All policies, rules, definitions and assessment matters are relevant. A summary of proposed provisions and components of the Earthworks Chapter that give effect to the objectives:

- Policy 25.2.1.1 – Ensure earthworks minimises erosion, land instability, and sediment generation and off-site discharge during construction activities associated with subdivision and development;
- Policy 25.2.1.2 – seeks protection of valued resources from inappropriate earthworks;
- Policy 25.2.1.3 – seeks to minimise effects on landforms;
- Policy 25.2.1.4 – seeks to manage the effects of earthworks on section amenity values;
- Policy 25.2.1.5 – that earthworks are designed to recognise the constraints and opportunities presented;
- Volume limits, matters of discretion and assessment matters to manage the environmental effects of earthworks;

• Area limits matters of discretion and assessment matters to ensure where erosion and sediment management is necessary it is effective; • A range of permitted exemptions are identified to facilitate small scale activities that would have no adverse effects, or only negligible adverse effects; • Permitting the volume, cut and fill associated with earthworks that are part of a subdivision application, recognising that the management of earthworks in terms of design and construction related processes can be managed as part of the assessment of the subdivision design and construction programme; • Permitting earthworks for ski area activities and vehicle testing facilities within the ski area subzone, except where there is potential for environmental effects on water bodies and roads.			
Sub topic / Rule	***Costs***	***Benefits***	***Effectiveness & Efficiency***
Volume limitations **Variation to Chapter 2 – Definitions:** **Earthworks, landfill, mining activity, cleanfill, cleanfill facility, mineral exploration,** **Mineral prospecting,**	***Environmental*** • Costs to the environment where activities are undertaken within the permitted limits. These costs are considered to be low. ***Economic*** • Costs to persons undertaking earthworks to apply for consent where the permitted standards are not met. ***Social & Cultural*** • None identified.	***Environmental*** • Ability to manage potential effects on landforms, including Outstanding natural features and landscapes. • The policies and assessment matters require oversight of the design of earthworks to ensure earthworks are sympathetic to the receiving environment. ***Economic*** • Management of environmental effects from earthworks will ensure the District's drawcard as a tourism and visitor destination will be maintained. • The rules are not overly conservative and enable a reasonable degree of earthworks anticipated by the zone.	**Effectiveness:** The provisions enable earthworks while giving a clear indication through the policies, rules, matters of discretion and assessment matters as to the different effects which can arise as a result of the activity being undertaken. Appropriate controls are implemented to ensure that effects from these activities are no more than minor or are avoided where appropriate and practicable. The provisions ensure that adverse effects on landscape, amenity and character shall be managed appropriately in the context of the sensitivity of the environment, while also ensuring that earthworks do not increase or create risk of natural hazards. **Efficiency**

Regionally Significant Infrastructure. **Variation to Subdivision Chapter 27.** **Variation to Jacks Point Chapter 41.**		***Social & Cultural*** • The earthworks rules will enable persons to undertake a range of land uses and developments on the basis reasonable and appropriate limitations are imposed.	The provisions provide the most appropriate approach to managing earthworks at various scales, while ensuring the adverse effects from earthworks are appropriately controlled. The rules do are not considered to be over-restrictive and the area limits in particular are considered commensurate to the sensitivity of the receiving environment. The provisions are also efficient in that they allow the earthworks rules in the Energy and Utilities Chapter 30 to prevail, and consequently any National Environmental Standard.
Area limitations **Variation to Chapter 2 – Definitions:** **Earthworks, landfill,**	***Environmental*** • Potential environmental cost associated with exempting earthworks for erosion and sediment management. This is considered to be a small cost and the procedures should be undertaken using best practice. The potential for harm is low. ***Economic*** • Costs to persons who are required to source materials and undertake erosion	***Environmental*** • Provides a means to manage the potential effects of soil erosion and sedimentation from development on water bodies, stormwater networks and neighbouring properties. ***Economic*** • The erosion and sediment management guidelines will assist those contemplating smaller scale activities to understand	

mining activity, cleanfill, cleanfill facility, mineral exploration, **Mineral prospecting, Regionally Significant Infrastructure.** **Variation to Subdivision Chapter 27.** **Variation to Jacks Point Chapter 41.**	management; however this is considered a small cost relative to not managing the potential harm. • Costs where it is considered necessary to obtain a erosion and sediment design from a suitably qualified person, however this will mostly affect large scale developments with commensurately higher operational budgets. This cost is considered low relative to the potential for adverse effects associated with inadequate erosion and sediment management. ***Social & Cultural*** • None identified.	good principles and initiate basic erosion and sediment management. This will assist with reducing costs associated with compliance. • Non-notification for activities that do not comply with the area standard. Recognising that this rule is to ensure processes and design is in place to minimise erosion, sediment and runoff. ***Social & Cultural*** • Assists with safeguarding the life supporting capacity of water.	
Setback from waterbodies **Variation to Chapter 2 – Definitions:** **Earthworks, landfill,**	***Environmental*** • None identified. The setback is considered appropriate to safeguard potential effects. The safeguard is considered to be considerable more effective than the equivalent rule in the Operative District Plan that allows 20m³ within the 7m of a waterbody. ***Economic***	***Environmental*** • Provides a basis to require consent and manage the actual and potential adverse effects where earthworks could affect water bodies and their margins. ***Economic*** • Positive economic effect associated with ensuring potential adverse effects are managed and not allowing. Not managing potential effects through the	

mining activity, cleanfill, cleanfill facility, mineral exploration, **Mineral prospecting, Regionally Significant Infrastructure.** **Variation to Subdivision Chapter 27.** **Variation to Jacks Point Chapter 41.**	• Costs to persons who are required to apply for resource consent; however this is considered a small cost relative to not managing the potential harm from uncontrolled earthworks within the margins of a waterbody. ***Social & Cultural*** • None identified.	earthworks chapter and resource consent could harm the environmental reputation of the District and result in increases to economic costs through remediation or delays to a project where earthworks are not appropriately managed. ***Social & Cultural*** • Assists with safeguarding the life supporting capacity of water.	

Table 2.

<u>Issue 2 – Earthworks and people, safety and cultural values.</u>

All policies, rules and assessment matters are relevant. A summary of proposed provisions and components of the Earthworks Chapter that give effect to the objectives:

- Policy 25.2.2.1 – recognises the benefits of earthworks for specified activities;

• Policy 25.2.2.2 - protects infrastructure, buildings and stability of other land; • Policy 25.2.2.3 – manages the nuisance and health effects from earthworks; • Policy 25.2.2.4 and 25.2.2.5 – manages necessary processes to avoid adverse effects on cultural heritage, including wāhi tapu, taonga, and archaeological sites, or where these cannot be avoided, effects are remedied or mitigated; • Policy 25.2.2.6 – manages effects on amenity and traffic generation associated with earthworks; • Policy 25.2.2.7 - seeks to ensure that natural hazard risk is managed; • Accidental discovery rule (25.5.14) process set out in Schedule 25.10; and • Setback from boundaries (Rule 25.5.18).			
Sub topic / Rule	***Costs***	***Benefits***	***Effectiveness & Efficiency***
Volume **Setback from boundaries** **(land stability and natural hazards)** **Variation to Chapter 2 – Definitions:** **Earthworks, landfill, mining activity,**	***Environmental*** • None identified, the permitted thresholds are unlikely to generate environmental harm. ***Economic*** • Costs to persons who are required to apply for resource consent; however this is considered a small cost relative to the alternative of not managing the potential harm from uncontrolled earthworks. • The permitted standards are considered reasonable and enable the battering of a cut slope up to within 300mm of the boundary, and allows cut and fill up to 300mm depth up to the boundary. This is more lenient and reasonable than the equivalent Chapter 22 Operative District Plan rules that for cuts, requires the crest of the cut is setback from the boundary the same distance as depth. ***Social & Cultural***	***Environmental*** • The rules will ensure an appropriate level of intervention where cuts and fill could have adverse effects on land stability. ***Economic*** • The intervention and requirement for a resource consent/limit for permitted activities are likely to prevent persons from undertaking earthworks that could undermine existing buildings, or areas with surcharge. The requirement for a resource consent will ensure that if necessary earthworks and stability issues are appropriately addressed. This will ensure that from an economic perspective earthworks are manged to prevent harm to existing built resources. ***Social & Cultural***	**Effectiveness:** The provisions enable earthworks while setting in place measures to protect, where necessary land and built resources from stability issues. The provisions also provide a clear and effective process for when an accidental discovery is made. Identified sites of significant to iwi will be protected by not allowing any earthworks as a permitted activity in these areas. Appropriate controls are implemented to ensure that effects from these activities are no more than minor or are avoided where appropriate and practicable. **Efficiency**

cleanfill, cleanfill facility, mineral exploration, **Mineral prospecting, Regionally Significant Infrastructure.** **Variation to Subdivision Chapter 27.** **Variation to Jacks Point Chapter 41.**	• None identified.	• None identified.	The provisions provide the most appropriate approach to managing earthworks where stability, hazards are at issue. Where earthworks affect a site of significance to iwi the process is not efficient as a Discretionary resource consent is required, however the level of intervention is appropriate to ensure section 6(e) of the RMA is provided for. The rules and policies are not considered to be overly-restrictive and are reasonable in the context of the likely sensitivity of the receiving environment.
Heritage and Tangata Wheua **Variation to Chapter 2 –**	***Environmental & Social & Cultural*** • None identified. The rules have a relatively high level of intervention and this is considered appropriate. ***Economic*** • Potential costs for person undertaking	***Environmental Social & Cultural*** • Appropriate level of intervention for safeguarding of heritage and arras of significance to Tangata Whenua. ***Economic*** • Early and appropriate intervention could	

Definitions: **Earthworks, landfill, mining activity, cleanfill, cleanfill facility, mineral exploration,** **Mineral prospecting, Regionally Significant Infrastructure.** **Variation to Subdivision Chapter 27.** **Variation to Jacks Point Chapter 41.**	earthworks within an identified/protected area or where an accidental discovery is made. However the costs are low compared to the potential harm to heritage and cultural values.	save persons from further delays prosecution if the protocols in the accidental discovery advice in Schedule 25.10 are observed.	

Table 3.

Matters that will not be notified

Rule 25.6 states that activities that exceed the area (m²) limitation (Rule 25.5.11) shall not require the written consent of other persons and shall not be

notified or limited notified.

The principal reasons for the area limitation are to manage the potential adverse effects from land disturbance that are soil erosion, sediment generation and run-off, traffic effects and dust arising from earthworks that are of a relatively short term duration associated with construction activities.

The reason for making these activities not applicable to a 'notification assessment' and precluding any opportunity for involvement by other persons is that the actual and potential adverse effects should be able to be sufficiently avoided by the design and implementation of erosion and sediment methods and construction related methods to ensure that sediment and dust are managed. The restricted discretionary activity status provides the Council with sufficient power to decline applications that have insufficient design relating to erosion and sediment management, and providing the design is adequate there is a high degree of certainty that the environment and other persons would be subject to negligible adverse effects, through the implementation of the approved design and imposing conditions.

It is considered impractical and unlikely the non-notification elements of this rule could be used to circumvent an undesirable outcome on the environment or other persons because There are also other rules in the Earthworks Chapter that would require a resource consent to address the actual and potential environmental effects associated with uncontrolled land disturbance activities:

- Earthworks within a statutory acknowledgment Area (Rule 25.4.6), or accidentally discovers an archaeological site (Rule 25.5.18);
- Earthworks must be undertaken in a way that prevents sediment entering water bodies, stormwater networks or going across property boundaries (Rule 25.5.12);
- Material being transported shall be deposited on any Road (Rule 25.5.13); and
- Any person carrying out earthworks shall implement dust control measures to minimise nuisance effects of dust beyond the boundary of the site (Rule 25.5.14).

It is considered that applications relating to the area of land disturbed can be efficiently and effectively processed without notification because the matter is a process component should be able to designed sufficiently such that the activity complies with other standards.

Costs	***Benefits***	***Effectiveness & Efficiency***
Environmental • Potential where other persons are prevented from being involved, unless the case for a special circumstance arises. ***Economic*** • Subsequent economic costs to those	***Environmental*** • No direct environmental benefits. ***Economic*** • Reduced economic costs through a curtailed resource consent process where non-notification is guaranteed and an abridged assessment and decision making reporting obligations under section 104 of	**Effectiveness:** The notification clause is a process related component of the PDP, rather than an environmental matter. However, better and more effective outcomes can be had where there is a wide range of input from parties other than the applicant and the Council. **Efficiency** The non-notification of these applications will ensure

persons precluded from the process where there is an economic cost to them (i.e. an adverse effect that diminishes their economic value in some way). However, given the other rules in the Earthworks Chapter that manage adverse effects and could result in notification, it is considered the economic costs are low. ***Social & Cultural*** • Cultural costs could be where environmental harm causes a cultural value (i.e. Tangata Whenua) to be affected. However it is considered that there are other rules in the earthworks chapter that ensure consent is required and potential for notification, especially where statutory acknowledgment areas are involved that would ensure notification processes are available, if required (i.e. Rule 25.5.19 setback from water bodies and Rules 25.5.14 and 25.4.5 and 25.4.6 relating to sites of significance to iwi.	the Act, instead of section 95, that often requires lengthier assessments to satisfy the respective tests to determine whether the application needs to be process on a notified or limited notified basis. ***Social & Cultural*** • None identified.	efficiency in addressing potential adverse effects from temporary activities such as construction and land development that can be addressed through design with oversight from the Council alone. The non-notification of these activities will also fit with the status for subdivisions in Chapter 27 pf the PDP were many subdivisions that comply with the minimum allotment size or density rules will be processed on a non-notified basis. Rule 25.3.4.1 sets out that the area of land disturbance rule is applicable to subdivision activities. This is to reinforce and provide sufficient oversight of the importance of appropriate management of subdivision development, particularly large green-field subdivisions. The non-notification provision for these activities will improve efficiency with plan administration.

Table 4.

Matters that require an assessment to determine whether an application is processed on a notified basis.

Table 3 above identifies and evaluates the activities that shall be processed without notification.

All other earthworks activities would require an assessment under section 95 of the Act as to whether the adverse effects are such that the application is processed on a notified basis, or without notification but with notice served on specified persons.

Although earthworks are contemplated as part of many land uses and land development activities. The adverse effects resulting from earthworks can be

significant if not appropriately managed or designed appropriately or undertaken within what is reasonably expected by the zone the earthworks are located within. There can also be a range of adverse effects on other persons and statutory agencies associated earthworks in sensitive locations, large scale earthworks that can have adverse effects on visual amenity, landforms and natural features. It is considered appropriate that standards relating to earthworks near boundaries of properties could be notified for reasons relating to amenity generally, land stability effects and visual amenity from modification to the landform. Overall, the requirement for applications to undergo a notification assessment and could be processed on a notified or non-notified basis is substantially less efficient than a non-notification provisions. However the costs associated with precluding other persons from the process not providing the opportunity for notification where adverse effects are significant is not appropriate and is not considered to be justifiable.		
Costs	***Benefits***	***Effectiveness & Efficiency***
Environmental • None identified. ***Economic*** • Costs to applicants where the activity has adverse effects on another person and written approval is required for the activity to be processed on a non-notified basis. • Potential substantial costs and time delays associated with applications being processed on a notified or limited basis, however this is commensurate to the likely scale or breadth of the activity. • Cost to Council and consent holders where notification decision are challenged through judicial review process.	***Environmental*** • Could result in earthworks that are avoided or more sensitive with respect to effects o other persons. ***Economic*** • Has potential for more sensitive and appropriately considered earthworks activities that in the longer terms, and from a District perspective ***Social & Cultural*** • Benefits to persons and community for ability for wider input through notified resource consent applications when these present.	**Effectiveness:** The ability for applications to be notified could result in more sensitive designs fro the outset, particular in sensitive environments. **Efficiency** Requiring an assessment to determine whether an application is processed on a notified or limited notified basis is not as efficient as non-notification. The requirement for an application to be processed where submissions and/or a hearing is required can be very inefficient for the applicant. However, the process should be commensurate to the scale of the activity.

Social & Cultural • None		

Other reasonably practicable options for achieving the objectives ***(s32(1) (b)(i)):***

Option 1

Permitting earthworks within the footprint of a building

Some Council's district plans permit earthworks irrespective of volume/location where it is associated with a dwelling that has building consent[11]. This method was considered but was not considered to achieve the objectives as well as the preferred rules for the following reasons:

- The volume standards are relatively permissive and should address most residential construction scenarios to the extent contemplated in the respective zone;
- Anecdotal advice received was the these rules acted as a disincentive to persons undertaking initial subdivision/land development to bench and contour sites in an integrated manner, and left the earthworks to the end developer/homebuilder, which lead to an ad-hoc outcome in terms of finished levels between adjoining properties;
- There could be unintended adverse effects from exempting earthworks within a footprint and uncertainty with rule interpretation and plan administration.

Option 2

A tiered rule framework for erosion and sediment management

The Council has received advice on the most appropriate methods to manage soil erosion and sediment generation and run-off. That advice is to have a rule limiting the area of land disturbed both under (10,000m²) and over (2500m²) a specified slope of 10°, derived from an analysis of a soil loss equation based on parameters unique to the District.

The advice also considered additional rules for various receiving environments however decided this was not necessary given the characteristics of the potential for soil loss in the District, sensitivity to receiving environments and the additional rules, including a setback of earthworks from waterbodies of 10 metres.

[11] i.e. Christchurch Replacement District Plan, and Upper Hutt District Plan.

It was investigated whether additional rules were appropriate once earthworks over a certain scale required consent under a separate rule (i.e. area of land disturbed over 30,000m²), on the basis that it would be likely that there could be a higher potential for adverse effects and it indicated a higher level of oversight was required.

This option was rejected on the basis that irrespective of the scale of land disturbance the matters of discretion and assessment matters are suitable to address activities of all scales. The recommended area limitations are appropriate and no additional rules for large scale activities are considered necessary.

Option 3

Exempting all earthworks associated with a subdivision (operative District Plan Chapter 22)

The Proposed Earthworks Chapter exempts the following earthworks where associated with a subdivision:

a. volume standards in Table 25.2;
b. Rule 21.5.15 cut standards; and
c. Rule 21.5.16 fill standards.

The reason for this is because the volume of material exceedances is often not relevant in the context of the overall activity, particularly when the nature and scale of the subdivision is contemplated by the zone.

The Operative District Plan Earthworks Chapter 22 appears to exempt all earthworks associated with a subdivision. This option is not considered appropriate because there is not considered to be any reason why there is a difference in adverse effects on (for instance) an adjoining owner if earthworks undertaken within a property boundary setback, or setback from a water body for a subdivision, or for any other land use.

It is important that an assessment as to the effects on adjoining property owners is available where cut and fill adjacent to the boundary could have substantial adverse effects on these persons. Continuation of the operative regime is not the most appropriate way to meet the objectives.

Option 4

Setbacks of earthworks from other properties

The Operative District Plan Chapter 22 requires that the crest of a cut is setback from a property the same distance as the cut (i.e. a 1 metre deep cut must be setback 1 metre from the boundary). The rule is considered to be potentially difficult to be complied with where driveways are located near a property boundary's and, the rule seems to encourage vertical cuts because of the requirement to ensure the crest of the cut is setback from the boundary the same distance as the depth.

It is considered more appropriate to enable cuts closer to a property boundary providing the cut does not undermine any structures or the land on neighbouring properties. The proposed rule enables a cut of 1:3 on the basis it is setback at least 300mm from the boundary. A cut of 1:3 is shallower than the Council's code of practice, however a gradient of 1:3 (expressed in Rule 25.5.19 as a requirement for the distance to be 1.5 times the depth) is considered suitable as a permitted rule. Continuation of the operative setback from boundary for cut is not considered the most appropriate way to meet the objective.

Option 5

Not providing any assessment matters

The approach through the PDP is to reduce assessment matters in favour of applying the consideration of activities through the policies themselves. It is the case with the earthworks Chapter and the wide variety of activities that earthworks are associated with, and range of zones and receiving environments that assessment matters were included. While this is a departure from other District Wide Chapters of the PDP it is considered the most appropriate way to achieve the objectives, in this instance.

Assessment matters can be ineffective where they do nothing more than mimic the policy, in this case the assessment matters articulate at a finer grain, how an activity is designed or will be undertaken and the extent this accords with the policy, the assessment matters in this instance provide added value and are considered the most appropriate way to meet the objective.

10. THE RISK OF NOT ACTING

10.1. Section 32(c) of the RMA requires an assessment of the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the provisions. It is not considered that there is uncertain or insufficient information about the subject matter of the provisions.

10.2. The issues identified and options taken forward are the most appropriate way to achieve the purpose of the RMA. If these changes were not made there is a risk the District Plan would fall short of fulfilling its functions.

Appendix 1. Approaches to earthworks – Review of 7 District Plans within 3 regions and comparison of the relationship with the Regional Policy Statements and Plans, with particular regard to the management of soil erosion and sedimentation.

Appendix 2. Review of management for erosion and sediment management

Appendix 1. Approaches to earthworks – Review of 7 District Plans within 3 regions and comparison of the relationship with the Regional Policy Statements and Plans, with particular regard to the management of soil erosion and sedimentation

Region	Territorial Authority	District Plan	Rules	Generic Overview	Non Notification	Regional Council Policy Statements and Plans
Otago	**Queenstown Lakes**	**Operative District Plan Chapter 22 (June 2016)**	**Volume limits**	• 300m³ Residential Zones • 1000m³ Rural General Zone	Most earthworks non-notified except: Involving blasting or presence of substantial groundwater, earthworks located within an internal or road boundary (22.3.2.6(i)). Volume limitations except where specified zones adjoins a residential or Open Space – Landscape Protection (22.3.2.6(ii)). Involvement with the National Grid	**Otago Regional Policy Statement** The Operative Regional Policy Statement (1998) (**ORPS**) identifies in Issue 5.3.3 (Otago's water resources may be adversely affected by land activities) sedimentation associated with a range of land uses and activities. Policy 5.5.5(c) seeks to minimise the adverse effects of land use activities on the quality and quantity of Otago's Water resource through…(c) *Avoiding, remedying or mitigating the degradation of groundwater and surface water resources caused by the introduction of contaminants in the form of chemicals, nutrients and sediments resulting from land use activities.* A range of methods are identified in the ORPS to manage the effects of earthworks and sedimentation from land use activities, however, there is not a distinctly identifiable obligation for either regional or district plans. Method 5.6.21 is identified as being of relevance in terms of managing erosion and sediment: '*Consider including provisions and conditions in district plans and on resource consents to avoid, remedy or mitigate soil degradation resulting from the subdivision use, development or protection of land*'. Method 21.6.23 states '*Consider including provisions or conditions in district plans and on resource consents which seek to avoid, remedy or mitigate the adverse effects of land use activities on water resources*'. These two methods in particular are considered to give direction to territorial authorities to manage the effects of erosion and sedimentation arising from land use activities. The Proposed Regional Policy Statement 2015 (**PRPS**) (Decision version 1 October 2016) states that policies 3.1.7 (Soil Values), 3.1.8 (Soil erosion) and 5.4.1 (Managing for urban growth and development) are to be given effect to a range of Methods including via City and District Plans (Method 4.1.4). In particular, the Methods for Policy 3.1.8 (Soil Erosion) do not identify any obligation through Regional Plans to manage erosion and sedimentation through land use activities. Method 4.1.4 (District and City Plans) is '*Policies 3.1.7, 3.1.8, and 5.4.1 by including provisions to manage the discharge of dust, and silt and sediment associated with earthworks and land use'.* The PRPS places a clear obligation on territorial authorities to manage the potential effects of erosion and sedimentation from land use activities through district plans. The Otago Regional Council currently do not have a dedicated regional earthworks or soil conservation plan and the Methods of the PRPS indicate that it is intended that erosion and sediment is managed primarily by District and City Plans.
			Area limits	• None		**Otago Regional Plans** The Otago Regional Plan: Water for Otago (Operative 2004) contains the following provisions that relate to the discharge of water containing contaminants (including sediments) to water (Lakes/rivers/coast):
			Other Rules	• <20m³ within 7m of waterbody. • Not expose groundwater. • Manage erosion and sediments • Cut <2.4m • Fill <2.0m • Any person carrying out earthworks shall implement sediment and erosion control measures to avoid sediment effects beyond the boundary of the site. (22.3.3.iv(a)).		

Rule 12.C.1.1 permits the discharge of water or any contaminant to water, or onto or into land which may result in a contaminant entering water is a permitted activity providing a range of qualifiers are met, including at (d) the discharge:

(d)(i) Does not result in:

(1) A conspicuous change in colour or visual clarity; or

(2) A noticeable increase in local sedimentation, in the receiving water (refer to Figure 5); and

(ii) Does not have floatable or suspended organic materials; and

(iii) Does not have an odour, oil or grease film, scum or foam; and

…

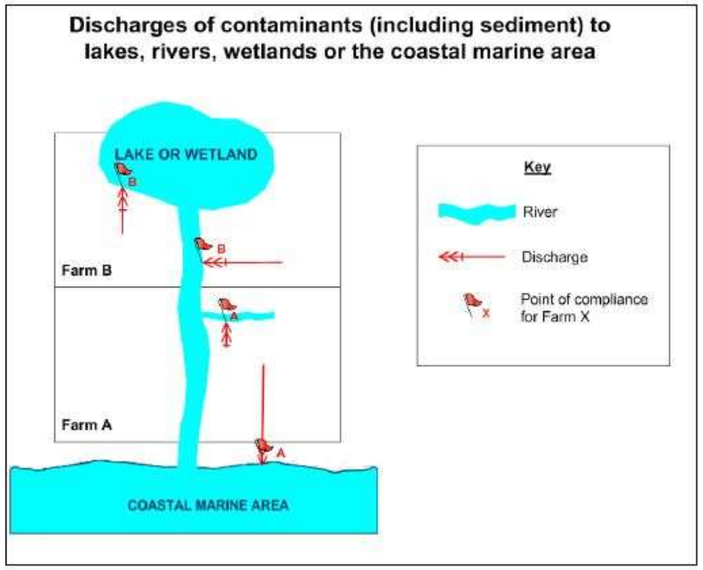


Figure 5: Implementation of Rule 12.C.1.1(d)(i)

In terms of achieving compliance associated with sediments entrained in water, Figure 5 makes it clear that the measurement/compliance point is where the sediment entrained water enters the river or lake and that for permitted status it must not result in (i)(2) *'a noticeable increase in local sedimentation, in the receiving* environment'

Non-compliance would require discretionary activity resource consent pursuant to Rule 12.C.3.

Rule 12.C.0.3 holds a prohibited activity status for the discharge of sediment from disturbed land to water where no measure is taken to mitigate sediment runoff.

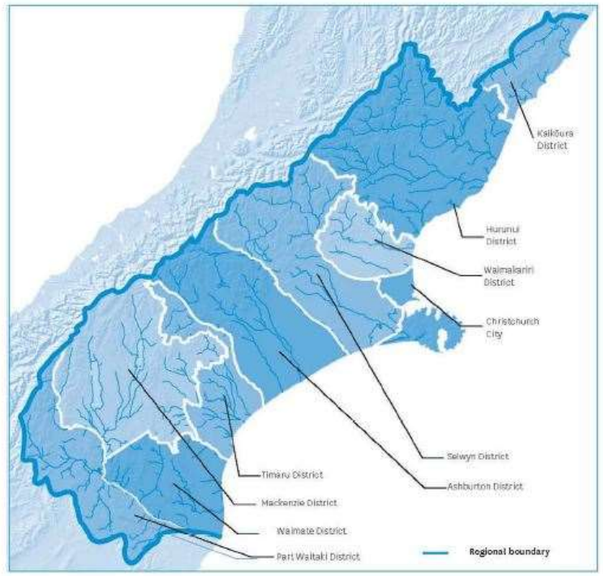
Typically therefore, water runoff from a site with disturbed land is permitted providing the sediment laden water does result in either a conspicuous change in colour or visual clarity or a noticeable increase in local sedimentation in the receiving water.

If no measures are made the activity status is prohibited and no resource consent can be granted. Where there is non-compliance but where measures have been made resource consent is required as a discretionary activity.

While rules are in place in the Otago regional Plan: Water, these are suited to activities where it would be a pre-meditated action before the activity commenced to note that compliance with the

						permitted standards cannot be achieved and to apply for a resource consent. The prohibited limb of the rule framework makes it clear that no avenue is provided to discharge sediments to rivers and lakes without undertaking sediment management measures. Instances where a resource consent is applied for to discharge sediment laden water to a waterbody would be for works within or adjacent to a waterbody and while sediment management would expected to be employed it is not possible to avoid all sediments entering the water stream and noticeable sedimentation of the water could occur. The types of activities that fall under these circumstances are culvert and bridge pile installation and repair. It is considered that because the Otago Regional Plan: Water does not control land disturbance activities, only the effects of a discharge, the opportunity to proactively manage the potential adverse effects of sedimentation entering rivers; lakes or onto land arising from temporary construction activities associated with land use activities is limited. It is unlikely that the proponents of typical subdivision and development activities would apply for a discretionary activity through the Otago regional Plan: Water on the off-chance permitted status could not be achieved. It could also the case that the Otago Regional Council would encourage compliance with the permitted standards to minimise effects on the receiving environment, rather than grant a discretionary activity resource consent where compliance with Rule 12.C.1.1 can be achieved. The Regional Plan Water does not directly intervene with land use activities to manage soil conservation or the potential effects of erosion and sedimentation. Instead, the Regional Plan Water does not specify controls on land uses or land disturbance activities, but controls adverse effects on the environment through managing discharges. **Regional land use plan earthworks/land activities** The Otago Council does not have a land use plan to manage the effects of earthworks for soil conservation or sedimentation. The management of sedimentation to water on sites with land disturbance activities, to ensure that runoff from these sites complies with Rule 12.C.1.1 of the Otago regional Plan: Water is a permitted activity is considered to fall on district and city plans. This is reinforced by Method 4.1.4 identified in the PRPS 2015. **Relationship between the QLDC Operative Earthworks Chapter and Regional Plans/Policy Statements** The Operative Earthworks chapter assists with the management of the potential adverse effects of erosion and sedimentation through the standard that requires erosion and sediment management is undertaken (Rule 22.3.3.iv(a)), and indirectly through limits on the volumes on a site and within 7 m of a waterbody. The Operative Earthworks Chapter provides for the management of potential adverse effects of erosion and sedimentation from land disturbance activities in the absence of a regional land use plan that directly specifies land use activities. However the level of intervention is not direct and is left to a single generic rule that requires erosion and sediment management is undertaken.
Otago	**Dunedin City**	**2GP notified October 2015 (DCC 2GP)** **Residential Zones (Rule 15.6.2)**	**Volume limits**	Ratio of volume per area, maximum allowed 30m³ per 100m² of site, reducing as the gradient increases: i.e. >26° but <35° permits 0m³ fill, 5m³ cut per 100m² of site.	Rule 15.4. No non-notification provisions for earthworks.	**Refer to the above discussion on the Otago Regional Council Statements and Plans.** **Relationship between the DCC 2GP Earthworks Chapter and Regional Plans/Policy Statements** The DCC 2GP includes controls to manage the areas of land disturbed and has additional emphasis in sensitive areas and receiving environments. The DCC 2GP provides for the management of potential adverse effects of erosion and sedimentation from land disturbance

			Area limits	Residential Area: (Nil) Urban conservation area (50m²) Within 5m of a water body (25m²)		activities in the absence of a regional land use plan that directly specifies land use activities. The DCC 2GP utilises area disturbance limits in sensitive receiving environments and has a generic rule that ensures erosion and sediment management is effective (Rule 15.6.2.7).
			Other Rules	< 1.5m change in ground level (cut/fill) Earthworks must be undertaken in a way that prevents sediment entering water bodies, stormwater networks or going across property boundaries. (15.6.2.7)		
Otago	**Central Otago**	**Operative 1 April 2008**	**Volume limits**	**Section 7 Residential Resource Area** No earthworks rules identified with the exception of earthworks in relation to the National Grid (refer to District Wide Rules and Performance Standards Section 12). Earthworks are a matter of control or discretion with subdivision. **Section 5 Water Surface and Margin Resource Area** Rule 5.7.2 (b))Earthworks within 10m of a water body is a restricted discretionary activity. **Rural Resource Area (Section 4)** Earthworks shall not exceed 20m³ within 10m of a water body. Rule 4.7.6.I. Earthworks shall not exceed 2000m² or 3000m³. (Rule 4.7.6J(b)	None identified.	**Refer to the above discussion on the Otago Regional Council Statements and Plans.** **Relationship between the Central Otago District Plan and Regional Plans/Policy Statements** The Central Otago District Plan has few controls to manage the areas of land disturbed and potential adverse effects of erosion and sedimentation from land disturbance activities in the absence of a regional land use plan that directly specifies land use activities.
			Area limits			
			Other limits			
Otago And Canterbury	**Waitaki**	**Operative May 2010**	**Volume limits**	**Residential Rules (Part III Section 2)**	Earthworks greater than 100m³ or 50m²	**Refer to the above discussion on the Otago Regional Council Statements and Plans.** **Relationship between the Waitaki District Plan and Otago Regional Plans/Policy Statements**

				No earthworks rules identified. **Rural Areas (Part III Section 4)** <100m³ (controlled activity) Rule 4.3.2(1)		The Waitaki District Plan has few controls to manage the areas of land disturbed and potential adverse effects of erosion and sedimentation from land disturbance activities in the absence of a regional land use plan that directly specifies land use activities.
			Area limits	**Rural Areas (Part III Section 4)** < 50m² (controlled activity) (Rule 4.32.(i).		**Canterbury Region** **Regional Policy Statement Revised February 2017** Map of Canterbury region  The Waitaki District is located within both the Otago and Canterbury regions, as illustrated in the image above, sourced from the Canterbury Regional Policy Statement. Land uses causing soil and sediment run-off into water bodies and coastal water, and adversely affecting the quality of that water, are addressed in Chapter 7 - Fresh Water. Broadly, the relevant objectives are: • Objective 7.2.1 – Sustainable management of fresh water; • Objective 7.2.2 – Parallel processes for managing fresh water • Objective 7.2.3 Protection of intrinsic value of waterbodies and their riparian zones. Policy 7.3.7 – Water quality and land gives effect to these objectives and states: *To avoid, remedy or mitigate adverse effects of changes in land uses on the quality of fresh water (surface or ground) by:* *1. identifying catchments where water quality may be adversely affected, either singularly or cumulatively, by increases in the application of nutrients to land or other changes in land use; and* *2. controlling changes in land uses to ensure water quality standards are maintained or where water quality is already below the minimum standard for the water body, it is improved to the minimum*
			Other limits	**Subdivision (Part III Section 14)** Matters of control and discretion for subdivision include stormwater runoff (7b)		

				The Methods state at (2) Local Authorities will *'Work together to manage the adverse effects of land uses on freshwater quality including appropriate controls on land uses in district or regional plans. This may include adopting a holistic approach to the management of the impacts of development such as low-impact urban design and development principles, and riparian management.'* The Canterbury RPS places as obligation on district councils to manage the effects of land uses on water quality. **Canterbury Land and Water Regional Plan 2017 (CLWP 2017)** The Canterbury Land and Water Regional Plan has jurisdiction over the diversion and discharge of stormwater, however it also manages the following land use activities that could also generate erosion and sedimentation: • Stormwater (Rules 5.93A – 5.97). • Earthworks and vegetation clearance in Riparian Areas (Rules 5.167 – 5.169). • Vegetation Clearance and Earthworks in Erosion - Prone Areas (Rules 5.170 – 5.171). • Burning of Vegetation (Rules 5.172 – 5.174). **Stormwater (Rules 5.93A – 5.97)** Rules 5.93A to 5.94 manage stormwater discharged from a reticulated stormwater system. A cascading rule framework is used to manage stormwater runoff from land disturbance, including 'construction-phase stormwater'. Construction-Phase stormwater is defined in the CLWP 2017 as: *Means water, sediment and entrained contaminants resulting from precipitation on exposed or unstabilised land and which arises from construction or demolition activities, or the development of a building site.* The discharge of stormwater or construction phase stormwater requires resource consent as a restricted discretionary activity if qualifiers are met including the preparation of a stormwater management plan and the discharge meets parameters set out in schedule 8 of the CLWP 2017. Activities that fail these are a non-complying activity (Rule 5.94). Rule 5.94A - B manages discharges of construction phase stormwater from non-reticulated stormwater systems. The discharge of construction phase stormwater in these circumstances is permitted if certain qualifiers relating to the area of land disturbed are met including: • The area of disturbed land from which the discharge is generated is less than 1000m² within an area identified in the planning maps as High Soil Erosion Risk, or • Two hectares in any other location (Rule 5.94 1 (b)) • Limits on the concentration of suspended solids • Limits on the increase in the flow of any receiving waterbody • The discharge is not from a contaminated water body, contain hazardous substances and does not occur within a community drinking-water protection zone identified in the CLWP 2017. Non-compliance is a restricted discretionary activity (Rule 5.94B) Through these rules the CLWP 2017 controls land use to manage the potential effects of sedimentation from land disturbance.

						Earthworks and vegetation clearance in Riparian Areas (Rules 5.167 – 5.169) Rule 5.167 controls the use of land for vegetation clearance outside the bed of a river, lake or adjacent to a wetland boundary, but within 10m of land identified as Hill and High Country or as High Soil Erosion Risk on the planning maps and any associated discharge of sediment or sediment laden water where it may enter surface water is a permitted activity providing conditions are met. Rule 5.168 controls earthworks in the same areas described above as a permitted activity providing conditions are met, including that earthworks are limited to 500m² or 10% of the area, the volume is less than 10m³. Non-compliance with Rules 5.167-5.168 is a restricted discretionary activity. These rules control land use to manage the potential effects of sedimentation from land disturbance. **Vegetation Clearance and Earthworks in Erosion - Prone Areas (Rules 5.170 – 5.171)** Specific land use activities are controlled within areas identified in the CLWP 2017 as High soil erosion risk to manage erosion and sedimentation. The activities and controls include: • Cultivation or spraying of slopes greater than 25° is limited to 200m² • Creation or the maintenance of existing firebreaks limited to cuts of 0.5m • Construction of walking tracks up to 1.5m wide • Earthworks limited to 10m³ per hectare and maximum depth of cut or fill is limited to 0.5m • Limits on the concentration of total suspended solids of discharges **Burning of Vegetation (Rules 5.172 – 5.174)** Burning of vegetation is a permitted activity providing conditions are met including: • Burning does not occur within 5m of the bed of a river where the wetted bed is more than 2m wide or a wetland boundary where the wetland is more than 0.5ha in area • Within an area to be burnt the area of bare ground is less than 20%, the slope is less than 35° and the land is less than 900m above sea level • The burnt area is either spelled from grazing for a minimum of 6 months following burning, or sown with pasture within 6 months of burning, or planted with trees within one year of burning. Where non-compliance is not achieved, a controlled activity is required providing a range of qualifiers are met. The matters of control relate to effects on water quantity and quality and soil conservation. The matters of control or discretion associated with non-compliance of the rule As well as managing the effects of sedimentation on water quality, the vegetation clearance and earthworks in erosion – prone areas and burning of vegetation rules (Rules 5.170 – 5.174) also address the Canterbury Regional Council's responsibility under section 30(1)(c) of the Act to control the use of land for the management of soil conservation. **Relationship between the Waitaki District Plan and Canterbury Regional Plans/Policy Statements** The Waitaki District Plan has few controls to manage the areas of land disturbed and potential adverse effects of erosion and sedimentation. However, as discussed above, the CLWP 2017 has land use rules that manage the potential adverse effects of soil erosion and sedimentation. The CLWP 2017 makes up for the apparent shortfall in the rules in the Waitaki District Plan where it is within the jurisdiction of the Canterbury Region.
Canterbury	**Christchurch**	Christchurch Replacement District Plan	**Volume limits**	Table 9: maximum volumes • Residential Zones 20m³ site	Controlled and restricted discretionary	**Refer to the above discussion on the Canterbury Regional Council Statements and Plans.** Also note Policy 8.1.4.1.a. of the CRDP which is:

		(**CRDP**) Chapter 8 Subdivision, Development and Earthworks (part) Stage 2		• Commercial local and Banks Peninsula Zones 20m³ site • Commercial core/retail parks 1000m³/ha • All rural zones 100m³/ha • Transport no limit	activities.	*Ensure earthworks do not result in erosion, inundation or siltation, and do not have an adverse effect on surface water or groundwater quality.* **Relationship between the CRDP and Canterbury Regional Plans/Policy Statements** The CRDP does not have area limitations, however it has relatively conservative permitted thresholds and generic thresholds for steep slopes and waterbodies. The matters of discretion provide for the management of erosion and sedimentation. As discussed above, the CLWP 2017 has land use rules that also manage the potential adverse effects of soil erosion and sedimentation from land use activities. The CRDP rules provide an additional layer of management, primarily through the matters of discretion, however the rules of the CRDP do not duplicate the detailed rules of the CLWP 2017, in particular those relating to stormwater discharges related to 'construction-phase activities'.
			Area limits	None		
			Other limits	• Earthworks shall not occur on land with a gradient steeper than 1 in 6 (Rule P1.iii). • Chapter 6 City and Settlement Water Body Setbacks controls earthworks in within the bed of waterbodies. Matters of discretion include natural values and assessment matter 6.3.6.7.2 (c) includes any adverse effects of the discharge of sediment to the water body and downstream receiving environment.		
Canterbury	**Selwyn**	Selwyn District Plan Operative 3 May 2016 (**SDP**)	**Volume limits**	Township Volume: • Not more than 2,000m³ per project (Living Zones) • Not more than 5,000m³ per project (Business Zones) Rural Volume: • Not more than 5,000m³ per project	No provisions identified	**Refer to the above discussion on the Canterbury Regional Council Statements and Plans.** **Relationship between the SDP and Canterbury Regional Plans/Policy Statements** The SDP does not have area limitations or slope thresholds, and has relatively liberal permitted volume limits and generic setback rules for waterbodies. The matters of discretion are not particularly specific with regard to erosion and sediment management. For instance the most relevant matter of discretion (Rural Volume 2.1.5.3) is 'any mitigation measures proposed'. In the Rural Volume the matters of discretion do not specify erosion and sediment management but identify 'the effectiveness of any proposed mitigation measures' (Rural Volume 1.7.3.2). In the Rural Volume, Reasons for Rules (C1 Earthworks), states: *Rules are needed to manage these effects because they often have effects on other people or other parts of the environment, rather than having a direct cost to the person undertaking the earthworks. The rules are included in the District Plan because: regional rules only apply to*
			Area limits	Dust and siltation: • Rule 1.7.1.4 Any stockpiling of earth, soil or other material		

				within 100m of any dwelling, other than a dwelling erected on the same property as the earthworks, is to be kept moist and consolidated.		*the Port Hills at present; and building consents are only required for earthworks related to dams over 20,000m^3 in size. Even when a building consent is required, it will only address matters relating to the stability of the excavation.* It is uncertain whether this statement is currently accurate because the CLWP 2017 includes rules over all land areas, as discussed and identified above. It is noted that the SDP district plan review is underway however the replacement plan has not yet been notified. As discussed above, the CLWP 2017 has land use rules that also manage the potential adverse effects of soil erosion and sedimentation from land use activities. The SDP rules provide limited additional complementary management, however the SDP does have regard to the CLWP 2017 and exempts earthworks that have a resource consent under the Canterbury Regional Land and Water Plan.
			Other limits	Exemptions: 1.7.1 (iii) any earthworks which has been granted resource consent for a discretionary or non-complying activity from the Canterbury Regional Council. Township Volume: • Stockpiled material is kept consolidated or covered to avoid sediment run-off from rainfall (i.e. 2.1.1.2) • Setbacks from waterbodies of either 20m listed in Appendix 12 to the SDP or 10m of any other waterbody. Rural Volume • 20m setback of water bodies • 100m² within 5m of a water body over 5 years • 40m³ within 5m of a water body over 5 years		
Wellington	**Upper Hutt**	Operative	**Volume limits**	• Rule 23.2 existing ground level cannot be altered by cuts more than 1.5m or fill of 0.5m, except these rules do not apply within 2 metres of the footprint of a dwelling.	Activities shall be processed without notification unless Transpower New Zealand is identified as affected.	**Wellington Regional Policy Statement Operative 24 April 2013** **Section 4.1 Regulatory Policies – direction to district or regional plans and the Regional Land Use Transport Strategy** The relevant policy is and explanation is copied in full: *Policy 15: Minimising the effects of earthworks and vegetation disturbance – district and regional plans* *Regional and district plans shall include policies, rules and/or methods that control*
			Area	• Rule 23.4 states that		

			limits	the physical extent of earthworks shall not exceed 150m² in surface area on any one site within any continuous 12 month period. • Rule 23.13 states within an area identified as Southern Hills Overlay Area, the physical extent of earthworks shall not exceed 300m2 in surface area on any one site within any continuous 12 month period. However this rule primarily relates to landscape effects.		*earthworks and vegetation disturbance to minimise:* *(a) erosion; and* *(b) silt and sediment runoff into water, or onto land that may enter water, so that aquatic ecosystem health is safeguarded.* *Explanation* *An area of overlapping jurisdiction between Wellington Regional Council and district and city councils is the ability to control earthworks and vegetation disturbance, including clearance. Large scale earthworks and vegetation disturbance on erosion prone land in rural areas and many small scale earthworks in urban areas – such as driveways and retaining walls – can cumulatively contribute large amounts of silt and sediment to stormwater and water bodies. This policy is intended to minimise erosion and silt and sedimentation effects associated with these activities.* The policy and explanation make it clear that erosion and sediment management from land disturbance is both a regional council and territorial authority function. **Wellington Regional Soil Plan Operative 9 October 2000** The Regional Soil Plan applies to soil disturbance and vegetation disturbance on erosion prone land only. There are four rules in the Plan. These control: • roading and tracking (unless it is associated with works allowed by a subdivision consent) • disturbing more than 1000 cubic metres of soil clearing more than one hectare of vegetation Any development or use of land that is not specifically restricted by a rule in the Plan is allowed as of right (unless it is restricted by a rule in a district plan). **Wellington Regional Freshwater Plan Operative December 1999** Rule 2 'Stormwater discharges' manages the discharge of sediment to stormwater into surface water providing conditions are met including: … (*3) The person responsible for the discharge shall ensure that, after reasonable mixing, the stormwater discharge will not give rise to any of the following effects:* *(a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials; or* *(b) any conspicuous change in the colour or visual clarity; or* *(c) any emission of objectionable odour; or* *(d) the rendering of fresh water unsuitable for consumption by farm animals; or* *(e) any significant adverse effects on aquatic life; and* *(3a) The discharge does not originate from an area of bulk earthworks greater than 0.3 ha;* Non-compliances would require a discretionary activity resource consent. **Relationship between the Upper Hutt District Plan and Wellington Regional Plans/Policy Statements** The key rule of the Wellington Regional Council Freshwater Regional Plan is that land disturbance limited to 0.3ha. The Upper Hutt District Plan identifies in Part 9.5.1 'Subdivision and Earthworks' the need for performance standards and consent conditions to minimise the adverse effects of earthworks, including managing dust, water body siltation, soil erosion, effects on ground stability and other hazards.
			Other limits	• Rule 23.5 requires that a resource consent is required to undertake Earthworks on 'erosion prone land' identified as having a gradient steeper than 28°, or within 10m of such a slope. • Rule 23.6 requires that earthworks shall not be undertaken within 10m of a waterbody. • Rule 23.7 requires that Sediment retention and run-off controls shall be implemented to ensure there is no contamination of natural water by sediment. • Rule 23.8 states that earthworks which are not being		

				worked for three months or more, shall be hydroseeded or sown in order to achieve ground cover. • Rule 23.10 states that Stormwater resulting from earthworks development is to be controlled and managed so as to avoid, remedy or mitigate adverse effects on other land.		The Upper Hutt District Plan contains controls on earthworks on steep land where stability and erosion issues are likely to be present if not managed (Rule 23.8), and has a relatively conservative rule that limits the area disturbed on a site to 150m² (Rule 23.4). The Upper Hutt District Plan has regard to the obligation set out in the Wellington Regional Policy Statement that erosion and sediment management is a function of both regional and district plans.

Summary

Within the Otago region, the Operative Queenstown Lakes, Dunedin 2 GP, Central Otago and Waitaki District Plans illustrate a wide divergence in the controls, which is indicative recognition of the absence of any land plan produced by the Otago Regional Council. The Queenstown and Dunedin District Plans include rules to manage erosion and sedimentation from land use activities. These rules fit within the role of the territorial authority in terms of section 31 of the Act and do not step across into a regional council function by way of setting limits as to the discharge of contaminants.

The Central Otago and Waitaki District plans do not contain sufficient provisions to manage the effects of erosion and sediment from land use activities. The Example of the Waitaki District Plan sharing regional council jurisdictions, and the difference in management between the Canterbury Regional Council's Land and Water Regional Plan 2017, and the Otago Regional Council's Regional Plan: Water for Otago illustrates where there is a potential shortcoming in the Waitaki District Plan in the area administered within the Otago Region, at least compared with the equivalent rules in the CLWP 2017.

The Operative Queenstown and Dunedin 2 GP District Plans contain provisions including rules requiring erosion and sediment management is undertaken. The Dunedin 2 GP has rules limiting the area disturbed based on slope, the greater the slope the lower the permitted clearance. The Operative Queenstown District Plan could have more emphasis through rules or assessment matters as to when in particular erosion and sediment management is a necessity, the receiving environment is sensitive or the scale of works are such that more oversight is required. The absence of an area control could contribute to this lack of oversight.

The portion of the Waitaki District within the jurisdiction of Canterbury Region, Christchurch District and Selwyn District also has a wide variance of intervention to manage erosion and sediment. All of these District's sit within the ambit of the CLWP 2017 which has been identified above as possessing a range of detailed controls on land use activities that could affect soil conservation and if left unchecked could lead to sedimentation of water bodies.

District Plans sitting within the Canterbury Region have the benefit of the CLWP 2017 which provides in particular for 'construction-phase stormwater' in both reticulated and non-reticulated circumstances. Although the Otago region has provisions identified above in part 12 of the Otago Regional Plan: Water for Otago which manage the discharge of sediments to water and land, the linkage to managing the potential effects of land use activities and that these activities are often the generator of potential for soil erosion and sedimentation of water bodies needs to be stronger, owing to the absence in the Otago Regional Plan: Water for Otago of land use rules that specifically address soil conservation and the effects of sedimentation from land use activities.

The Upper Hutt District Plan has a relatively high level of intervention (compared to District Plans identified in the Otago region) that cover a wide range of potential adverse effects arising from land disturbance. The Wellington Regional Policy Statement places a clear obligation on territorial authorities to manage erosion and sedimentation from land use activities.

Appendix 2

4SIGHT CONSULTING

LAND. PEOPLE. WATER.

QUEENSTOWN LAKES DISTRICT COUNCIL

Queenstown Lakes District Council Proposed District Plan: Assessment of Thresholds for Earthworks

for

Queenstown Lakes District Council
Planning and Development

September 2017

Appendix 2

REPORT INFORMATION AND QUALITY CONTROL

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Appendix 2

4SIGHT CONSULTING

CONTENTS

Page

List of Figures

List of Appendices

1 INTRODUCTION

1.1 Introduction

The Queenstown Lakes District Council (QLDC) is preparing an earthworks chapter as part of its wider district plan review.

Currently, the operative district plan earthworks chapter focuses on amenity effects associated with earthworks, the rules are based on the volume of soil excavation and disturbance and there are no specific (area) land disturbance stormwater/erosion and sediment control rules. The general standards have erosion and sediment control obligations but these are broad and could be more effective. Additionally, the framework of the subdivision chapter and rules is such that the volume limits for earthworks are exempt where a subdivision is involved. While the Council have control over erosion and sediment management there are often large scale (60 lots + over 5 ha area) subdivisions that lack adequate attention to erosion and sediment management. Furthermore, the Otago Regional Council (ORC) does not have a land use plan/soil conservation plan that manages earthworks and associated erosion and the subsequent discharge of sediment. The ORC relies on general receiving environment standards for discharges and the respective territorial authority plans and earthworks controls – although it is noted that the discharge of sediment from disturbed land to water is prohibited if there are no measures taken to mitigate sediment runoff.

Recent cases in the district, for example where sediment from bulk earthworks associated with a subdivision entered a stream adjacent to a Fish and Game hatchery, have highlighted the need to review the rule framework. There has also been renewed interest from the public and elected representatives at a district council level on water/lake quality and associated concerns with the growth experienced in the district and associated adverse effects, including through the development phase. Nationally the implementation of erosion and sediment control practices is well established and has commonly been driven by development pressure and the management of the adverse effects of bulk earthworks on water quality, aquatic habitat and amenity.

QLDC have drafted an earthworks chapter for public notification in November 2017. 4Sight Consulting Limited (4Sight) has been commissioned by the QLDC to assist with recommending appropriate thresholds for the earthworks chapter. These thresholds define the point at which a resource consent is required.

1.2 Approach

It is important to recognise that there are a number of factors that influence soil erosion, the subsequent discharge of sediment from an earthwork site and the adverse effects that result. These include:

- Local climate conditions, particularly the frequency and intensity of rainfall events;
- Soil types and their erodibility, once exposed by earthworks;
- Topography – steep slopes are more susceptible to erosion than flat areas;
- The area of exposed soil, which influences the amount of soil that is eroded and discharged, and the duration of exposure;
- The application of erosion and sediment control measures to firstly minimise soil erosion and then to removed entrained sediment from runoff;
- The location and nature of receiving environments and their sensitivity to sediment-laden discharges.

Given this range of factors, there is no single measure that defines earthworks discharge 'risk'. Rather it is a combination of factors that need to be considered and assessed to determine the threshold(s) at which the risk is sufficient large to justify a more comprehensive approach to erosion and sediment control management, including regulatory assessment and oversight through a resource consent process.

Our approach to defining the rule thresholds has been to:

- Assess the comparative sediment yield discharging from a site and the factors that increase risk. This has been done using the Universal Soil Loss Equation (USLE) with representative local rainfall, soil and slope characteristics.
- Assess thresholds adopted in other relevant plans;

- Assess current erosion and sediment control practices - including during a site visit of the district to see existing bulk earthworks sites, current erosion and sediment control practices and future areas of growth identified in the proposed district plan.

2 CONTEXT

2.1 Environmental Setting

A site visit was undertaken with QLDC staff in August 2017 to assist with understanding the environmental conditions, earthworks risk profile, development potential and type and the amenity and receiving environment values to inform earthworks rule thresholds.

The freshwater receiving environments observed during the site visit (Lake Wakatipu, Shotover River, Kawarau River, Lake Wanaka, Clutha River and others) form an important part of the landscape providing both amenity and ecological habitat and were in generally in close proximity to existing and future land development areas. Streams and watercourses were observed in Wanaka as well as existing overland flowpaths and reticulated stormwater systems.

A cross section of sites in Queenstown, Wanaka and the Arrowtown/Millbrook area were observed either undergoing development under operative zone rules or are proposed development zones. Site slope (a contributing factor to erosion and sediment control assessments) was generally in the range of flat to gently undulating (0-3°), undulating (4-7°) or rolling (8-15°). A selection of sites proposed for residential development in Queenstown were particularly steep in the area surrounding Goldfield Heights with slopes ranging from strongly rolling (16-20°) to moderately steep (21-25°).

In terms of annual rainfall and rainfall patterns for the district, Niwa[1] reports rainfall is highest among the western ranges which have both high elevation and western exposure. Such high rainfall is primarily a result of the orographic effect such that there is a marked decrease eastwards in median annual rainfall beyond the Otago lakes and headwaters. Rainfall tends to be evenly distributed across the year in Queenstown and Wanaka, suggesting that there is no basis for seasonal restrictions on earthworks (as are in place for some other areas in New Zealand). Rainfall intensity is also similar across the district. Niwa's HIRDs[2] data is used as a factor in the USLE discussed in Section 3.

General observations were made during the site visit as to the type and characteristics of soil in the district and were verified more formally using Landcare's S-map online soil database. Again this data was used for the USLE where the generally high silt content is indicative of a highly erodible soil when exposed during earthworks activities.

2.2 Observed Erosion and Sediment Control Practices

An important component of the earthworks rule chapter proposed by QLDC will be the associated implementation of erosion and sediment control practices either as a permitted activity standard, or via the requirements of a resource consent. Accordingly, an aspect of the site visit was to understand the current earthworks practices in the district which will ultimately inform the recommendations in this report. Poor erosion and sediment control practice is another risk factor that may influence earthwork thresholds.

A cross section of residential development sites were observed in the Wanaka, Millbrook, Arthurs Point and Queenstown areas. Wanaka exhibited several earthworks sites (each estimated to exceed 1 ha of earthworks area) that were being undertaken entirely without sediment and erosion control practices or were utilising practices which appeared to be functioning poorly (e.g. silt ponds, sediment fences) compared to best practice.

[1] The Climate and Weather of Otago. Niwa. 2015

[2] High Intensity Rainfall Design System v3. Niwa. https://hirds.niwa.co.nz

Examples of practices are illustrated below in Figures 1 to 7. Figures 2 and 3 show the same location visited during the site visit and the following day after rain, which resulted in a significant sediment discharge across adjoining land and the Clutha River approximately 1km downstream from the site.

On site erosion mitigation such as clean water diversions, slope length cut off drains and staging of earthworks and progressive stabilisation of completed sites to reduced exposed areas also appeared to be limited. In one case finished contours had been achieved with completed roads etc but exposed slopes remained (i.e. not grassed or mulched) and rill erosion was evident. Similarly, temporary and semi-permanent topsoil stockpiles were observed either with no sediment control, or no stabilisation to minimise erosion.

Overall observations from the site visit concluded that the current implementation of erosion and sediment control practice is limited and below current best practice. Accordingly improving earthworks management, using both regulatory and non-regulatory tools, is an important outcome for the new earthworks chapter and supporting technical guidance material.

2.3 Otago Regional Plan

As indicated previously, the ORC does not have a land use plan/soil conservation plan that manages earthworks and associated erosion and the subsequent discharge of sediment. The ORC relies on general receiving environment standards for discharges. While the discharge of sediment from disturbed land to water is prohibited if there are no measures taken to mitigate sediment runoff (Rule 12.C.0.3), there is no indication of the extent of mitigation that is required.

Where not prohibited, the discharge of sediment laden water is a permitted activity, subject to meeting receiving environment water quality standards, including that the discharge does not result in a conspicuous change in colour or visual clarity to result in a noticeable increase in local sedimentation.

It is not clear from the plan what course of action is implemented where the permitted activity standards are breached 'after the event'. That is, where earthworks are undertaken under the permitted activity rule, but subsequently fails to meet the receiving environment standard.

Figure 1: Topsoil stockpiles with no sediment control

Figure 2: Outlet Road overland flow path and sediment fence
(Twin culverts indicate flow potential from upstream catchment)

Figure 3: Outlet Road overland flow path and silt fence failure with sediment discharge to the Clutha River

Figure 4: Unstabilised slope with rill erosion.
Note planted trees indicating works are complete with finished contours

Figure 5: Unstabilised topsoil stockpile

Figure 6: Open earthworks areas with no clear staging or progressive stabilisation

Figure 7: Sediment collected in a completed stormwater pond from Figure 6 catchment (the stormwater pipe was half full of sediment and will require extensive mucking out)

3 ASSESSMENT METHODOLOGY

3.1 Approach

Based on the risk associated with bulk earthworks activities, sediment discharges and the draft rule framework in the QLDC earthworks chapter we have sought to answer the following questions in respect of the development of a suitable threshold:

1) What is a suitable threshold for bulk earthworks activities to require resource consent, and associated more comprehensive erosion and sediment control;

2) Are there factors that significantly increase risk and hence require a more stringent threshold, including commonly utilised factors such as:

   a) Slope; and

   b) Proximity to a water body.

To answer these questions, we undertook the following tasks:

- A review of the current earthworks rule chapters from surrounding district councils and regional councils;
- The application of the sediment yield USLE with local rainfall, soil and slope characteristics using several area and slope scenarios; and
- Using observations from the site visit, we considered the practicalities of rule thresholds in the context of existing development and erosion and sediment control practices.

These matters are discussed in the following subsections.

3.2 Assessment of other Plans

An assessment of the earthworks controls in nearby district plans and regional plans from Canterbury and Wellington. Earthwork area thresholds of the type being developed for QLDC are not commonly included in district plans and this was confirmed by the assessment of plans. Accordingly, the reviewed district plans did not provide a comparable approach.

Earthworks and discharge provisions in the Canterbury and Wellington regional plans are more aligned to the approach being adopted by QLDC and the following thresholds were identified. It is acknowledged that these plans deal with different climate and soil conditions, and hence have only been utilised as being indicative area thresholds.

3.2.1 Canterbury Land and Water Regional Plan 2017:

Permitted activity Rule 5.94A manages the discharge of 'construction phase stormwater'. It includes the following area thresholds of relevance:

- Less than 1,000m^2 for any construction-phase stormwater generated as a result of work carried out in an area shown as High Soil Erosion Risk on the Planning Maps; or
- Two hectares (20,000m^2) in any other location;

The rule also contains water quality standards and other requirements. Non-compliance with the rule is a restricted discretionary activity (Rule 5.94B).

3.2.2 Wellington Regional Freshwater Plan Operative December 1999

Pursuant to Rule 2, the discharge of stormwater into surface water is a Permitted Activity provided that the discharge complies with the specified conditions. Of relevance is Condition 3a, that requires that the discharge does not originate from an area of bulk earthworks greater than 0.3 ha (3,000m^2). Non-compliance with this area threshold is a discretionary activity.

3.2.3 Wellington Regional Soil Plan Operative October 2000

The Wellington Regional Soil Plan applies to soil disturbance and vegetation disturbance on erosion prone land only. Pursuant to Rule 2, any soil disturbance on erosion prone land that involves the disturbance of greater than or equal to 1,000 m^3 of soil, within any 10,000 m^2 area and within any continuous 12-month period (excluding any soil disturbance associated with roading and tracking activities or undertaken in accordance with conditions on a subdivision consent) is a restricted discretionary activity.

3.3 Assessment sediment runoff potential

The USLE is a relatively simple model which was originally developed in the United States for agricultural practices. It has since been found to be suitable as a sediment yield estimation tool for a range of land disturbing activities, including earthworks and is a commonly used tool in parts of New Zealand to assist with resource consent applications and the specification of erosion and sediment control practices.

The USLE calculates the amount of sediment generated from an area and is expressed as sediment yield (measured in tonnes/hectare/year). The factors of rainfall, soil erodibility, slope, ground cover and duration of soil exposure combine to influence the amount of sediment that may be generated from an earthworks site. Application of the sediment delivery ratio and works duration then determines the sediment lost from the site. An important aspect of implementing the USLE is to use local data and in this assessment, the Landcare online GIS resources: S-map and Our Environment were used to respectively define local soil constituents (% of clay, silt and sand) and typical slope relative to operative and proposed development zones in the district. Local rainfall intensity data was obtained from the Niwa HIRDS database where the 2 year, 6 hour duration storm is specified for the USLE.

3.3.1 Considerations and Risks

For assessing bulk earthworks activities, the USLE is typically applied to a site and area to identify potential areas of risk in terms of sediment runoff allowing practitioners respond accordingly via erosion and sediment control design. In this case the USLE was used to test various area threshold scenarios (500m^2, 1,000m^2, 2,500m^2, 5000m^2, 10,000 m^2, 20,000m^2 and 50,000m^2) against a range of slope angles derived from the upper range of each slope classification in the Our Environment GIS tool. A sediment yield assessed in isolation provides little value to determine the effect of sediment discharging from a site. Therefore, the purpose of the assessment was to understand the relative sediment yield through changes in slope angle and earthworks area to help guide the establishment of thresholds.

A review of the soil types for the key development areas in the district (e.g. Wanaka, Queenstown, Millbrook/Arrowtown) indicated a typically high silt content with the soil profile being either silty loam or loam. Using the known silt/clay/sand percentage proportions from S-Map the USLE then defines soils erodibility (K) as an input. All soils reviewed exhibited a soil erodibility above 0.4 indicating high erodibility.

The USLE identifies slope is a slope angle is known risk factor and therefore for slope above 10^o the USLE accounts for this by applying a higher sediment delivery ratio (SDR) which is a measure of how much sediment leaves a site relative to the volume which is entrained and redeposited within its boundaries. For example, a site with a slope angle of 8^o with and sediment generation of 1000 tonnes/ha/year, 50% of sediment will leave the site (assuming no sediment controls). This increases to 70% for sites over 10^o. While there is a stepwise increase in the SDR in the analysis discussed in Section 4, in reality the increase in slope angle relative to sediment lost would be incremental as slope increases. However, the 10% slope is a commonly used threshold for defining a point at which sediment loss, and hence risk, increases.

3.3.2 Key assumptions

To maintain consistency in application of the USLE and enable a viable comparison between area and slope scenarios, several assumptions were made for the input values. The key assumptions are listed below:

- As discussed above, all soil types reviewed exhibited a K soil erodibility factor above 0.4. Conservatively, the highest K value was selected and applied to all analysis scenarios;
- To derive the slope length (a USLE input value) for each area threshold scenario, the 'sites' were assumed to be square where the slope length was measured on the diagonal.

- The USLE uses a 2 year, 6 hour duration rainfall depth as an input value. Being the most conservative, the number for Queenstown (~26mm) was used for all area scenario calculations.
- The USLE allows duration of earthworks to be inputted thereby allowing a proportion of the annual sediment to yield to be calculated. For this analysis, all scenarios were calculated based on an earthworks duration of 1 year.

3.4 Practical considerations

As was observed during the site visit the implementation of erosion and sediment control practices does not currently meet best practice. An expectation in implementing the rule chapter (and a key driver for seeking to regulate bulk earthwork activities with area thresholds) is that erosion and sediment control practices will be applied through both permitted activity and consented earthworks.

Area thresholds are also linked to the sizing, design complexity and implementation of sediment control practices (e.g. sediment ponds and decanting earth bunds). That is, as earthworks sites become larger, and sediment laden water runoff is more significant, more sophisticated and comprehensive controls are required. These would generally require engineering design and operational oversight as failure of such systems leading to bulk sediment discharges can result in adverse environmental effects. As risk increases, compliance oversight by Council is also desirable to further reduce the risks associated with the implementation and management of controls.

Conversely, at the lower end of the risk scale, the Council is developing a set of guidelines for implementation on small sites where the erosion and sediment control practices are simple, fit for purpose and where implemented properly will contribute to the outcomes sought by the earthworks chapter.

In the USLE assessment, both untreated and treated sediment yields were considered. In the latter, a sediment removal of 50% was applied to areas less than 2,500 m^2 and 75% sediment removal applied for areas above 2,500m^2. This reflects both the point at which more comprehensive controls are expected and the greater removal efficiency that results.

4 ANALYSIS

4.1 USLE Results

The results from the USLE analysis are plotted in Figures 8, 9 and 10. Figure 8 plots the analysis data across each of the area threshold scenarios (500m^2, 1,000m^2, 2,500m^2, 5,000m^2, 10,000m^2, 20,000m^2, 50,000m^2) with the corresponding influence of slope angle and sediment generation.

Figure 9 uses the same data set and assesses the influence of applying sediment control measures, although this assumes correct implementation and maintenance, which was generally not evident from the inspection of current earthwork sites. As indicated above, up to 2,500m^2 example best practice sediment control is to use silt fences or decanting earth bunds with a sediment removal efficiency of approximately 50%. For 2,500m^2 and above, the remaining area threshold scenarios are plotted assuming sediment ponds which typically exhibit a sediment removal efficiency of 75%. Figure 10 illustrates more clearly sediment loss for sites up to 2,500 m^2 and the influence of slope angle and sediment removal practices.

As was discussed earlier, the influence in increasing slope angle above 10° is evident in the plots where the sediment delivery ratio increases from 0.5 to 0.7 thus creating a step change increase in sediment leaving the site. Below 10° there is a general incremental and linear increase in sediment loss up to 50,000m^2. As can be seen from the graphs, slope is a significant, and probably the most significant, determinant of sediment yield.

Slope length also has an influence for the larger area scenarios resulting in steeper curves for the higher slope angles and is evident above site sizes of 10,000m^2. For larger site areas, in practice, slope lengths of up to 300m (50,000m^2 area scenario) would be unlikely as best practice is to construct slope cut-off drains to minimise runoff lengths. This analysis is useful nonetheless to demonstrate what sediment loss can occur at the upper end of the area/slope length slope angle spectrum.

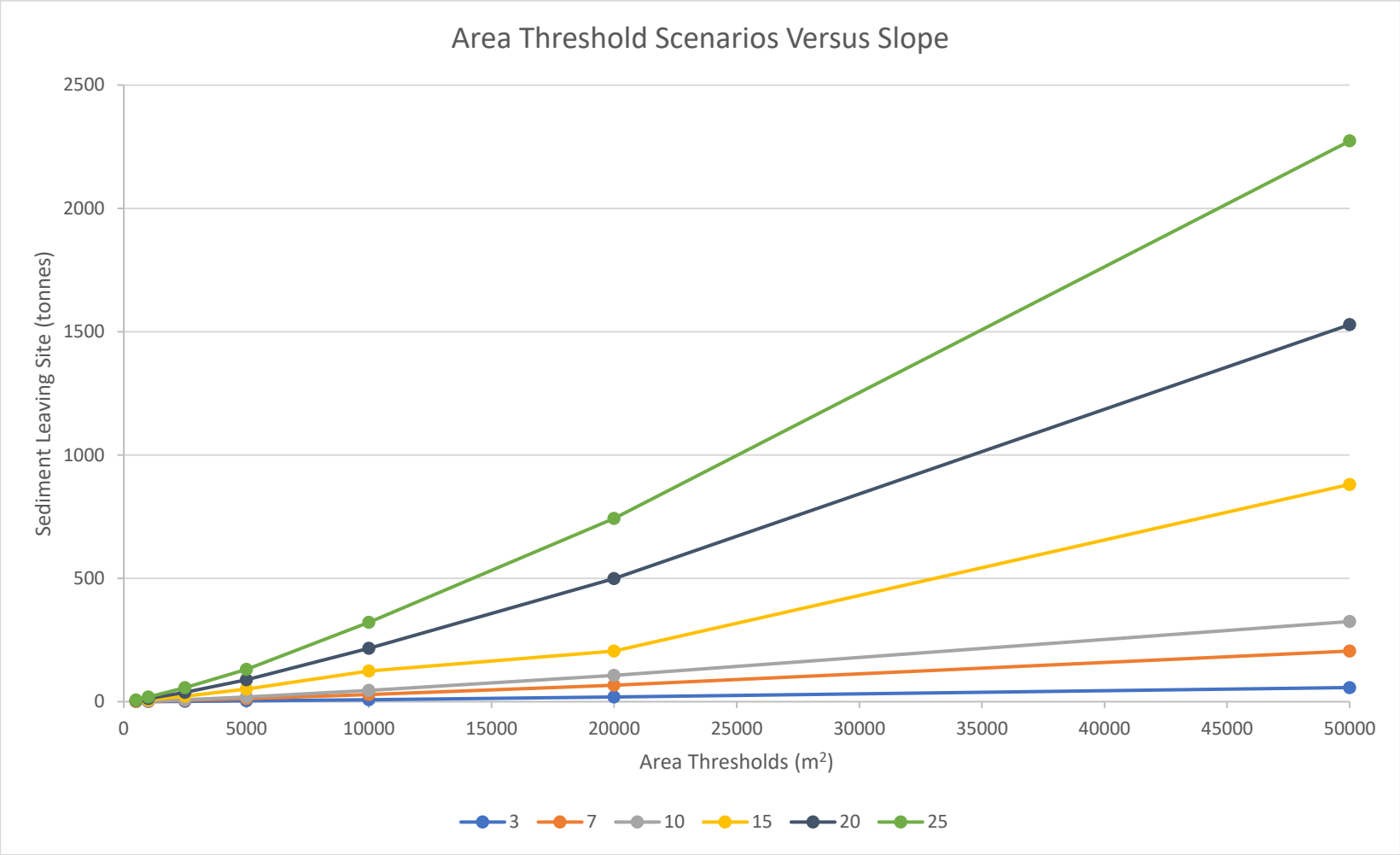


Figure 8: Area Threshold Scenarios Versus Slope

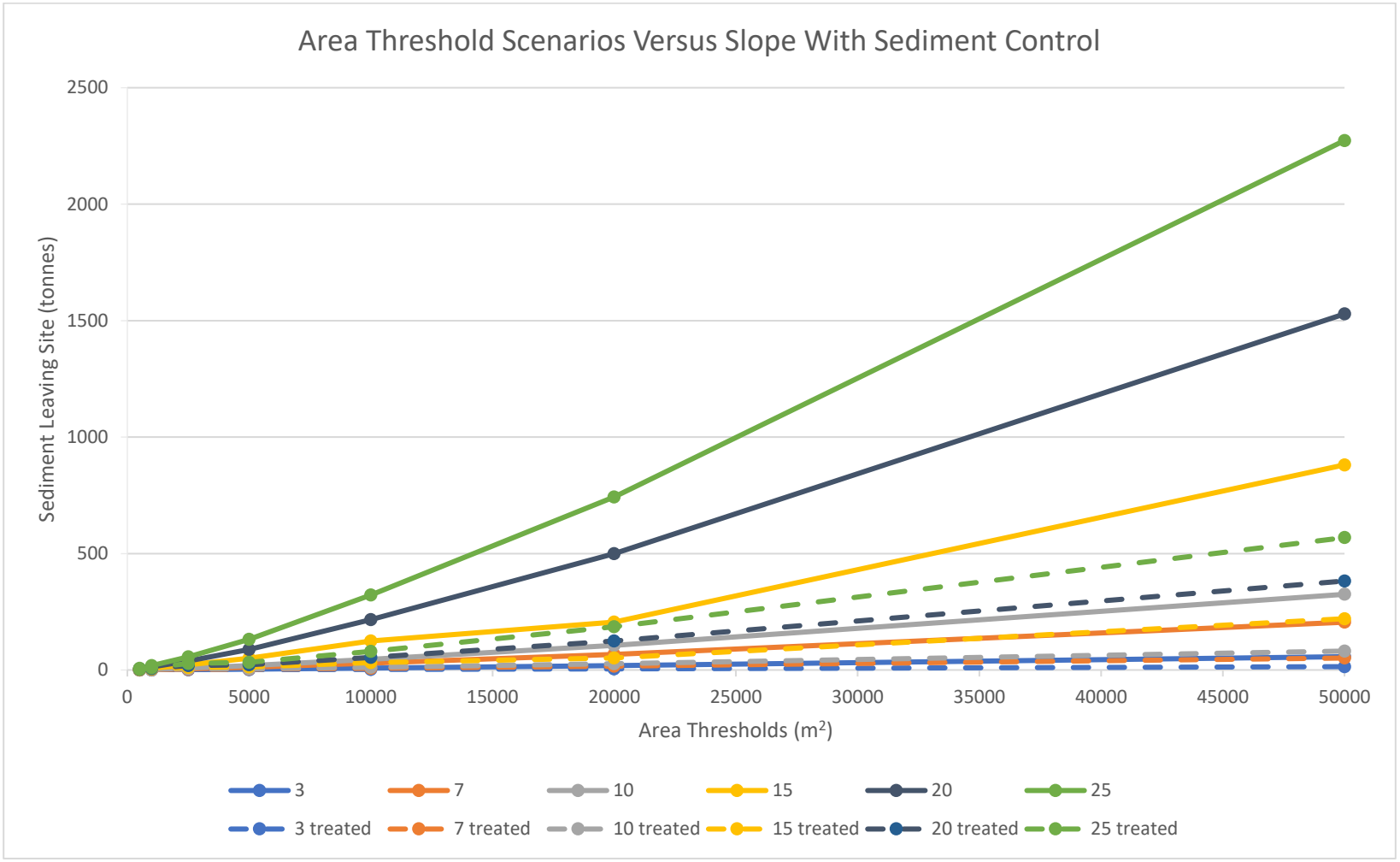


Figure 9: All Area Threshold Scenarios with Sediment Control

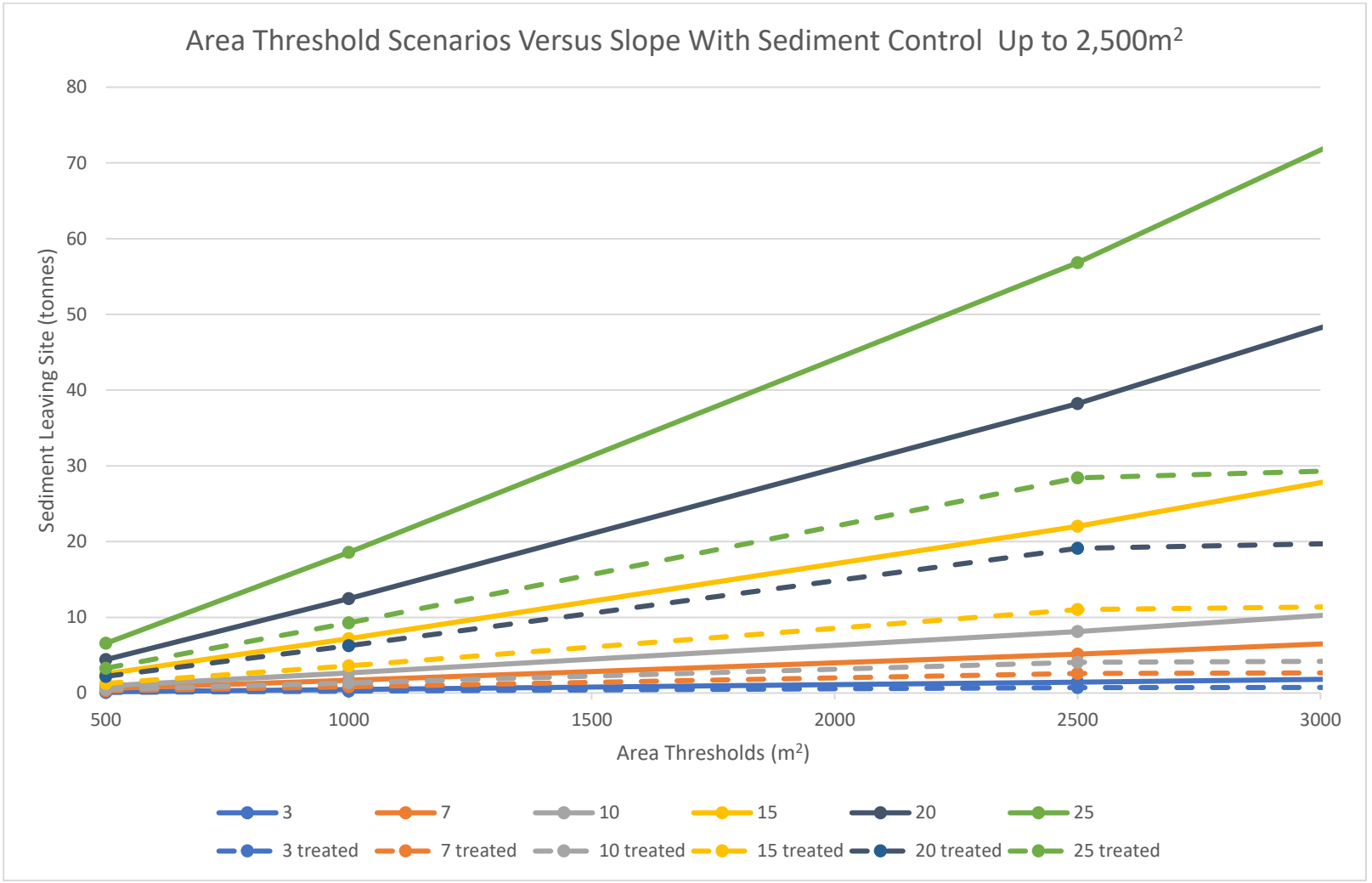


Figure 10: Area Threshold Scenarios with Sediment Control up to 2,500m^2

4.2 Discussion

As indicated previously, the USLE provides a comparative rather than absolute assessment of sediment yield and cannot be used to ascertain a management threshold in the absence of other considerations and risks. The assessment assumes annual yields and cannot take into account factors such as the effects of discharged sediment on downstream properties and receiving environments. However, the following points are noted from the assessment including the site inspection and review of local soil and climate information:

- The soil types assessed and inputted into the USLE all exhibited high erodibility with a K value above 0.4. This means when exposed to rainfall, soil is easily detached, tends to crust and produces higher levels of sediment runoff relative to less erodible soils.
- Coupled with the high K soil erodibility factor, slope is a key determinant to increasing sediment runoff volume where the USLE introduces a higher sediment delivery ratio (sediment loss from a site) for slopes above 10°. The chart plots illustrate this effect markedly in comparison to lower slope angles where sediment loss is linear as site area increases.
- No seasonal restriction on earthworks is proposed in the new earthworks chapter. This is another consideration when determining area thresholds where the Niwa climate report for Otago reports rainfall is evenly distributed for Queenstown and Wanaka throughout the year.
- The proximity of a site to a waterbody (other than immediately adjacent to the waterbody) is not considered a significant determinant of sediment runoff risk. This was highlighted by the sediment discharge to the Clutha River from the Outlet Road site via an overland flow path some considerable distance from the waterbody and a visual assessment of topography/hydrology in other areas. Accordingly, no Sediment Control Protection Area, as found in some other plans, is proposed.
- The new earthwork chapter is seeking the outcome of managing the effects of bulk earthwork activities through area based thresholds and new consent requirements. Coupled with its implementation will be the requirement for the development industry (with advocacy from the Council) to significantly improve current erosion and sediment control practices. We consider this a relevant factor in setting consent area thresholds.
- The review of the district and regional plans rules from Canterbury and Wellington rule frameworks, while not directly transferrable to QLDC, has been helpful to gauge other Council practices. We note that while the thresholds for QLDC were assessed independently, the recommended thresholds are not dissimilar. While we acknowledge that there are different climatic and soil conditions, the soils in the subject area are defined as highly erodible and there are other risk factors that apply.

5 RECOMMENDATIONS

QLDC is proposing a new earthworks chapter which in addition to volumetric consent triggers, will also seek to apply area thresholds in relation to earthworks activities to manage the effects of sediment leaving development sites. To inform a set of recommendations for the QLDC the following has been undertaken:

- A review of the operative and draft earthworks chapter;
- A review of summary information on earthwork provisions from several other council plans;
- A site visit to view development areas, the 'lie of the land', receiving environments and current industry erosion and sediment control practices;
- An assessment of comparative soil loss for different scenarios.

In respect of the question points identified earlier in this report we make the following recommendations:

1. **What is a suitable threshold for bulk earthworks activities to require resource consent, and associated more comprehensive erosion and sediment control?**

We agree with the QLDC proposal to establish an area resource consent threshold. We consider that earthworks area (combined with slope) is an appropriate metric to indicate the point at which earthworks scale, complexity and risk warrant regulatory oversight.

We recommend the following permitted/consent thresholds be adopted in the proposed earthworks chapter:

- Earthworks of up to 2,500 m^2 on land with a slope of over an area of 10^o or more.
- Earthworks of up to 1 ha (10,000m^2) on land with a slope of less than 10^o.

The lower threshold primarily reflects the significant impact that slope has on soil erosion and loss, the highly erodible soil, the scale at which more comprehensive erosion and sediment controls are typically required, and current practice in respect of the implementation of erosion and sediment controls for bulk earthwork activities. A slope angle of 10^o has been selected primarily on the basis that this is the point at which the USLE adopts different parameters reflecting that sediment generation and off-site delivery increase with increasing slope.

The 1 ha threshold is considered appropriate on low-slope terrain, reflecting the significantly lower risk of erosion and sediment runoff. However, at the same time, it also reflects the highly erodible soil and the relative early stage of erosion and sediment control in the Queenstown Lakes District, which suggests a conservative approach to setting thresholds is appropriate to manage erosion and sediment discharge risk.

At permitted activity level, we expect that sediment and erosion risk can be appropriately managed using a suitable 'tool box' and common erosion and sediment control practices and devices. However, we recommend that appropriate guidance material is prepared (or adopted from other councils) and emphasis is given to upskilling industry and council staff to ensure effective implementation – both for permitted activities and resource consents.

2) Are there factors that significantly increase risk and hence require a more stringent threshold, including commonly utilised factors such as:

a) Slope; and

b) Proximity to a water body.

As indicated above, slope is a key factor in erosion and subsequent sediment discharge. Both the generation of sediment and the sediment delivery ratio (the amount leaving the site) increase notably for slopes above 10^o. While the USLE has a stepwise change at 10^o, and hence the graphs presented above accentuate the significance of this slope angle, it is considered an appropriate slope threshold to adopt – in part on the basis of the USLE's selection of this angle as a point of change. We also note that this is the slope angle applied in the Auckland Unitary Plan (Operative in Part) for earthworks. Accordingly, above, we have recommended a more stringent (lower) area threshold of 2,500 m^2 for slopes above 10^o.

Earthwork activities close to a waterbody (e.g. stream or lake) are an additional area of risk and some councils have opted to require resource consents when working within certain distances from a water body. For example, the Auckland Unitary Plan regulates a sediment control protection area when working within 50m of a watercourse.

The site visit to the District was invaluable in assessing whether such a requirement would be appropriate for the QLDC earthworks chapter. Apart from the large river systems, the relative lack in abundance of smaller streams and function of overland flow paths in conveying sediment laden water rivers (as was observed at the Outlet Road site, where a sediment discharge occurred into the Clutha River via a natural overland flow path a significant distance from the site source) leads us to conclude that there is no significant additional risk that would be managed by having more stringent earthwork area thresholds in the general proximity of watercourses – other than immediately adjacent to the waterbody (a setback distance).

In respect of a setback distance, the operative QLDC district plan includes an earthworks setback distance of 7 m from a water body, within which no more than 20m^3 of earthworks can be undertaken as a permitted activity in any 12 month period. We recommend that an earthworks setback from a waterbody be retained, but that this is increased to 10 m to reflect practical considerations and current practice elsewhere in New Zealand:

- The greater distance provides:
  - additional protection, and buffer, for river and lake receiving environments;

- additional room to provide for erosion and sediment control (such as silt fences) to minimise and mitigate discharges to waterways;
- protection of the structure and function of the riparian margin.

- The Central Otago District Plan (Operative April 2008) has adopted an earthworks setback of 10m from a water body in Surface Water and Margin Resource Management Area and in a Rural Resource Area (20m^3 earthworks allowed).
- A 10 metre or more buffer has been adopted in the recent Auckland Unitary Plan (Operative in Part – November 2016)). This plan has established riparian yards of 10m and 20 m from the edge of intermittent and permanent rivers in urban and rural areas respectively. Earthworks within riparian yards are limited to less than 5m^2 or 5m^3 for general earthworks and less than 10m^2 or 5m^3 for the installation of new network utilities as a standard on all permitted, controlled and restricted activities.
- The Resource Management (National Environmental Standards for Plantation Forestry) Regulations 2017 has established an (permitted activity) earthworks setback of 10m from a perennial river; wetlands larger than 0.25 ha; lakes larger than 0.25 ha; an outstanding freshwater body; or a water body subject to a water conservation order. We understand that this setback was determined on an assessment of current best practice around New Zealand.

We note that this does not preclude earthworks from being undertaken within 10 m of a water body, but that a resource consent would be required to ensure protection to the water body, its banks and margins.

4SIGHT CONSULTING

Appendix A:

USLE Example

4SIGHT CONSULTING

4Sight USLE QT3 working - Excel

Trent Sunich

File Home Insert Draw Page Layout Formulas Data Review View Foxit PDF Tell me what you want to do Share

Cut Copy Format Painter Paste Clipboard

Microsoft Yi Ba 10 Font

Wrap Text Merge & Center Alignment

General Number

Conditional Formatting Format as Table

Normal 2 Normal 2 2 Normal_AR-1... Normal_AR-1... Normal_usle Normal Styles

Insert Delete Format Cells

AutoSum Fill Clear Sort & Filter Find & Select Editing

AL86

Estimation of Sediment Yield

Assessment utilises Universal Soil Loss Equation (USLE)

USLE formula: A = R * K * LS * C * P where:

A	=	Average annual sediment generated (tonnes / hectare / year)	
R	=	Rainfall Erosion Index = 0.00828 * p 2.2 * 1.70 (tools / hectare), where p = 6 hour 2 year storm. *inc. imperial to metric 1.70*	
K	=		
LS	=	Based on specific and conservative length and slope values for each treatment device	
C	=	Ratio of loss under a specified condition compared to that of a bare site	
P	=	Surface Roughness Factor = 1.0 for between rough irregular surface and track walked on contour	

Estimation of residual sediment discharged to receiving environment:

SL	=	A * SDR * (1-Eff), where...
SL	=	Sediment lost in receiving environment (tonnes / hectare year)
SDR	=	Sediment Delivery Ratio of between 0.5 and 0.6 assumed (0.7 for steep slopes), taking into consideration topography and th
Eff	=	0.35 (35%) for chemicalle treatment SRP, 0.75 (75%) for batch dosed DEBs (0.85 for combined DEBs/SRPs), and 0.5 for 50%

Area (ha	p	R	K*	L	s	LS	C	P	A	SDR	Eff	SL	Exp (Tyted. Lost
1	26.1	18.41	0.739	150	26%	13	1	1	178	0.7	0	124.61	1.00 124.611

Total ##### tonnes

AUCKLAND COUNCIL GD05

B1.4 Calculating sediment yield

The amount of sediment discharged from a catchment is the catchment's sediment yield (generally measured in tonnes/ hectare/year). The factors of rainfall, soil erodibility, slope, ground cover and duration of soil exposure combine to influence the amount of sediment that may be generated from an earthworks site and consequently, the amount of sediment that must be captured by sediment control devices to adequately minimise adverse effects on the receiving environment.

It is the topography of a site and the area of bare earth that will most influence the sediment yield, and thereby determine potential hotspots where ESC is required.

The scale of a sediment yield assessment needs to reflect the scale of the proposed earthworks. Careful consideration should be given to the practical benefit of undertaking a sediment yield assessment and if deemed necessary, the methodology to be used. Typically, the larger the earthworks proposed and the higher the sensitivity of the receiving environment, the more beneficial a sediment yield assessment will be.

B1.4.1 Potential calculation tools

The Universal Soil Loss Equation (USLE) is a tool that has been used in New Zealand to estimate the potential annual soil loss on a slope based on rainfall pattern, soil type, topography, vegetation cover and management practices. The USLE can help identify the scale of potential effects on receiving environments, and the risk associated with those sedimentation effects. (Note: The USLE will not help choose the most appropriate ESC practice(s) – it is only appropriate to identify those areas of a site with a higher sediment generating potential.)

A more recent advance in the field of estimating sediment yield has been the introduction of computer models. One such model used in recent large scale roading projects in the Auckland region has been the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model. This is a physically based model developed for continuous simulation of surface runoff and sediment losses on a field-scale. The model inputs are similar to the USLE, including land cover, soil type and slope in conjunction with a long-term climate record and other hydrological parameters. The GLEAMS model has been used to predict sediment yields with and without the inclusion of sediment control. It can be used to predict sediment yields for rainfall events with different recurrence intervals. The outputs assist in quantifying the downstream ecological effects. Further details on the GLEAMS model are available here: http://tools.envirolink.govt.nz/dossl/groundwater-loading-effects-of-agricultural-management-systems.

Other models include:

CLUES (Catchment Land Use for Environmental Sustainability), which can predict mean annual farm, catchment and regional sediment yield.

SEDNET, a model that constructs sediment and nutrient budgets for regional scale river networks.

USLE Factsheet 8

USLE method to be used to identify variation in potential sediment yield across a site, rather than providing a numerically accurate estimate of actual total sediment yield. While the overall estimate of yield is indicative of the magnitude of sediment likely to be discharged, the range of assumptions required in the USLE calculation means that it should not be relied on as an accurate assessment of actual total yield.

It is critical that a site is divided into logical sectors based on variations in gradient, slope length, soil type and surface cover. Other factors to consider are the proximity and nature of any waterbody in relation to the site. Once the sectors have been determined, a USLE calculation should be completed for each so that variations in sediment generation potential between sectors can be identified. This allows the erosion and sediment control methodology to be tailored to suit variations across the site.

Ratio s, %	10	25	50	75	100	125	150	175	200	225	250	275	300
0.5	0.08	0.09	0.11	0.11	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.15
1.0	0.09	0.12	0.15	0.17	0.18	0.20	0.21	0.22	0.23	0.23	0.24	0.25	0.26
2.0	0.14	0.19	0.23	0.26	0.29	0.31	0.32	0.34	0.35	0.37	0.38	0.39	0.40
3.0	0.21	0.27	0.33	0.38	0.41	0.44	0.46	0.48	0.50	0.52	0.54	0.56	0.57
4.0	0.26	0.37	0.49	0.57	0.64	0.70	0.76	0.80	0.85	0.89	0.93	0.96	1.00
5.0	0.31	0.48	0.69	0.84	0.97	1.08	1.19	1.28	1.37	1.45	1.53	1.61	1.68
6.0	0.39	0.61	0.86	1.06	1.22	1.36	1.49	1.61	1.72	1.83	1.93	2.02	2.11
7.0	0.47	0.75	1.06	1.29	1.49	1.67	1.83	1.98	2.11	2.24	2.36	2.48	2.59
8.0	0.57	0.90	1.27	1.56	1.80	2.01	2.20	2.38	2.54	2.70	2.84	2.98	3.11
9.0	0.67	1.06	1.50	1.84	2.13	2.38	2.60	2.81	3.01	3.19	3.36	3.35	3.68
10.0	0.78	1.24	1.75	2.15	2.48	2.77	3.04	3.28	3.51	3.72	3.92	4.11	4.30
11.0	0.91	1.43	2.02	2.48	2.86	3.20	3.51	3.79	4.05	4.29	4.53	4.75	4.96
12.5	1.10	1.74	2.46	3.02	3.48	3.89	4.26	4.61	4.92	5.22	5.51	5.77	6.03
15.0	1.47	2.32	3.28	4.02	4.64	5.19	5.68	6.14	6.56	6.96	7.34	7.69	8.04
16.7	1.74	2.76	3.90	4.77	5.51	6.16	6.75	7.29	7.79	8.27	8.71	9.14	9.55
20.0	2.34	3.70	5.23	6.40	7.39	8.26	9.05	9.78	10.45	11.09	11.69	12.26	12.80
22.0	2.73	4.32	6.11	7.49	8.65	9.67	10.59	11.44	12.23	12.97	13.67	14.34	14.98
25.0	3.38	5.34	7.55	9.25	10.68	11.94	13.08	14.12	15.10	16.01	16.88	17.70	18.49
30.0	4.56	7.21	10.19	12.48	14.41	16.12	17.95	19.07	20.39	21.62	22.79	23.90	24.97
33.3	5.41	8.55	12.09	14.80	17.09	19.11	20.93	22.61	24.17	25.64	27.03	28.34	29.61
35.0	5.86	9.26	13.10	16.05	18.53	20.71	22.69	24.51	26.20	27.79	29.30	30.73	32.09
40.0	7.25	11.47	16.22	19.86	22.93	25.64	28.09	30.34	32.43	34.40	36.26	38.03	39.72
45.0	8.71	13.78	19.48	23.86	27.55	30.80	33.74	36.45	38.96	41.33	43.56	45.69	47.72
50.0	10.22	16.15	22.84	27.98	32.31	36.12	39.57	42.74	45.69	48.46	51.08	53.57	55.95
55.0	11.74	18.56	26.25	32.15	37.10	41.51	45.47	49.12	52.51	55.69	58.71	61.57	64.31
57.0	12.35	19.53	27.62	33.83	39.06	43.67	47.84	51.68	55.24	58.60	61.77	64.78	67.66
60.0	13.27	20.98	29.67	36.34	41.96	46.91	51.39	55.51	59.34	62.94	66.35	69.59	72.68
66.7	15.29	24.18	34.20	41.89	48.36	54.07	59.23	63.98	68.40	72.55	76.47	80.20	83.77
70.0	16.27	25.73	39.63	44.57	51.46	57.53	63.03	68.08	72.78	77.19	81.37	85.34	89.13
75.0	17.72	28.03	39.63	48.54	56.05	62.67	68.65	74.15	79.27	84.08	88.62	92.95	97.08
80.0	19.13	30.25	42.78	52.39	60.50	67.64	74.10	80.03	85.56	90.75	95.66	100.33	104.79
85.0	20.49	32.39	45.81	56.11	64.79	72.43	79.34	85.70	91.62	97.18	102.43	107.43	112.21
90.0	21.79	34.45	48.72	59.67	68.90	77.03	84.38	91.14	97.43	103.35	108.94	114.25	119.33
95.0	23.03	36.41	51.50	63.07	72.83	81.42	89.19	96.34	102.99	109.24	115.15	120.77	126.14
100.0	24.21	38.28	54.14	66.31	76.57	85.61	93.78	101.29	108.29	114.85	121.07	126.98	132.62

Calculated From:

$$LS = \left(\frac{65.41 \times s^2}{s^2 + 10{,}000} + \frac{4.56 \times s}{\sqrt{s^2 + 10{,}000}} + 0.065\right) \times \left(\frac{l}{72.5}\right)^m$$

LS= topographic factor
l = Slope length, m
s = Slope steepness
m = Exponent dependent on slope steepness
0.2 for slopes<1%, 0.3 for slopes 1-3%. 0.4 for slo
4.5%, and 0.5 for slopes > 5%)

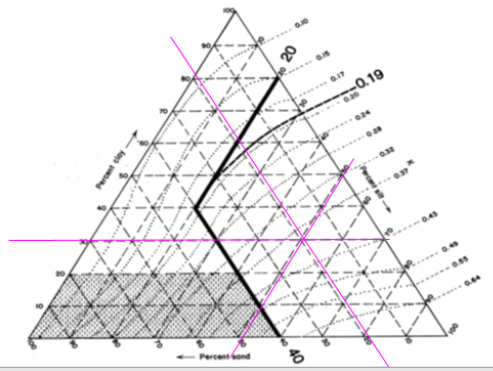
Table 2 (Modified from Goldman et al 1986)

Treatment	C factor	P factor
Bare Soil		
- compacted and smooth	1.0	1.32
- track walked on contour	1.0	1.2
- rough irregular surface	1.0	0.9
- disked to 250 mm depth	1.0	0.8
Native vegetation (undisturbed)	0.01	1.0
Pasture (undisturbed)	0.02	1.0
Establishing grass	0.1	1.0
Mulch – on subsoil*	0.15 (3 month period only)	1.0
Mulch – on topsoil*	0.05 (3 month period only)	1.0

Table 1

	Correction factor when percent organic matter is				
	0% (clay)	1%	2%	3%	4% (topsoil)
Value					
reater than 0.40	+ 0.14	+ 0.07	0	- 0.07	- 0.14
20 – 0.40	+ 0.10	+ 0.05	0	- 0.05	- 0.10
e ss than 0.20	+ 0.06	+ 0.03	0	- 0.03	- 0.06

Triangular Nomograph for Estimating K Values



USLE HIRDs

Ready 45%

Appendix 2