TKO Properties – RC230179

Summary overview – July 2024

The additional investigations and information gathered in response to submissions and the original s42A report are as follows:

- Further Site Survey and Ecological Mapping undertaken by the Ecologists and mapped by Baxter Design;
- Memorandum regarding Lizard Management, prepared by Wildlands;
- Terrestrial Invertebrate Desktop Assessment, prepared by Wildlands;
- Consultation with Avifauna expert (Wildlands);
- Saline Soils Investigation, undertaken by Roger Gibson;
- Vegetation Succession and climax communities reporting, prepared by Wildlands (Field work by Simon Beale and Andrew Wells);
- Biodiversity Offset Modelling prepared by Wildlands;
- Updated Ecological Impact Assessment, prepared by Beale and Wildlands;
- Additional Landscape Assessment by Baxter Design;
- Water and Wastewater Report, prepared by CKL, supported by site Geotech investigations by Mt Iron Drilling;
- Stormwater Management Plan and Flood Risk Assessment prepared by CKL;
- Fire Risk Assessment, undertaken by Wildfire Management NZ;
- Land History and Status Report prepared by Coterra Surveying;
- Legal memo on application of planning hierarchy and nature of DoC Covenant by Todd & Walker;
- Traffic assessment (of State Highway and Bendigo Loop- Rd) by Carriageway Consulting. Liaison with Waka Kotahi. Proposal of conditions for intersection upgrade by Waka Kotahi;
- Review and update of Archaeological Assessment by Chris Jennings of the University of Otago.

Consequently, the proposal has been updated and is now summarised as follows:

(a) Total number of lots reduced from 33 to 30 (previous Lots 14, 23, 24, 25, 27, and 30 have been removed);

(b) The building platforms Lots 1 – 9 have been reduced in size and locations adjusted to more appropriately sit in the landscape;

(c) An additional lot, Lot 10, has been proposed as an alternative to the previous Lot 14;

(d) The 'Cabins' have been rearranged to avoid unnecessary removal of Kanuka and provider a tighter footprint by aligning the aspect of each cabin;

(e) Lots 21 and 22 have been proposed as an alternative to the former Lots 27 and 30 in an area of the site with no sensitive visual or ecological receptors;

(f) The previous Lots 23-25 have been removed to ensure no development is proposed on saline soil;

(g) Lots along Bendigo Loop Road have been re-arranged, Lot 30 has been moved east and there is a new lot in this area;

(h) A public walking track and carpark is now proposed within the site;

(i) Design controls have been updated, further controlling building size, form and materiality;

(j) Offset planting is proposed within Bendigo Hills and enrichment planting is proposed within Rocky Point;

(k) Formal protection of the balance land (91% of the land area) is now proposed;

(l) An Ecological Enhancement and Monitoring Plan is proposed;

(m) The applicant has described the shared services and land management structures that will be put in place. The following documents are now provided as part of the application:

- Overview of Rocky Point Services;
- Rocky Point Services template constitution;
- Rocky Point Services – Landowner Services Agreement (in the form of a covenant);
- Draft Fire Risk Management Plan;

(n) The applicant has also commenced a discussion with DoC representatives in relation to ongoing conservation management and the operation of the DoC covenant. A description of that proposal is provided as part of the updated application.

APPLICATION FOR RESOURCE CONSENT

For a comprehensive residential development at Rocky Point

Rocky Point, Cromwell

Updated 26 July 2024

BROWN&COMPANY
PLANNING GROUP

APPLICATION FOR RESOURCE CONSENT UNDER SECTION 88 OF THE RESOURCE MANAGEMENT ACT 1991

APPLICANT AND PROPERTY DETAILS

Applicant's name:	TKO Properties
Address for Service:	C/- Morgan Shepherd Brown & Company Planning Group PO Box 1467, QUEENSTOWN 9348 morgan@brownandcompany.co.nz 03 4092258
Address for invoicing:	82 Centennial Avenue Alexandra 9320 shanon@infraconltd.co.nz
Site Address:	Rocky Point & Bendigo Hills
Legal Description:	Lot 1 & Lot 2 DP561457
District Plan Zone:	RuRA2 & RuRA1
Plan Designations, Limitations or Overlays:	Rocky Point Recreation Zone – Landscape Protection Area and a Development Area Outstanding Natural Landscape Transecting High Voltage Transmission Lines
Activity Status:	Non-complying

Prepared for:	*TKO Properties Limited*
Date:	*16 June 2023 – updated 26 July 2024*
Prepared by:	*Morgan Shepherd*
Reviewed by:	*Jeff Brown*

Declaration

The Council relies on the information contained in this application being complete and accurate. The Applicant must take all reasonable steps to ensure that it is complete and accurate and accepts responsibility for information in this application being complete and accurate.

If signing as the Applicant, I/we hereby represent and warrant that I am/we are aware of all of my/our obligations arising under this application including, in particular but without limitation, my/our obligation to pay all fees and administrative charges (including debt recovery and legal expenses) payable under this application as referred to the Fees Information section.

If signing as agent of the Applicant, I/we hereby represent and warrant that I am/we are authorised to act as agent of the Applicant in respect of the completion and lodging of this application and that the Applicant is aware of all of his/her/its obligations arising under this application including, in particular but without limitation, his/her/its obligation to pay all fees and administrative charges (including debt recovery and legal expenses) payable under this application as referred to the Fees Information section.

I hereby apply for the resource consent(s) for the Proposal described above and I certify that, to the best of my knowledge and belief, the information given in this application is complete and accurate.

.....
for Brown & Company Planning Group
on behalf of

TKO Properties Limited

16 June 2023 – updated 26 July 2024

ATTACHMENTS

A	An assessment of effects on the environment in accordance with the Fourth Schedule to the Act.
B	Records of Title
C	Updated Scheme Plan
D	Updated Archaeological Assessment prepared by Chris Jennings of the University of Otago
E	Additional Landscape Assessment prepared by Baxter Design
F	Landscape Attachment & Plans
G	Water and Wastewater Report prepared by CKL supported by site Geotech investigations by Mt Iron Drilling
H	Updated Ecological Impact Assessment prepared by Beale and Wildlands
I	Ecological Enhancement and Monitoring Plan prepared by Beale and Wildlands
J	Further Site Survey and Ecological Mapping prepared by Beale and Wildlands and mapped by Baxter Design
K	Memorandum regarding Lizard Management prepared by Wildlands
L	Terrestrial Invertebrate Desktop Assessment prepared by Wildlands
M	Saline Soils Investigation prepared by Roger Gibson
N	Vegetation Succession and climax communities reporting prepared by Wildlands (Field work by Simon Beale and Andrew Wells)
O	Stormwater Management Plan and Flood Risk Assessment prepared by CKL
P	Fire Risk Assessment prepared by Wildfire Management NZ
Q	Land History and Status Report prepared by Coterra Surveying
R	Legal memo on application of planning hierarchy and nature of DoC Covenant by Todd & Walker
S	Draft Constitution and Services Agreement prepared by TKO Properties Ltd
T	Traffic assessment (of State Highway and Bendigo Loop- Rd) prepared by Carriageway Consulting.

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FOURTH SCHEDULE
ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

1. A DESCRIPTION OF THE PROPOSAL

1.1. Scope of this Document

This Assessment of Effects on the Environment (**AEE**) is submitted in fulfilment of the applicant's duties under the Resource Management Act 1991 (**RMA**). The AEE addresses matters relating to this land use consent application to the Central Otago District Council (**CODC** or **the Council**) for the proposal.

This AEE has been prepared in accordance with the requirements of section 88 and the Fourth Schedule of the RMA and provides all information necessary for a full understanding of the proposal and the effects it will have on the environment. To this end, the AEE contains the following information:

- A description of the site and surrounding locality;
- Development and consent history;
- A description of the proposal;
- Relevant provisions of the Central Otago District Plan (**CODP**);
- An assessment of effects on the environment;
- Section 104 and 104D Assessment;
- Part 2 RMA considerations;

1.2. The site and locality

The Rocky Point site is a 68.7ha rural property near Bendigo Station, currently undergoing subdivision. It is bordered by Tarras Cromwell Road (SH8) and Lake Dunstan to the west. Bendigo Loop Road runs across the north of the property and provide access. To the east is the established "Chinaman's Terrace / Bendigo viticulture area. Running across the south of the property, extending northeast is the ~1200ha Bendigo Scenic Reserve. It is of varied topography with flatter plateau and steeper slopes. Vegetation is predominantly grass and shrubland. Existing farm tracks cross the site, and an existing transmission line runs through the site.

The site is shown in ***Figure 1*** below.

Figure 1. Site location (outlined in black & yellow)

The application also relates to parts of the Bendigo Hills site which is located to the south of Rocky Point.

A field survey/inspection was undertaken by Chris Jennings in November 2022. Four archaeological sites that are primarily related to the operation of the historic Morven Hills Station, and later Bendigo Station were recorded on the site as seen in ***Figure 2*** below.

Figure 2. Sites recoded during November 2022 field survey

The recorded sites are detailed in the Archeological Assessment (**Attachment D**) and summarised as follows:

- G41/771 – Earth bank feature
- G41/772 – Stone retaining wall
- G41/773 – Earth bank feature
- G41/774 – Sluicing Area

As discussed in the Landscape Assessment (**Attachment E**) the site occupies a part of the lower reaches of the Dunstan Ranges and presents a highly complex landscape character. The Landscape Assessment breaks the site landscape into identifiable components as follows:

- The rolling flats – the lower part of the site adjacent to Bendigo Loop Road which has space vegetation cover and minor rocky outcrops.
- Kanuka escarpments – relatively steep land flanking the rolling flats with a series of small ridges and gullies with exposed ridges on the upper potion.
- Elevated rocky knoll – steeply rising landform with a consistent cover of kanuka amongst broken rock forms, rock outcrops and an unmodified craggy landscape which occupies the northern portion of the site and the eastern 'bookend' of the Dunstan Range and its confluence with Lake Dunstan.
- Minor ridgelines and gullies – located above the kanuka escarpments where the landform transitions to a large series of ridges and gully. kanuka cover is less and there are open portions of the landscape covered in a mix of native and exotic grasslands.
- Upper valley – this component crosses the site east to west, connecting the Plateau to a smaller flat area on the eastern boundary of the site, sitting between two significant large elevate rocky knolls and a hillocky landform. The valley is largely screened from wider views by enclosing landform to the north and south and the vegetation cover is sparse.
- The plateau – a substantial natural plateau located on the western edge of the site which is boarded by two densely vegetated kanuka gullies. An access track and transmission lines run across the plateau.
- Minor southern valley – a small relatively flat valley located to the south of the upper valley and enclosed by rising land to the south. Contains open areas of grass and sweeps of kanuka and no evidence of human modification aside from grazing.
- Elevated rocky knolls – significant landscape features located on the southern portions of the site. Steeply rising faces clad in continuous kanuka cover with rocky outcrops, ledges and striated rock form.

As summarised in the Landscape Assessment, the site retains a distinctive natural character with a low level of human modification. The site remains reasonably rugged in character with the landscape forms of gullies, minor ridges, and rocky knolls throughout the entire site providing a strong cohesive landscape that is easily identifiable. The more exposed rocky knolls and lower minor ridges have an arid and exposed natural character. Low lying areas and values within the site are sheltered from wide views by large rocky knolls and dense kanuka vegetation, giving some parts of the site a more locally 'enclosed' character. The predominant vegetation pattern found throughout the site is kanuka with other scrubland species and some areas of invasive weed species on the lower northern slopes. Smaller grassland species and cushion plants are found through the site where areas of the landform are more exposed such as minor ridges and flats. Human modification on the site is restricted to access tracks, transmission lines, historic kanuka clearance and fencing.

In recent years the site has been retired from grazing and is demonstrating considerable regeneration of native Kanuka.

1.3. Development and Consent History

RM210203 – consent for earthworks to establish access to Lot 1 DP 561457.

RC230031 – consent was sought for a boundary adjustment between Lots 1 and 2 DP561457 and variation to RC210148 to defer the sealing of Lakefront Terrace and provide for a staged subdivision. The boundary adjustment component has been approved and the variation is imminent.

1.4. The proposal

1.4.1 Subdivision

The proposal is to subdivide the site to create 30 new allotments as shown on the Scheme Plan (**Attachment C)** and detailed in ***Table 1*** below. A balance lot will comprise the residual area surrounding proposed Lots 1 – 30. This area will be owned as undivided shares in common by each private lot owner. This surrounding area will remain undeveloped and will provide open space and amenity, as well as limited recreation, for owners.

Table 1*. Proposed Allotments*

Allotment	Building platform	Curtilage Area	Finished Floor Level	Zone	Area	Purpose
Lot 1	400m²	1900m²	292m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	9077m²	Residential
Lot 2	450m²	2449m²	291m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	7547m²	Residential
Lot 3	450m²	1603m²	290m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	7442m²	Residential
Lot 4	421m²	1441m²	296m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	2657m²	Residential
Lot 5	393m²	1104m²	296m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	2163m²	Residential
Lot 6	392m²	1191m²	297m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	2307m²	Residential
Lot 7	400m²	985m²	299m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	1964m²	Residential
Lot 8	360m²	1313m²	296m	Rural Resource Area (2) – Rocky Point Recreation	2395m²	Residential

Allotment	Building platform	Curtilage Area	Finished Floor Level	Zone	Area	Purpose
				Zone (Development Area)		
Lot 9	373m²	1084m²	301m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area + Landscape Protection Area)	2127m^2	Residential
Lot 10	279m²	718m²	-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	1355m^2	Residential
Lot 11	84m²		-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area + Landscape Protection Area)	1507m^2	Residential
Lot 12	84m²		-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area + Landscape Protection Area)	737m^2	Residential
Lot 13	84m²		-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area + Landscape Protection Area)	4565m^2	Residential
Lot 14	84m²		319m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	479m^2	Residential
Lot 15	84m²		-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	535m^2	Residential
Lot 16	84m²		-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	522m^2	Residential
Lot 17	84m²		-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	515m^2	Residential
Lot 18	84m²		-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	504m^2	Residential
Lot 19	272m²	1080m²	-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	4040m^2	Residential

Allotment	Building platform	Curtilage Area	Finished Floor Level	Zone	Area	Purpose
Lot 20	395m²	1564m²	332m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	4598m^2	Residential
Lot 21	508m²	1666m²	322m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area + Landscape Protection Area)	5426m^2	Residential
Lot 22	400m²	1703m²	324m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area + Landscape Protection Area)	2331m^2	Residential
Lot 23	385m²	1545m²	324m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area + Landscape Protection Area)	2869m^2	Residential
Lot 24	490m²	2059m²	325m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area + Landscape Protection Area)	9429m^2	Communal/ Commercial
Lot 25	339m²	1440m²	327m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	8360m^2	Residential
Lot 26	465m²	1675m²	328m	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area)	15,240m^2	Residential
Lot 27	714m²	2207m²	331m	Rural Resource Area (2) – Rocky Point Recreation Zone (Landscape Protection Area)	21,080m^2	Residential
Lot 28	575m²	2035m²	203m	Rural Resource Area (2) – Rocky Point Recreation Zone (Landscape Protection Area)	11,240m^2	Residential
Lot 29	611m²	1671m²	302m	Rural Resource Area (2) – Rocky Point Recreation Zone (Landscape Protection Area)	7706m²	Residential
Lot 30	1494m²	3123m²	302m	Rural Resource Area (2) – Rocky Point Recreation Zone (Landscape Protection Area)	5059m²	Communal/ Commercial
Lot 101	-	-	-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area	-	Access to be vested as road

Allotment	Building platform	Curtilage Area	Finished Floor Level	Zone	Area	Purpose
				& Landscape Protection Area)		
Lot 102	-	-	-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area & Landscape Protection Area)	-	Access to be vested as road
Lot 103	-	-	-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area & Landscape Protection Area)	-	Access to be vested as road
Lot 200	-	-	-	Rural Resource Area (2) – Rocky Point Recreation Zone (Development Area & Landscape Protection Area)	46.95ha	Balance / Common

The applicant proposes a staged subdivision and lots included in each stage will be determined in due course. The following staging condition is proposed:

(x) *This subdivision may be staged. For the purposes of issuing approvals under sections 223 and 224(c) of the Resource Management Act 1991, the conditions of this consent shall be applied only to the extent that they are relevant to each particular stage proposed. This consent may be progressed in any order and all stages may be combined, providing all necessary subdivision works (such as servicing, provision of formed legal access and other works required to satisfy conditions of this consent), are completed for each stage, prior to certification being issued as necessary under section 223 and 223(c) of the Resource Management Act 1991.*

1.4.2 Building platforms and controls

The proposal includes the identification of residential building platforms on proposed Lots 1 – 30. The size of the building platforms range depending on the lot size and location within the landscape. A range of design controls will apply to any future building within the platforms as set out in the Landscape Assessment (**Attachment E**) and detailed below:

Curtilage areas are identified around the proposed building platforms and will enable residential activity which is considered appropriate. Beyond the curtilage area is a proposed Landscape and Vegetation Protection Area (LVP) which will be subject to covenants limiting clearance of indigenous vegetation and an obligation to undertake weed management and control.

General Design Controls

Architectural

- All built form is to be contained within a prescribed building platform (RBP) and shall not exceed the site coverages set out below:

Lot 1	RBP 400m^2	55% site coverage	(220m^2 maximum)
Lot 2	RBP 450m^2	49% site coverage	(220m^2 maximum)
Lot 3	RBP 450m^2	49% site coverage	(220m^2 maximum)

Lot 4	RBP 421m^2	52% site coverage	(220m^2 maximum)
Lot 5	RBP 393m^2	56% site coverage	(220m^2 maximum)
Lot 6	RBP 392m^2	56% site coverage	(220m^2 maximum)
Lot 7	RBP 400m^2	55% site coverage	(220m^2 maximum)
Lot 8	RBP 360m^2	55% site coverage	(200m^2 maximum)
Lot 9	RBP 373m^2	54% site coverage	(200m^2 maximum)
Lot 10	RBP 278m^2	54% site coverage	(150m^2 maximum)
Lots 11-18	RBP 84m^2	100% site coverage	(84m^2 maximum)
Lot 19	RBP 272m^2	91% site coverage	(250m^2 maximum)
Lot 20	RBP 395m^2	63% site coverage	(250m^2 maximum)
Lot 21	RBP 250m^2	49% site coverage	(250m^2 maximum)
Lot 22	RBP 400m^2	63% site coverage	(250m^2 maximum)
Lot 23	RBP 385m^2	65% site coverage	(250m^2 maximum)
Lot 24	RBP 499m^2	50% site coverage	(250m^2 maximum)
Lot 25	RBP 339m^2	65% site coverage	(220m^2 maximum)
Lot 26	RBP 465m^2	56% site coverage	(260m^2 maximum)
Lot 27	RBP 714m^2	49% site coverage	(350m^2 maximum)
Lot 28	RBP 575m^2	61% site coverage	(350m^2 maximum)
Lot 29	RBP 611m^2	57% site coverage	(350m^2 maximum)
Lot 30	RBP 1494m^2	23% site coverage	(350m^2 maximum)

Architectural Design Controls

Lots 1 – 10, 25 and 26

- All buildings shall be in monopitch ('flat') forms only to follow the natural grade of the Rocky Point landscape forms. The 'downhill' elevation (being that facing towards the primary view or drop in elevation) shall be a maximum of 3m high in height sloping back up continuous to a maximum height of 3.8 metres. Refer to plans **Baxter Design Plan SK130**, **SK132**, and **SK133** for roof slope indication.

- All roof material shall be Steel tray roof or corrugated iron in Colorsteel 'Flaxpod' or similar.

- All exterior wall materials shall be restricted to the following:
    - **Natural timber cladding**, left to weather or in a clear 'natural' stain,
    - **Stained timber cladding**, in a 'Drydens' Stain Elm wood oil, or similar, or in a black stain,
    - **Corrugated Iron cladding**, in colorsteel 'Flaxpod' or similar
    - **Steel tray cladding** in Colorsteel 'Flaxpod' or similar, to match roof finish,
    - **Concrete**, either in situ or precast. Low light reflection coefficient to be achieved through texture or oxide additive,
    - **Locally sourced schist stone**, laid horizontally with dark tinted mortar/grout

- **Steel sheet cladding**, in mild steel, with steel oil ('Penetrol' or similar) to prevent rusting

- Glazing on the elevations facing wider views (generally elevations of 3m high) shall be restricted to 60% of that elevation, with the remaining elevation to be solid cladding.

- All glazing shall be non-reflective and recessed into any elevation by a minimum of 250mm.

Lots 11 – 18 (cabin lots with 84m² footprints)

- All buildings shall be constructed on timber piles. Timber piles must not exceed 1200mm in height.

- Maximum building height of 5.5m.

- All buildings shall have a single gabled roof form between 20 and 35 degrees only. No hip roofs are permitted.

- All roof material shall be Steel tray roof or corrugated iron in Colorsteel 'Flaxpod' or similar.

- All exterior wall materials shall be restricted to the following:
  - Horizontal rusticated weatherboard left to weather or in clear 'natural' stain or in a 'Drydens' Stain Elm wood oil, or similar, or in a black stain.

- Glazing is permitted on all elevations and shall not exceed 50% of the total wall area (all elevations combined).

- All glazing shall be non-reflective and recessed into any elevation by a minimum of 250mm.

Lots 19 – 23

- Maximum building height of 4.5m.

- All buildings shall have a gable roof only. A break in the gable (flat roof) is permitted up to 3m in height.

- All roof material shall be Steel tray roof or corrugated iron in Colorsteel 'Flaxpod' or similar.

- All exterior wall materials shall be restricted to the following:
  - **Natural timber cladding**, left to weather or in a clear 'natural' stain,
  - **Stained timber cladding**, in a 'Drydens' Stain Elm wood oil, or similar, or in a black stain,
  - **Corrugated Iron cladding**, in colorsteel 'Flaxpod' or similar
  - **Steel tray cladding** in Colorsteel 'Flaxpod' or similar, to match roof finish,
  - **Concrete**, either in situ or precast. Low light reflection coefficient to be achieved through texture or oxide additive,
  - **Locally sourced schist stone**, laid horizontally with dark tinted mortar/grout
  - **Steel sheet cladding**, in mild steel, with steel oil ('Penetrol' or similar) to prevent rusting.

- Glazing on all northern elevations shall be restricted to 75% of that elevation. Overall, the glazing shall not exceed 50% of all elevations combined.

- All glazing shall be non-reflective and recessed into any elevation by a minimum of 250mm.

Lot 24

- Maximum building height of 4.5m.
- All buildings shall have gable roof form between 20 and 25 degrees with the gable running west to east along the building form. A break in the gable (flat roof) is permitted up to 3m in height.
- All buildings shall be clad in locally sources schist stone stacked horizontally or aged uncoloured corrugated iron or a combination of both.
- Glazing on the northern elevation shall not exceed 50% of that elevation.
- All glazing shall be non-reflective and recessed into any elevation by a minimum of 250mm.

Lots 27 – 29

- Maximum building height of 5.0m.
- All buildings shall have a gable roof form. A break in the gable (flat roof) is permitted up to 3m in height.
- All roof material shall be Steel tray roof or corrugated iron in Colorsteel 'Flaxpod' or similar.
- All exterior wall materials shall be restricted to the following:
    - **Natural timber cladding**, left to weather or in a clear 'natural' stain,
    - **Stained timber cladding**, in a 'Drydens' Stain Elm wood oil, or similar, or in a black stain,
    - **Corrugated Iron cladding**, in colorsteel 'Flaxpod' or similar
    - **Steel tray cladding** in Colorsteel 'Flaxpod' or similar, to match roof finish,
    - **Concrete**, either in situ or precast. Low light reflection coefficient to be achieved through texture or oxide additive,
    - **Locally sourced schist stone**, laid horizontally with dark tinted mortar/grout
    - **Steel sheet cladding**, in mild steel, with steel oil ('Penetrol' or similar) to prevent rusting.
- Glazing shall not exceed a maximum of 50% of all elevations combined.
- All glazing shall be non-reflective and recessed into any elevation by a minimum of 250mm.

Lot 30

- Maximum building height of 5.5m.
- All buildings shall have either a gable form between 20 and 25 degrees or shall be monopitch ('flat') form. A break in the gable (flat roof) is permitted up to 3m in height.
- All roof material shall be Steel tray roof or corrugated iron in Colorsteel 'Flaxpod' or similar, or in aged corrugated iron.
- All exterior wall materials shall be restricted to the following:
    - **Natural timber cladding**, left to weather or in a clear 'natural' stain,
    - **Stained timber cladding**, in a 'Drydens' Stain Elm wood oil, or similar, or in a black stain,
    - **Corrugated Iron cladding**, in colorsteel 'Flaxpod' or similar

- **Steel tray cladding** in Colorsteel 'Flaxpod' or similar, to match roof finish,
- **Concrete**, either in situ or precast. Low light reflection coefficient to be achieved through texture or oxide additive,
- **Locally sourced schist stone**, laid horizontally with dark tinted mortar/grout
- **Steel sheet cladding**, in mild steel, with steel oil ('Penetrol' or similar) to prevent rusting.

- Glazing shall not exceed a maximum of 60% of all elevations combined.

- All glazing shall be non-reflective and recessed into any elevation by a minimum of 250mm.

Landscape controls

- Tree and shrub planting is restricted to Kanuka only, with any existing Kanuka that is removed (not including that removed for fire management) to be replaced with a similar area of Kanuka within the lot boundary.

- Each lot is permitted to have an area of 30m^2 of herb and garden planting located no more than 5m from the dwelling, with species not to exceed 1m in height.

- Additional planting of a mixture of dryland species may be planted, with species restricted to: *Corokia cotoneaster Korokia, Olearia lineata, Olearia odorata, Coprosma propinqua, Coprosma crassifolia, Coprosma virescens, Ozothamnus vauvilliersii* Mountain cottonwood and *Meuhlenbeckia axillaris.*

- All noxious weeds are to be controlled by the lot owners.

- No fencing is permitted outside of the curtilage area, with fencing within the curtilage area restricted to 1m high post and wire fencing only for the purpose of containing pets and for rabbit proofing.

- Any entry gates or feature wall at lot entries shall constructed in weathered timber, schist stone or weathered mild steel only, and shall not exceed 1m in height (unless required for retaining).

- Exterior lighting shall be restricted to downlighting only, and the light source shall not be more than 1.2m above ground level and shall be LED, incandescent, halogen or other 'white light' with sodium vapour or other coloured lighting not allowed. All lighting shall align to the 5 Five Principles for Responsible Outdoor Lighting from the International Dark-Sky Association.

- Driveways shall be constructed in gravel only, with vehicle courtyards restricted to gravel or exposed aggregate only.

- External air conditioning units, meters or any other electronic units shall be painted to match house cladding or screened with planting and are not permitted to be roof-mounted.

- All utilities including gas supply, electrical supply, stormwater piping, foul sewer, and telecommunications shall be underground or contained within the building structure.

- All water tanks shall be located within the curtilage areas and at least 60% of the structure is to be buried underground, with the above-ground part of the structure to be in dark colours and fully screened by planting.

1.4.3 Vegetation clearance and proposed planting

The proposal requires clearance of stands of kanuka and individual tress, and areas of cushionfield, grassland vegetation and exotic herbfield to allow the construction of accessways and identification of building platforms.

The table below summarises the approximate areas proposed indigenous vegetation clearance:

Indigenous dominant vegetation community	Current extent (m²)	Areas to be cleared	Percentage cleared
Kanuka shrubland/scrub	**343,942**	**13,539**	**2%3.9%**
Cushionfield	**139,649**	**39,880**	**28.5**

The proposal includes a biodiversity offset involving planting of forest and shrub species at three sites (Hemlock Gully, Panorama Rise and Pylon Flat) in the adjacent Bendigo Hills site as seen in ***Figure 3*** below.

***Figure 3**. Proposed offset planting sites*

The Hemlock Gully site is 1.77ha, the Panorama Rise site is 1.27ha and the Pylon Flat site is 1.96ha. The sites have been selected due to their south to south-westerly aspect, favourable soils and dominance of exotic grasses and forbs.

The species proposed for the offset planting areas are:

- Cheilanthes sieberi
- Polystichum neoselandicum
- Polystichum vestitum
- Asplenium ricardii
- Carmichaelia compacta
- Coprosma crassifolia
- Coprosma propinqua
- Coprosma virescens
- Corokia cotoneaster
- Melicope simplex
- Melicytus alpinus
- Olearia odorata
- Veronica salicifolia
- Myrsine divaricate
- Oleria lineata
- Veronica pimeleoides
- Vittadinia australis
- Griselinia littoralis
- Hoheria angustifolia
- Kunzea serotina
- Myrsine australis
- Pittosporum tenuifolium
- Plagianthus regius
- Pseudopanax ferox
- Sophora microphylla

The offset plantings are described in detail in the Ecological Assessment (**Attachment H**) and include 7500 plants per hectare based on an average spacing of 2.5m for trees and 1.3m for shrubs. A timeframe for the offset of 30 years has been adopted in accordance with best practice.

The compensation planting will be undertaken in stages, as development is undertaken, in accordance with the Ecological Enhancement and Monitoring Plan (**Attachment I**).

The proposal also involves four areas (as seen in ***Figure 4*** below) of enrichment planting which will comprise species identified by Wildlands (and discussed in the Ecological Assessment) as likely component of the pre-settlement vegetation types that occurred on the alluvial gravels at the base of the hillslopes at the north of Rocky Point and within the gullies and basins.

Figure 4. Proposed enrichment planting sites

1.4.4 Commercial and communal residential activities

It is proposed that Lots 24 and 30 are created for the purpose of communal residential activity, leisure activities, accommodation facilities and temporary activities, to be utilised by the future residents, friends and family.

1.4.5 Access

The proposal includes the construction of a new accessway extending from Bendigo Loop Road and traversing across the site. The access point is approximately 100m from the eastern boundary of the site as detailed in the Scheme Plan (**Attachment C**). The route avoids rock outcrops and minimises earthworks volumes and extents.

This route is modified from that originally identified in Schedule 19.16: Concept Plan – Rocky Point Recreation Zone. Further engineering design work has assessed it to be more direct/shorter, safer, and less impactful on natural features.

The intent is to construct an access road which is 5.5m wide leading from Bendigo Loop Road to a cul-de-sac head at the top of the site. Due to the steep mountainous terrain, and the preference to minimise earthworks, some sections of road will exceed 1:6. It is expected that these sections will be asphalted. No road exceeds 1:5. The road will additionally have asphalt in areas of high wear, and the remainder my either be asphalt or two coat chip seal, but this will be subject to final design.

Proposed Lot 101 contains the main accessway (20m legal width and 5.5m carriageway) and is proposed to be vested as road. Proposed Lots 102 and 103 extend up the site to provide access to proposed Lots 10 – 25. Private driveways will be constructed at the time a future building is established; however these are required to be no more than 3m in width and unsealed.

1.4.6 Earthworks

Earthworks are required for the proposed roading construction, approximate volumes are detailed in the table below.

Component	Road type	Length (m)	Cut (m³)	Fill (m³)
Main Access Road	Road to vest	1500	15000	15000
Access to Lots 1-7	Shared	175	1000	0
Access to Lot 30 and Bendigo Station	Shared	400	7000	1500

The total volume of earthworks is approximately 39,500m³ across the site and these will be undertaken in accordance with an Environmental Management Plan (EMP) which will be required by way of condition.

In addition to the earthworks required for the roading, earthworks will be undertaken on the future lots to create level building platforms to ensure they are ready to build upon by future owners. The general 're-contouring' of the sites is shown on the Landscape Plans (**Attachment F**), and it is anticipated that full earthworks drawings will be prepared as part of a detailed engineering acceptance application.

1.4.7 Infrastructure / Servicing

Wastewater

CKL prepared a Water and Wastewater Assessment (**Attachment G**) to provide an assessment for the treatment and disposal of wastewater. In summary, the report concludes:

- On-site secondary level treatment for Lots 1 – 3 and 19 – 30;
- The remaining lots (Lots 4 – 18) are unsuitable for onsite treatment and disposal, therefore a low-pressure sewer reticulation system to convey effluent to the area west of Lot 20 for treatment and disposal is proposed;
- Treatment can be achieved via a communal land wastewater treatment plan and land disposal or a large septic tank and aeration chamber capable of treating approximately 9,000L/day.
- Approximately 900m² of land is required for the primary disposal area.

The proposed wastewater treatment and disposal is further detailed within the Water and Wastewater Assessment (**Attachment G**) and illustrated in ***Figure 5*** below.

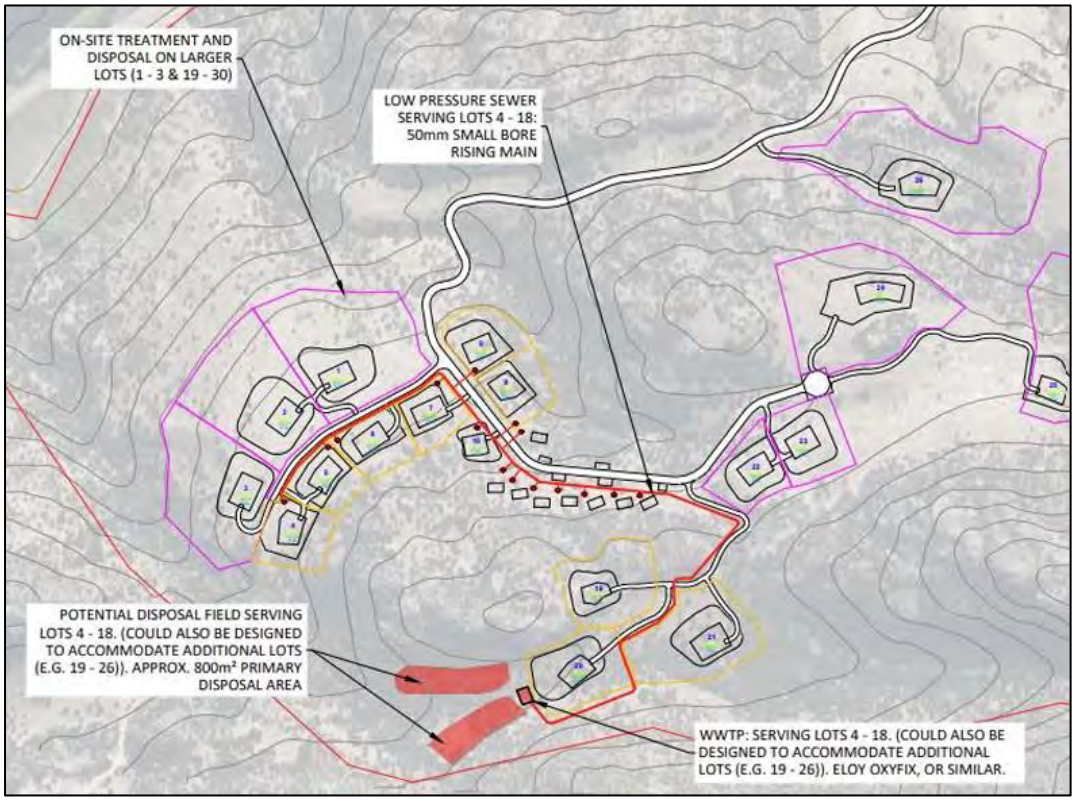


Figure 5. *Proposed treatment plant and communal wastewater disposal area location*

Stormwater

As discussed in the Water and Wastewater Assessment (**Attachment G**) the lots have limited suitability for soak pits due to a combination of low permeability soils and depth to rock. The stormwater from each lot could either be directed to a soak pit or to a semi-reticulated system.

Stormwater runoff from the site should mimic that of the pre-development scenario, including 1% AEP and allowance for climate change in accordance with NZS4404:2010. It is anticipated that a condition of consent will require detailed design of the stormwater systems be supplied prior to 223.

Water supply

Domestic water will be supplied via the Chinaman's Terrace water scheme. The applicant has a water right of 500,000L/day from the scheme which is allocated to Rocky Point and Bendigo Hills (the applicant's neighbour site). Water will be extracted from the scheme at the existing header tanks located in proposed Lot 5 of Bendigo Hills and reticulated to Rocky Point.

A services company or other legal entity will be established to manage the combined Bendigo Hills and Rocky Point water supply. An Overview of Rocky Point Services, including a draft Constitution and Services Agreement (**Attachment S**) has been prepared and will be ratified shall consent be granted. It is anticipated that a condition of consent and/or consent notice condition will be required in this regard.

Power and telecommunications

Power and telecommunications services are available and have sufficient capacity to cater for the proposal. The services will be installed in underground.

2. RESOURCE MANAGEMENT MATTERS

The site is shown on Planning Map 41D of the Central Otago District Plan and is located within the Rural Resource Area 2 (**RuRA(2)**) and subject to the Rocky Point Recreation Zone as per Schedule 19.16 Concept Plan – Rural Resource Area (2) as seen in ***Figure 6*** below.

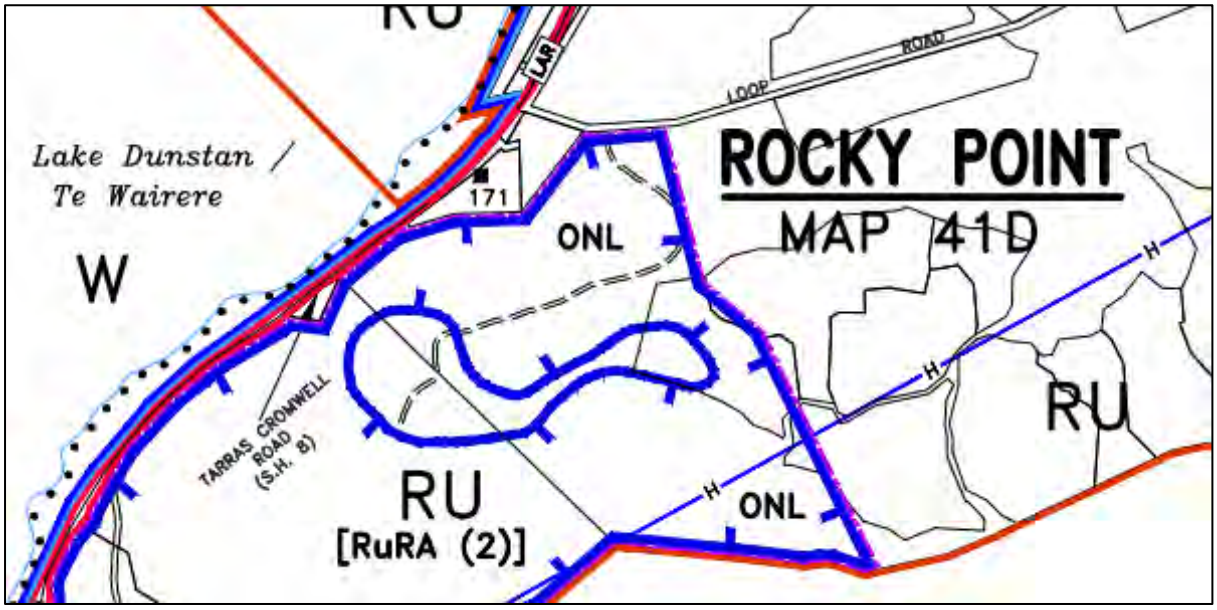


Figure 6. *Planning Map 41D – Rocky Point*

The majority of the site is within the Outstanding Natural Landscape (ONL) classification with the exception of the 'Development Area'[1] identified in Schedule 19.16 as seen in ***Figure 7*** below.

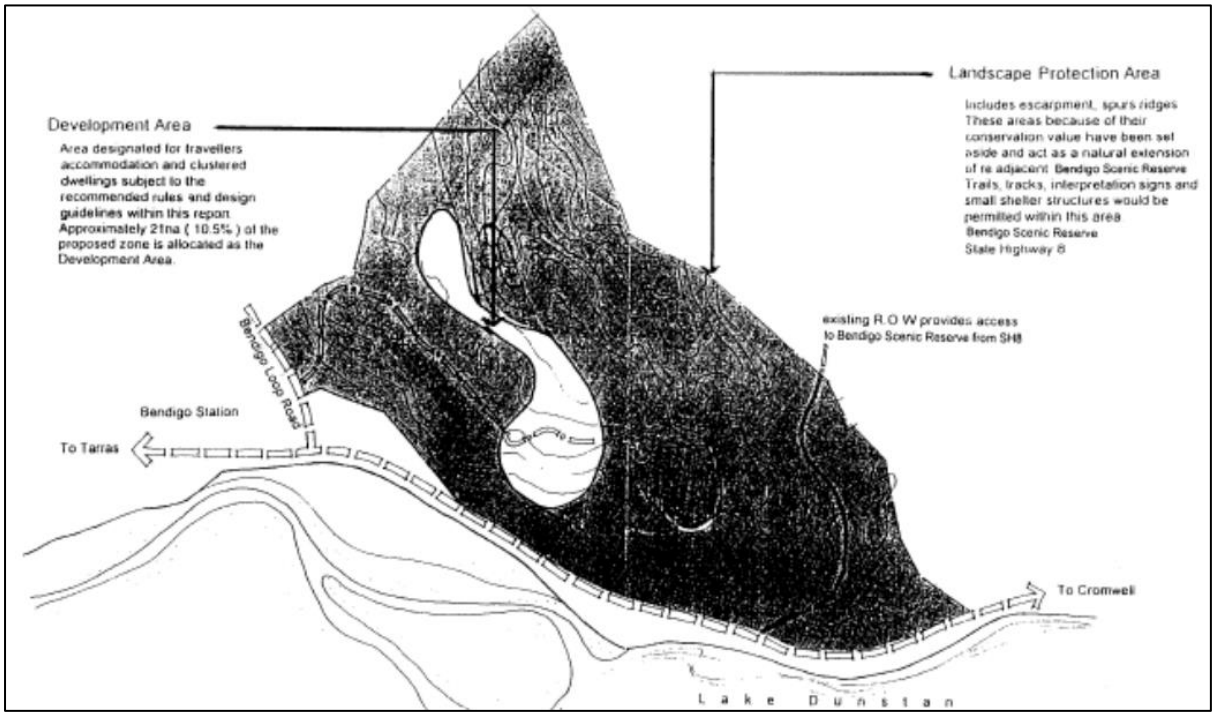


Figure 7. *Schedule 19.16: Concept Plan – Rural Resource Area (2), Rocky Point Recreation Zone*

[1] Area designated for travellers accommodation and clustered dwellings subject to the recommended rules and design guidelines within this report. Approximately 21ha (10.5%) of the proposed zone is allocated as the development area.

Schedule 19.16.1 contains a table of 'Areas of Significant Indigenous Vegetation, Habitats of Indigenous Fauna and Wetlands'. Item 23 is 'Bendigo' with an area of 3077ha, and legally described as Run 238 M Wakefield & Tarras & Run 238 L Wakefield SD. The District Plan map spatially identifies areas of 'Significant Natural Value', one which is located to the south-east of the site and understood to be the area of Significant Indigenous Vegetation that is listed in Schedule 19.16.1. Therefore, the site does not include any areas of Significant Indigenous Vegetation.

The proposed activity is assessed under the relevant activity rules and standards (in ***Tables 2*** and ***3*** below).

Table 2. *CODP Activities*

Rule	Activity	Activity status / Consent required?
Section 4 – Rural Resource Area		
4.7.2(i)	**Residential Activity** Residential activity in areas identified as "Rural Residential" ([RR]), Rural Resource Area (1) and Rural Resource Area (2) on the planning maps or located on a residential building platform consented under Rule 4.7.3(vii) or located on a residential building platform identified on a plan of subdivision that has been granted subdivision consent prior to 28 May 2011 and which is set in a condition of consent subject to a consent notice is a controlled activity provided the following standards are complied with: **(a) General Standards** The relevant standards set out in 4.7.6 are complied with. **(b) Residential Activities per Site** There shall be no more than one residential activity on the relevant certificate of title unless additional residential activity is required to accommodate people working on the property and their families. **(c) Access** No additional formed accesses are to be created to any State Highway. **(d) Separation Distances** Where the dwelling is not located on a building platform established by way of resource consent the following separation distances to any existing dwelling, any dwelling under construction, any registered building platform established by way of resource consent, or any urban area shall apply; Rural-Residential - 50 metres Rural Resource Area (1) - Not applicable Rural Resource Area (2) - Not applicable Elsewhere in Rural Resource Area - Not applicable **(e) Visibility** **…** *Rural Resource Area (2)* The dwelling, other residential buildings and accessory buildings are not to be visible from State Highway 8 and Lake Dunstan. Note: This rule only applies to Rural Resource Area (1) that applies in the Bendigo area – see Maps 41D & E, 48 and 52 and to Residential Resource Area (2) that applies at Rocky Point in the Bendigo area – see Maps 41D & E.	**No –** the requirements to be a **Controlled** activity consent are not met as all standards will not be complied with. Compliance is detailed below: (a) Does not comply – as identified in detail in the relevant standards, the proposal breaches standards in 4.7.6. (b) Complies – only one residential unit per allotment is proposed (as demonstrated by RBP). If future owners seek additional residential activities, further consent will be required. (c) No additional access to SH8 is proposed. (d) Not applicable to RuRA(2). **(e)** Does not comply - Lots 1-7 and 10 may potentially be visible from Lake Dunstan, while Lots 23-30 may potentially be visible from SH8. (f) The proposed design control restriction on LRVs for cladding will comply.

Rule	Activity	Activity status / Consent required?
	(f) Colour and Finish of Buildings **…** *Rural Resource Area (2)* The following colour and finish of buildings (including accessory buildings) shall apply; All buildings shall be finished in any of the following materials: i. Timber (vertical and horizontal) ii. Plaster/Adobe iii. Schist iv. Corrugated iron: Desert Sand, Lichen, Sandstone Grey, Kauri, Grey Friars, New Denim Blue, (Colorsteel colours). Detailing around verandahs, posts windows and doors may differ. The exterior walls of all buildings shall be finished in the colour range of browns, dark greens and greys. v. Roofing shall be finished in any of the following: Unpainted natural products, ie, timber shingles, slate or corrugated iron in one of the following colours: Iron sand, Lignite, kauri, Grey Friars, New Denim Blue (Colorsteel colours), turf. **…**	
4.7.2(ii)	**Subdivision** (a) Except as otherwise provided in (b) below and Rule 4.7.4(iii), subdivision shall be a controlled activity provided the following standards are complied with: **i. Minimum Allotment Sizes** Minimum allotment sizes shall be as follows; **…** In the area identified as "Rural Resource Area (2)" [(RuRA(2))] on planning maps – any application for subdivision consent shall include a minimum area of 1 hectare within which land can be further subdivided to create allotments and units as follows: (a) For residential purposes – sufficient area to meet open space and bulk and location rules. (b) For travellers accommodation – minimum area 2000m^2 with sufficient area to meet open space and bulk and location rules. **…** **iii. Concept Plans** **….** In the area identified as "Rural Resource Area (2)" on the planning maps subdivision shall comply with the concept plan attached as Schedule 19.16. **….** **iv. Maximum Number of Allotments for Residential Activities** The maximum number of allotments on a plan of subdivision	**No –** the requirements to be a **Controlled** activity consent are not met as all standards will not be complied with. Compliance is detailed below: i. Does not comply - The site to be subdivided is greater than 1ha, however as travellers accommodation for up to six guests is proposed on all residential lots and as there are lots less than 2000m^2 in area, this standard cannot be complied with. A number of lots will also not meet the minimum yard requirements (10m front, and 25m side and rear) for residential purposes, or the landscaped area requirement (500m^2) for travellers

Rule	Activity	Activity status / Consent required?
	likely to accommodate a residential activity shall be as follows: Rural Residential – 5 Rural Resource Area (1) – 16 Rural Resource Area (2) – No limit Rural Resource Area (3) – 12 **v. Access Formed** No additional accesses are to be created to any State Highway.	accommodation. ii. … iii. Does not comply - Lots 24 and 26-30 are located outside of the Development Area and therefore do not comply with the concept plan. iv. Complies – no limit on number of allotments. v. Complies – no additional access to SH8 is proposed.
4.7.2(vi)	**Outstanding Natural Landscapes, Outstanding Natural Features and Land in the Upper Manorburn/Lake Onslow Landscape Management Area** (a) Except as otherwise provided for in (b) below any new bladed/excavated fence line, new fire break, new fertiliser bin, new stock yards, or fire fighting water ponds within any area identified as an outstanding natural landscape, outstanding natural feature or as land in the Upper Manorburn/Lake Onslow Landscape Management Area as shown on the planning maps is a controlled activity. (b) Rule 4.7.2(vi)(a) shall not apply to: i. Reviewable land that has been freeholded under Part 2 of the brown Pastoral Land Act 1998 subsequent to the operative date of this plan; and ii. Unrenewable occupation licence land that has been designated for disposal as fee simple under Part 3 of the Crown Pastoral Land Act 1998 subsequent to the operative date of this plan; and iii. Freehold land listed in Schedule 19.6.3.	**No – Controlled** activity consent is not required as Bendigo Station is listed in Schedule 19.6.3 as it was freeholded under a tenure review process and therefore Rule 4.7.2(vii)(a) does not apply.
4.7.2(vii)	**Accommodation Facilities** Accommodation facilities in areas identified as "Rural Residential" ([RR]), Rural Resource Area (1) and Rural Resource Area (2) on the planning maps or located on a residential building platform identified on a plan of subdivision that has been granted subdivision consent prior to 28 May 2011 and which is set in a condition of consent subject to a consent notice and that do not exceed that required to accommodate 6 persons on a commercial fee paying basis is a controlled activity provided the following standards are complied with: **(a) General Standards** The relevant standards set out in 4.7.6 are complied with.	**No –** assuming that this rule is intended to capture travellers accommodation ("Accommodation Facilities" is not a defined term in the ODP), the requirements to be a **Controlled** activity consent are not met as all standards will not be complied with. Compliance is detailed below:

Rule	Activity	Activity status / Consent required?
	(b) Access No additional formed accesses are to be created to any State Highway. **(c) Separation Distances** Where the accommodation facility is not located on a building platform established by way of resource consent the following separation distances to any existing dwelling, any dwelling under construction, any building platform established by way of resource consent, or any urban area shall apply; RuRA(1) & (2) and elsewhere in the RuRA – not applicable	(a) The standards for travellers accommodation relating to yards and landscaped area in 4.7.6 are not complied with; (b) Complies – no new access to SH8 is proposed; (c) Not applicable.
4.7.3(i)	**Breach of Standards** Any activity that fails to comply with the following rules: **4.7.2(i)(d) Separation Distances** **4.7.2(ii)(a)(ii) Separation Distances for Dwellings** **4.7.2(vii) Accommodation Facilities** **4.7.6A Bulk and Location Requirements (a), (b), I, (f), (h) (i) and (k) 4.7.6C Tree Planting** **4.7.6F Storage** **4.7.6H Signs** is a discretionary (restricted) activity.	**Yes – Restricted Discretionary** activity consent is required as the proposal fails to comply with the following rules: 4.7.2.viii Accommodation Facilities 4.7.6A Bulk and Location Requirements (a) Yards, (b) Open Space, and (f) Height .
4.7.3(ii)	Any activity that fails to comply with **Rule 4.7.6A Bulk and Location (g)** is a discretionary (restricted) activity.	**No – Restricted Discretionary** activity consent is not required as separation of buildings from transmission lines will be achieved.
4.7.3(iii)	Any activity that does not comply with **Rule 4.7.6D Visual Effects of Buildings** is a discretionary (restricted) activity**.**	**No – Restricted Discretionary** activity consent is not required as the future buildings will be required to comply with design controls that achieve the outcomes of this rule.
4.7.3(iv)	Any activity that fails to comply with **Rule 4.7.6E Noise** is a discretionary (restricted) activity.	**No – Restricted Discretionary** activity consent is not required as noise levels will be achieved.
4.7.3(v)	Any activity that fails to comply with **Rule 4.7.6G Provision of Services** is a discretionary (restricted) activity	**Yes – Restricted Discretionary** activity consent is required for failure of some lots to provide onsite effluent treatment (Lots 4-18).

Rule	Activity	Activity status / Consent required?
4.7.3(vi)	Any activity that fails to comply with the following **Rules; 4.7.6I. Riparian Margins or Rule 4.7.6J Earthworks For Access Tracks & Extractive Activity (a) Tracks** is a discretionary (restricted) activity.	**No – Restricted Discretionary** activity consent is not required.
4.7.3(vii)	**Residential Activity, Residential Building Platform & Accommodation Facilities** Residential activity[2], a residential building platform and/or accommodation facilities that do not exceed that required to accommodate 6 persons on a commercial fee paying basis and that are not provided for in Rule 4.7.2(i)[3], 4.7.2(ia)[4] and Rule 4.7.2(vii)[5] is a discretionary (restricted) activity provided the following standards are complied with: **(a) General Standards** The relevant standards set out in 4.7.6 are complied with. **(b) Residential Activities per Site** There shall be no more than one residential activity on the relevant certificate of title unless additional residential activity is required to accommodate people working on the property and their families. **(c) Access** No additional formed accesses are to be created to any State Highway **(d) Separation Distances** Where the dwelling is not located on a building platform established by way of resource consent a 50m separation distance to any existing dwelling, any dwelling under construction, any residential building platform established by way of resource consent, or any urban area shall apply.	**No** - the requirements to be a **Restricted Discretionary** activity consent are not met as all standards will not be complied with. Compliance is detailed below: (a) Does not comply - Residential activity and travellers accommodation will not comply with the standards in 4.7.6 as previously detailed. (b) Complies – no more than one residential activity is proposed on each lot. (c) Complies – no additional formed accesses to a state highway are proposed. (d) Not relevant – building platforms are proposed for all lots.
4.7.4(i)	**Any activity that fails to comply with the following rules**: • 4.7.2(i) Residential Activities (b), (c), (e) and (f) • 4.7.2(vi) Outstanding Natural Landscapes, and Land in the Upper Manorburn/Lake Onslow Landscape Management Area • 4.7.2(vii)(b) Accommodation Facilities • 4.7.3(vii)(b)-(d) Residential Activity, Residential Building Platform & Accommodation Facilities • 4.7.6A Bulk and Location Requirements (c) and (d)	**Yes – Discretionary** activity consent is required as follows: • 4.7.2.i Residential activities – the proposal does not comply with (e) as buildings some lots may be potentially visible from Lake Dunstan / SH8 and

[2] **Residential activity**: means a use of land and buildings by people for the purpose of living accommodation in a household unit and includes a dwelling. It includes accessory buildings, sleepouts, leisure activities associated with needs generated principally from living on the site; home occupation as defined; and homestay as defined.

[3] Residential activity in areas identified as Rural Residential, Rural Resource Area (1) and Rural Resource Area (2) on the planning maps.

[4] Residential activity in Rural Resource Area (3)

[5] Accommodation facilities in areas identified as Rural Residential, Rural Resource Area (1) and Rural Resource Area (2) on the planning maps.

Rule	Activity	Activity status / Consent required?
	• 4.7.6B Traffic Generation and Characteristics of Activities • 4.7.6J Earthworks for Access Tracks & Extractive Activity Any application made relating to a breach of Rule 4.7.2(ia)(a) – (c), (e) and (f) will generally be publicly notified.	therefore the rule is triggered for this aspect of the proposal; • 4.7.2.vi – not relevant (land excluded due to freeholding) • 4.7.2.vii Accommodation Facilities – the proposal complies with (b) as there will be no new access onto SH8; • 4.7.3.vii.b-d Residential Activity, Residential Building Platform & Accommodation Facilities – complies or not relevant as assessed above; • 4.7.6.A Bulk and Location Requirements c and d – not relevant to the proposal; • 4.7.6B Traffic Generation – the proposal complies.
4.7.4(iii)	**Subdivision** Except as otherwise provided for in Rule 4.7.2(ii)(b) subdivision that: (a) Creates an allotment that fails to comply with any of the standards set out in Rules 4.7.2(ii)(a)(iii) to (vii), OR (b) Creates allotments with an average allotment area of no less than 8 hectares and a minimum allotment area of no less than 2 hectares in an area not identified on the planning maps as Rural-Residential, Rural Resource Area (1) or Rural Resource Area (2) or Rural Resource Area (3), OR (c) Creates allotments that are not in accordance with Rule 4.7.2(ii)(a)(i) in an area identified on the planning maps as Rural Resource Area (3), OR (d) Involves land that is subject to or potentially subject to, the effects of any hazard as identified on the planning maps, or land that is or is likely to be subject to material damage by erosion, falling debris, subsidence, slippage, or inundation from any source, (e) Is not in accordance with a development concept plan incorporated in a consent granted under Rule 4.7.3(ix) in the Rural Resource Area (4), is a discretionary activity.	**Yes – Discretionary** activity consent is required as some lots are located outside the Development Area and therefore not in accordance with the Concept Plan (fails to comply with 4.7.2(ii)(a)(iii)).

Rule	Activity	Activity status / Consent required?
4.7.4.(v)	**Tree planting in Rural Resource Areas (1) (2) and (3)** Tree planting not associated with landscaping in the immediate vicinity of any building in the areas identified as Rural Resource Areas (1) and (2) on the planning maps	**Yes – Discretionary** activity consent is required for the proposed offsetting and enrichment planting within RuRA(2).
4.7.5(iii)	**Subdivision** Except as otherwise provided for in Rule 4.7.2(ii)(b), subdivisions that creates: • an allotment or allotments with an average area less than 2 hectares in areas identified as "Rural Residential" ([RR]) on the planning maps or • an allotment or allotments with an average area less than 8 hectares and/or with an area less than 2 hectares in an area in the Rural Resource Area not identified on the planning maps as Rural Residential ([RR]); or • an allotment that breaches Rule 4.7.2(ii)(a)(i)[6] as it relates to Rural Resource Area (1), or Rural Resource Area (2) or Rural Resource Area (5); or • an allotment in excess of 160 allotments used for residential activity in Rural Resource Area (5)	**Yes – Non-Complying** activity consent is required for subdivision creating lots that do not meet bulk and location requirements (yards and landscaped area), and minimum lot sizes (travellers accommodation).

Table 3: CODP Standards

Rule	Standard	Status if breached	Consent Required?
Chapter 4 – Rural Resource Area			
4.7.6.A	**Bulk and Location Requirements** Buildings and any area used for storage purposes (including the stockpiling of materials) that is not enclosed or partly enclosed by a building shall be located to conform with the following standards. **(a) Yards** Except as provided for in (c) below, a minimum side and rear yard of 25 metres and a front yard of 10 metres for buildings used for residential activity and/or an accommodation facility except on land subject to the Rural Residential notation; and a minimum yard of 10 metres for all other buildings and buildings used for residential activity and/or an accommodation facility on land subject to the Rural Residential notation shall be provided to all adjoining property boundaries (including	**See relevant activity rules in Table 2**	**Yes –** consent is required for the reasons set out below: (a) Does not comply - The applicable yards for the proposal are a 10m front yard and 25m side and rear yards and this will not be met. (b) Does not comply – Lots 13-18 are not capable of complying with the 500m^2 landscaped area requirement. It

[6] In the area identified as "Rural Resource Area (2)" [(RuRA(2))] on planning maps – any application for subdivision consent shall include a minimum area of 1 hectare within which land can be further subdivided to create allotments and units as follows:
(a) For *residential purposes* – sufficient area to meet open space and bulk and location rules.
(b) For *travellers accommodation* – minimum area 2000m² with sufficient area to meet open space and bulk and location rules.

Rule	Standard	Status if breached	Consent Required?
	roads) provided that a minimum yard of 20 metres shall be provided to all State highways and Arterial Roads listed in Schedule 19.7. Note: See also Rule 4.7.6A(h) and Rule 12.7.7. **(b) Open Space in Rural Resource Area (2)** Every dwelling, or travellers accommodation unit shall have an open space of not less than 45m^2 in area with a minimum dimension of 5 metres. Such open space is to be located adjacent to the lounge and/or dining area and is to be for the exclusive use of the occupants. This rule shall not apply to apartments or travellers accommodation units located entirely at or above the first floor level. A landscaped area of 500m^2 is to be provided on the same site occupied by travellers accommodation. This area shall be planted in trees and shrubs or otherwise landscaped. **(c) Water bodies** No building shall be located within 20 metres of the bank of: any stream or river - any wetland identified in Schedule 19.6.1 - any lake (excluding irrigation dams within a farm property) 0.5 hectares or greater in area … **(e) Separation Distances from Water Races and Irrigation Pipelines** i. On slopes of 0-12 degrees no buildings, excavations or tree planting shall be permitted within 6 metres of the water's edge of a water race or irrigation pipeline. ii. On slopes of 13-20 degrees no buildings, excavations or tree planting shall be permitted within 7 metres of the water's edge of a water race or irrigation pipeline. iii. On slopes of greater than 20 degrees no buildings, excavations or tree planting shall be permitted within 10 metres of the water's edge of a water race or irrigation pipeline. iv. No fences shall be erected within 6 metres of a water race or irrigation pipeline except for those which cross the race/pipeline and then a gate will be included across any access berm or tracks. **(f) Height** Except in the area shown as Rural Resource Area (1) on the planning maps where the maximum height shall be 5 metres, as Rural		is anticipated that compliance for the 45m^2 area can be achieved, although full compliance as it relates to the location adjacent to lounge / dining area is not able to be assessed for future dwellings. A consent notice requiring compliance with this standard at time of building is anticipated; (c) Not applicable; (d) Not applicable; (e) Not applicable; (f) Does not comply – the proposed design controls provide for height of 5.5m for future dwellings on Lots 11-18 and 30; (g) Complies – no buildings are proposed near transmission lines; (h) Complies – no structures proposed within 15m of the new intersection; (i) Not applicable; (j) Not applicable; (k) Complies – no communal wastewater treatment for more than 100 people is proposed.

<table>
<tr><th>Rule</th><th>Standard</th><th>Status if breached</th><th>Consent Required?</th></tr>
<tr><td></td><td>Resource Area (2) on the planning maps where the maximum height for dwellings shall be 5 metres and for travellers accommodation the maximum height shall be 7 metres, and as Rural Resource Area (4) on the planning maps where the maximum height for travellers accommodation, conference facility and golf club house shall be 15 metres and the maximum height for all other buildings shall be 10 metres, the maximum height is as follows:
<table><tr><th>Landscape Category</th><th>Dwellings and buildings accessory to dwellings</th><th>Other Buildings including buildings accessory to farming activity</th></tr><tr><td>Outstanding Natural Landscape (ONL)</td><td>5.5m</td><td>6m</td></tr><tr><td>Significant Amenity Landscape (SAL)</td><td>6m</td><td>7.5m</td></tr><tr><td>Other Rural Landscapes (ORL)</td><td>7.5m</td><td>10m</td></tr></table>
(g) Transmission Lines
Separation from high voltage transmission lines that are part of the transmission network shall be accordance with Rule 12.7.8 (pg 12:25).
(h) Road Intersections
No structure (excluding post and wire fences), building or stockpile of materials shall be sited in that triangle of land formed by the straight line between two points measured 15 metres in each direction from the intersection point of the legal road boundaries.
(i) …
(k) Oxidation Ponds and Sewage Treatment Facilities
No residential building shall be located closer than 150 metres to any oxidation pond or sewage treatment facilities with the capacity of serving the equivalent of 100 or more people.
…</td><td></td><td></td></tr>
<tr><td>4.7.6.B</td><td>Traffic Generation and Characteristics of Activities
(a) Home stay or accommodation facilities on a property shall not exceed that required to accommodate 6 persons on a commercial fee paying basis.
(b) No more than 3 persons shall be engaged in any activity of a commercial, industrial or manufacturing nature except in areas identified as “Rural Residential” ([RR]) on the planning maps. For the purpose of this rule,</td><td>Discretionary</td><td>No – consent is not required as the proposal is restricted to accommodation facilities for up to 6 persons per site. The proposal does not involve the attraction of the public for community relates services or events other than for temporary</td></tr>
</table>

Rule	Standard	Status if breached	Consent Required?
	farming, horticulture, viticulture, network utilities and forestry activities are excluded from an activity of a commercial, industrial or manufacturing nature. Within areas identified as "Rural Residential" ([RR]) on the planning maps no person shall be engaged in any activity of a commercial, industrial or manufacturing nature. For the purpose of this rule, farming, horticulture, viticulture, network utilities and forestry activities are excluded from an activity of a commercial, industrial or manufacturing nature. (c) No activity shall involve the attraction of the public to a site for community related services or events other than for temporary activities.		activities (permitted activities).
4.7.6.C	**Tree Planting** (a) No trees shall be planted on a property in such a manner that they obstruct the vision of motorists on the road or cause the root system to have an adverse effect on the road surface. (b) No trees shall be planted adjacent to any road in a position that will shade the carriageway between the hours of 1000 and 1400 on the shortest day of the year where the speed limit is above 50km/hour and the topography is not already preventing direct sunlight onto the carriageway. (c) No trees shall be planted in those areas of land identified in Rule 4.7.6A(h) Road Intersections and Rule 4.7.6A(i) Airport Protection Zone, above, or that on maturity will project into the surfaces described in Schedules 19.8 and 19.8A. (d) No evergreen trees with dark green, blue and gold foliage (ie. conifers, in particular species from the Pinus genus) or species with wilding spread and self seeding capabilities shall be planted in the areas identified as Rural Resource Area (1) or Rural Resource Area (2) on the planning maps. (e) No tree shall be planted on a property in such a manner that it is likely to have an adverse effect on the existing electricity network.	**Restricted Discretionary**	**No** – consent is not required as the proposal does not include tree planting that contravenes this standard.
4.7.6D	**Visual Effect of Buildings and Structures** (a) All buildings including new, relocated and repainted buildings and structures (excluding post and wire fences; bird netting and support structures, wind machines, pivot irrigators and sprinklers and other equipment and fixtures incidental to agriculture, horticulture and viticulture), are subject to the following: **i. Finish**	**Restricted Discretionary**	**No** – consent is not required as all future buildings will comply as detailed below. (a) i. Complies - as per proposed design controls, which provide that exterior cladding shall be restricted to materials that comply.

Rule	Standard	Status if breached	Consent Required?
	All buildings shall be finished in any of the following materials: (i) Timber/Composite Weatherboard (vertical and horizontal). (ii) Plaster/Adobe/Rammed Earth/Masonry Products/Concrete. (iii) Stone. (iv) Coloured steel excluding unpainted zincalume and unpainted corrugated iron. (v) Weathered corrugated iron (vi) Brick **ii. Colour: Exterior Walls, Accents and Trim** The exterior walls, accents and trim for all buildings and structures shall be in a colour or colours selected from the following colour palette, provided that the colours of exterior walls shall be in a low sheen: Browns, greens, grey blue, greys, terracotta, tussock and dark reds provided that such colours shall have a Reflectivity Value (RV) of less than 38%. **iii. Colour: Roofs** The roofs of all buildings shall be in a low sheen in any colour that has a RV of less than 32% or shall be unpainted natural products such as timber shingles or slate. (b) All buildings and structures (excluding post and wire fences, bird netting and support structures, wind machines, pivot irrigators and sprinklers and other equipment and fixtures incidental to agriculture, horticulture and viticulture) shall not protrude onto a skyline or above a terrace edge when viewed from a public road or other public place at a distance not exceeding 2kms from the building or structure.		ii. Complies - as per proposed design controls, which provide that exterior cladding as set out above. iii. Complies - as per proposed design controls. (b) Complies - no building platforms are located to result in buildings protruding onto a skyline or above a terrace edge.
4.7.6E	**Noise** (a) All activities shall be conducted so as to ensure the following noise limits are not exceeded at any point within the notional boundary of any dwelling, resthome or hospital, or at any point within any Residential Resource Area or any Rural Settlements Resource Area: On any day 7:00am to 10:00pm 55 dBA L10 10:00pm to 7:00am the following day 40 dBA L10 70 dBA Lmax	**Restricted Discretionary**	**No** – consent is not required as the proposal will comply with the noise limits.
4.7.6G	**Provision of Services** **(a) Effluent Disposal**	**Restricted Discretionary**	**Yes** – consent is required as there is no existing sewerage scheme, and

Rule	Standard	Status if breached	Consent Required?
	Any site intended to accommodate a household unit or any activity that generates human effluent shall be either connected to an existing sewerage scheme at the owners cost (provided that the scheme has the capacity to accommodate the waste generated) or if such a scheme is not available the site shall be capable of effective disposal of effluent safely within the site. **(b) Water Supply** At the time of subdivision or prior to the issue of building consent to erect a residential building, the owner shall provide a safe and adequate water supply. This water supply shall be obtained from a source which is protected from contamination by animal sources and the normal activities that may cause contamination occurring or likely to occur within the catchment. The water will be of a quality which does not require any form of treatment, shall be adequate in quantity (approximately 300 litres per person per day) and where the supply is obtained outside the boundaries of the property, secured by permanent agreements and easements. The final product must meet the Ministry of Health Standards as defined in Drinking Water Standards for New Zealand 2000. **(c) Access, Loading and Manoeuvring** Access, loading and manoeuvring requirements shall be provided in accordance with Rule 12.7.1 page 12:13 and Rule 12.7.3 page 12:17. **(d) Parking** Parking shall be provided in accordance with Rule 12.7.2 (pg 12:16) and Table 12.3 (pg 12:25).		some lots cannot accommodate onsite disposal. The proposal will comply with (b) – (d).
4.7.6J	**Earthworks for Access Tracks and Extraction Activities** **(a) Tracks** [7] Where any earthworks are required for or in connection with the formation or construction of any road, track, landing, firebreak, fenceline, or utility service line, the following design standards shall be met: (i) All formation surfaces with an inwards crossfall shall be drained by a watertable; and (ii) Cutoffs or culverts shall be constructed or	**Discretionary**	**No** – the proposed earthworks for the construction of the road can comply with this standard.

[7] Intersections with public roads are to be constructed in accordance with the standards set out in Rule 12.7.1 page 12:13. Where bridges, culverts or bed disturbances are associated with activities subject to Rule 4.7.6J(a) compliance with regional rules in Chapter 13 of the Regional Plan : Water shall be met or appropriate consents obtained.

Rule	Standard	Status if breached	Consent Required?
	installed so as to prevent scour, gullying or other erosion of the formed or constructed surface and to adequately provide for fish passage when such fish passage is appropriate and practicable; and (iii) All areas of fill including any formation surface overlying fill shall be compacted; and (iv) Fill batters shall be constructed and vegetated to a standard that is adequate to mitigate any adverse visual effects when viewed from any State highway and to avoid batter erosion or failure; and (v) Adverse effects on any stream, river or lake or permanently wet wetland are avoided, remedied or mitigated; and (vi) Any cut or fill batter is no more than 2 metres in height or depth (provided that this may be exceeded for 10% or less of the total track length to a maximum 3 metres).		
4.7.5K	**Areas of Significant Indigenous Vegetation, Habitats of Indigenous Fauna and Wetlands** No activity shall have the effect of: a. Removing or adversely affecting indigenous vegetation, or b. Adversely affecting significant habitat of indigenous fauna or statutorily managed sports fish and game, or c. Draining or adversely affecting any wetland or associated values, or d. Erecting any structure (excluding fences and signs that conform with Rule 12.7.5.i.e) or e. Carrying out any earthworks or cultivation of land, or f. Establishing woodlots, production forestry or shelterbelts, or g. Subdivision of land (except for the creation of reserves or conservation areas) within those areas identified in Schedules 19.6.1 and 19.6A and on the planning maps and any wetlands over 800 metres, unless the work or activity is consistent with the particular Act under which the land is held, or any management strategy or plan developed under that Act.	**Discretionary**	**No** – the proposal is not located within an area of Significant Indigenous Vegetation, Habitats or Indigenous Fauna or Wetlands.
4.7.5.KA	**Clearance of Indigenous Vegetation** i. Clearance of indigenous vegetation on land not listed for protection under Schedule 19.6.1 and subject to Rule 4.7.6K, where the vegetation – a. comprises more than 10 hectares of snow tussock grassland (Chionochloa	**Restricted Discretionary**	**No** – consent is not required as Bendigo Station is listed in Schedule 19.6.3 as it was freeholded under a tenure review process

Rule	Standard	Status if breached	Consent Required?
	rigida), or half a hectare or more of other indigenous vegetation on one site; or b. involves any species listed as threatened in Schedule 19.6B, and the clearance affects a site containing any such species as identified on the planning maps; or c. is more than 1080m above sea level; is a discretionary (restricted) activity. Provided that this rule shall not apply to: i. Clearance of indigenous trees that have been windthrown or are dead standing as a result of natural causes and have become dangerous to life or property. ii. Clearance of indigenous vegetation on land that has been freeholded under Part 2 of the Crown Pastoral Land Act 1998. iii. The Greenland Recommended Area for Protection on Little Valley Station apart from the land subject to Conservation Covenant No. 5013375.2 (Otago Land Registry). And provided that i(b) of this rule as above shall not apply to: iv. Grazing, v. Oversowing and topdressing. And provided that i(a) and (c) of this rule as sbove shall not apply to: iv. Direct drilling associated with existing pasture. v. Clearance of matagouri. ii. For the purpose of this rule "clearance" is defined as the felling, clearing, or modification of any indigenous vegetation by cutting, mechanical crushing, spraying, burning and any activity causing disturbance to the soil.		and therefore this rule does not apply.
4.7.6.L	**Outstanding Natural Landscapes, Outstanding Natural Features and Land in the Upper Manorburn/Lake Onslow Landscape Management Area** 1. No activity shall have the effect of: (a) Erecting any structure (excluding post and wire fences) or building, or (b) Cutting new roads, new tracks, new landings, or new utility service lines, or (c) Excavating material in excess of $20m^3$ and/or disturbing any land $50m^2$ in area or greater in any one hectare in any continuous period of 5 years but	**Discretionary**	**No** – consent is not required as Bendigo Station is listed in Schedule 19.6.3 as it was freeholded under a tenure review process and therefore Rule 4.7.6L does not apply.

Rule	Standard	Status if breached	Consent Required?
	excluding cultivation of areas previously cultivated (for the avoidance of doubt this does not apply to the maintenance of roads, tracks, landings, fire breaks and other works), or (d) Establishing woodlots, production forestry or shelter belts, or (e) Subdivision of land (except for the purpose of creating reserves or conservation areas), within any area identified as an outstanding natural landscape, outstanding natural feature or land in the Upper Manorburn/Lake Onslow Landscape Management Area as shown on the planning maps except as provided for by Rules 4.7.5(vi), 13.7.6 and 13.7.8. 2. Rule 4.7.6L(1) shall not apply to: 1. reviewable land that has been freeholded under Part 2 of the Crown Pastoral Land Act 1998 subsequent to the operative date of this plan; and 2. unrenewable occupation licence land that has been designated for disposal as fee simple under Part 3 of the Crown Pastoral Land Act 1998 subsequent to the operative date of this plan; and 3. freehold land listed in Schedule 19.6.3[8]. 4. The area identified as Rural Resource Area (3) on the planning maps to the extent that: i. Rule 4.7.6L(1)(a) shall not apply to any dwelling and any accessory building authorised in terms of Rule 4.7.2(ia). ii. Rule 4.7.6L(1)(a) shall exclude unpainted post and wire fences only and stacked schist or stone fences that shall not exceed a height of 1.2 metres. iii. Rule 4.7.6L(1)(b) shall not apply to underground services or to the cutting of new roads or tracks as shown on the concept plan attached as Schedule 19.20 or to any water tank that is finished in natural tones to blend with the landscape. iv. Rule 4.7.6L(1)(c) shall not apply to earthworks involving up to 450m^2 of cut or fill per site provided that the		

[8] Bendigo Station is listed in Schedule 19.6.3 as it was freeholded under a tenure review process, and there has been an alternative statutory means to identify and address the values of these landscapes and features (conservation covenant).

Rule	Standard	Status if breached	Consent Required?
	maximum height of cut or fill is to be 0.75m unless lined with schist or to earthworks required to construct a building platform or to form access to a building platform as shown on the concept plan attached as Schedule 19.20 or where a building platform is located in the Development Zone shown on the concept plan attached as Schedule 19.20 (in compliance with Rule 4.7.2(ia)(a); no rocks over $2m^3$ (as visible above natural ground level) are to be removed or otherwise modified except to construct a building platform or to form access to a building platform as shown on the concept plan attached as Schedule 19.20 or where a building platform is located in the Development Zone shown on the concept plan attached as Schedule 19.20 (in compliance with Rule 4.7.2(ia)(a)); all un-walled cut or fill slopes are to be recontoured to blend with the surrounding natural landform and to provide for successful revegetation; all retaining walls are to be lined with schist; and a geotechnical report is required with respect to any earthworks for identified (numbered) building platform 4 and its associated access as shown on the concept plan attached as Schedule 19.20. v. Rule 4.7.6L(1)(e) shall not apply to any subdivision authorised in terms of Rule 4.7.2(ii)(a)(i), 4.7.2(ii)(a)(iii) and 4.7.2(b)(i), (ii), (iv), (v) and (vi). 3. For the purpose of Rule 4.7.6L(2)(a) reviewable land shall be deemed to be "freeholded" when the holder's acceptance of a substantive proposal takes effect under section 60 of the Crown Pastoral Land Act 1998. 4. For the purpose of Rule 4.7.6L(2)(b) unrenewable occupation licence land shall be deemed to be "designated for disposal as fee simple" when the Commissioner of Crown Land's adoption of a substantive proposal takes effect under section 89 of the Crown Pastoral Land Act 1998. 5. …		
Chapter 12 – District Wide			

Rule	Standard	Status if breached	Consent Required?
12.7.1	Access to and from roads is a permitted activity provided it is in accordance with the following standards: **(i) Construction and Maintenance** All vehicular accesses from a road shall be designed, constructed and maintained to ensure that: 1. They are able to be used in all weather conditions. 2. They have no adverse impact upon road drainage systems. 3. Stormwater and detritus (including gravel and silt) do not migrate on to the road. 4. They intersect with the property boundary within 15 degrees of a right angle. **(ii) Sight distances** Clear visibility along the road in both directions from intersections and vehicular access shall comply with Table 12.1. **(iii) Access to Rural State Highways and Arterial Roads** In addition to the requirements of (i) and (ii) above design and construction of access to rural State highways and arterial roads shall comply with the following standards: (a) The access shall be sealed to the same standard as the adjacent road carriageway. (b) Where the speed limit is 100 kph, spacing between accesses shall be not less than 200 metres (regardless of the side of road on which they are located), and no vehicle access shall be constructed within 100 metres of road intersections AND spacing between intersections (ie road intersections) shall be not less than 800 metres. (c) Except as provided for in (d) below, width of vehicular access ways at the property boundary are to be no greater than 6 metres. (d) Heavy vehicular accesses shall be designed and constructed to: i. A minimum width of nine metres. ii. Carry the volume and weight of traffic likely to use the access. iii. Ensure heavy vehicles do not have to cross the road centre line when making a left turn. iv. Ensure the surface is constructed to the same standard as the adjacent road carriageway.	**Permitted**	**No** – permitted activity standards will be complied with.

Rule	Standard	Status if breached	Consent Required?
	v. Have sufficient width to accommodate the swept path of the largest vehicle anticipated to use it. (e) Driveways shall not be parallel to and level with roads within 20 metres of the road reserve. (f) Figures 12.2 and 12.3 on pages 12:32 and 12:33 establish the minimum design standards for access determined by activity type. (g) Access to State highways shall be to Transit New Zealand design specifications. **Breach of Standards** Any activity that does not comply with the standards stated in Rule 12.7.1(i)-(vii) shall be considered as a discretionary (restricted) activity.		
12.7.2	**Parking** (i) Every activity shall make sufficient provision for vehicular parking in accordance with Table 12.3 (page 12:30) and the minimum dimensions stated in Figures 12.7 and 12.8 on pages 12:36 and 12:37 other than on roads provided that in the Business Resource Area no on-site parking is required except where the gross floor area of any building is 300m² or more. Vehicles shall not be required to undertake more than one reverse manoeuvre when manoeuvring out of any parking space to depart the site. (ii) Construction of parking areas to accommodate in excess of 3 carspaces including vehicle access and turning spaces, shall be constructed in accordance with the following standards; a. Parking areas shall be formed and sealed or otherwise constructed, so as not to create a dust nuisance or permit vehicles to carry deleterious materials such as mud, stone, chip or gravel onto the road or footpath. b. Stormwater originating from the parking areas shall be disposed of to an approved outfall either within the confines of the site or by pipe (of adequate diameter given the size of the parking area), to a road channel or stormwater drain. c. Traffic safety is to be ensured by: 1. Vehicles using the parking area being prevented from entering or leaving the site except by the vehicle access and crossing provided. 2. The parking area and turning spaces shall be laid out with sufficient manoeuvring space so that access can be obtained to the required parking	**Restricted Discretionary**	**No** – the proposal can comply with this standard.

Rule	Standard	Status if breached	Consent Required?
	space without the necessity for reversing onto or off the site. 3. Any part of the parking area which cannot be used for the parking shall be landscaped. d. Privacy of neighbours is to be protected by ensuring that where the parking area adjoins a residential property, a solid fence, no less than 1.5 metres in height, shall be erected and maintained by the developing owner provided that the height of the fence shall be reduced at access points to enable adequate visibility on adjoining roads. e. Queuing space is to be provided within the site for vehicles entering or leaving a private or public carpark on the following basis: 1. No less than 6 metres length in both directions for carparks of 20-100 car capacity. 2. No less than 15 metres length in both directions for carparks of greater than 100 car capacity. f. Any lighting associated with the parking area shall be directed to avoid adverse effects on adjoining properties or roads. g. All areas of carparking in excess of 100m² shall provide a strip of not less than 1.5 metres in width adjacent to any boundary that is not built up to except where a solid fence has been erected. h. The strip referred to in (g) shall not be paved and shall create the opportunity for landscaping to provide visual enhancement or screening. Landscaping shall not impede traffic visibility and shall be maintained in a healthy and tidy condition at all times.		
12.7.4	**Noise** Construction noise within the district which is ancillary to the principal use of the site shall not exceed the recommended limits in and shall be measured and assessed in accordance with the provisions of NZS 6803P:1984 The Measurement and Assessment of Noise from Construction, Maintenance, and Demolition Work. Discretionary adjustments provided in Clause 6.1 shall be mandatory within the district. Construction noise is permitted to occur only between the hours of 7:00am and 6:00pm within an urban area (as defined on page 18:11). Exemptions Noise limits in any part of the plan shall not apply:	**Restricted Discretionary**	**No** – consent is not required as the proposal will comply with construction noise limits.

Rule	Standard	Status if breached	Consent Required?
	(i) In any area to activities of a limited duration necessary for the production (but not processing) of primary products. (ii) In any part of the district where the noise source is a warning device used by emergency services. (iii) In any Residential Resource Area to activities of a normal domestic nature including recreational activities, such as sporting events, that do not involve powered motorsport, powered aviation, gunfire or amplified music. (iv) Where a carnival, show, display, field-day or exhibition with a duration less than five days occurs no more than four times in any period of a year. (v) To other temporary activities.		
12.7.6	**Lightspill Standard** No activities shall result in greater than 10 lux spill (horizontal and vertical) of light onto any adjoining property or road, measured at the boundary of a road or the notional boundary of a neighbouring property, provided that this rule shall not apply to headlights of moving vehicles or vehicles that are stationary for less than 5 minutes or to street lighting. The amount of light that may be spilled onto a neighbouring property may be increased by not more than 100%, in cases where the activity on that neighbouring property is not residential.	**Restricted Discretionary**	**No** – consent is not required as the proposal will not enable activities that result in greater than 10 lux spill.
12.7.8	**Transmission Lines** No building shall be erected within 12 metres from the centreline and 12 metres from the outer edge of the support structure of a high voltage transmission line that is part of the transmission network and is designed to operate at or over 110kV provided that this rule does not apply to: ….	**Restricted Discretionary**	**No** – the proposal does not include building platforms that are within 12m from the transmission lines onsite.

2.1.1. Summary of consents required

In summary, the following consents are required for the proposal:

Land use:

1. **Restricted Discretionary** activity consent pursuant to Rule 4.7.3.i. for breaches of:

   - 4.7.2.vii Accommodation Facility – as Lots 13 to 18, when providing for travellers accommodation, are not capable of complying with the requirement to provide 500m^2 of landscaped area in accordance with the standards in 4.7.6;

   - 4.7.6A Bulk and Location standards –

- a. the minimum yards standard;
- b. the open space standard in RuRA(2) for the requirement to provide 500m^2 of landscaped area for travellers accommodation on Lots 13-18;
- f. the maximum height standard for a breach of the maximum height of 5m on Lots 11-18 and 30;

2. **Restricted Discretionary** activity consent pursuant to Rule 4.7.3.v for breach of standard 4.7.6G (onsite servicing) for Lots 4 to 18;

3. **Discretionary** activity consent pursuant to Rule 4.7.4.i for Residential Activity that fails to comply with Rule 4.7.2.i.e (visible from State Highway or Lake Dunstan) for Lots 1-7, 10 and 23-30;

4. **Discretionary** activity consent pursuant to Rule 4.7.4.v for Tree planting not associated with landscaping in the immediate vicinity of any building for the offset and enrichment planting;

Subdivision:

5. **Discretionary** activity consent pursuant to Rule 4.7.4.iii. for a subdivision that does not comply with Rule 4.7.2.ii.a.iii (to comply with a Concept Plan);

6. **Non-Complying** activity consent pursuant to Rule 4.7.5.iii for a subdivision that does not comply with Rule 4.7.2.ii.a.i (lots created that do not meet the minimum allotment standards (bulk and location and open space and minimum lot size for travellers accommodation).

Other consents:

- The applicant applies for any other consents necessary to enable the proposal.

Overall, resource consent is required for a **Non-Complying** activity.

3. WHERE IT IS LIKELY THAT AN ACTIVITY WILL RESULT IN ANY SIGNIFICANT ADVERSE EFFECT ON THE ENVIRONMENT, A DESCRIPTION OF ANY POSSIBLE ALTERNATIVE LOCATIONS OR METHODS FOR UNDERTAKING THE ACTIVITY:

No significant adverse effects on the environment will arise, and no other alternatives were considered.

4. AN ASSESSMENT OF THE ACTUAL OR POTENTIAL EFFECT ON THE ENVIRONMENT OF THE PROPOSED ACTIVITY:

4.1. Introduction

This assessment of effects on the environment addresses:

- The permitted baseline and existing environment;
- Landscape effects;
- Ecological effects;
- Archaeological and cultural effects;
- Servicing effects;

- Positive effects; and
- Summary of effects on the environment.

4.2. Permitted/Consented Baseline and existing/receiving environment

When determining the actual and potential effects of an application for resource consent, the permitted baseline allows a comparison of the potential adverse effects of the proposal against what is permitted as of right under the District Plan (the permitted baseline) and what could lawfully be undertaken on the land by way of any existing consents (the existing environment).

4.2.1. Permitted Baseline

Section 104(2) of the Resource Management Act states that when forming an opinion on whether there are adverse effects from an activity on the environment, the consent authority may disregard adverse effects if the plan explicitly permits that certain activity.

Any activity that is not listed as either a controlled, discretionary (restricted), discretionary, non-complying or prohibited activity and that complies with the rules and standards set out in Sections 12 – 15 of the District Plan and the standards in Section 4.7.6 is a permitted activity. Of relevance to the proposal, the following development/activities are enabled on the site as of right:

(a) Farming activity which could reasonably include cultivation, grazing, fertilising, cropping, fencing and shelterbelt planting;

(b) Tree planting that is associated with farming activity or landscaping in the immediate vicinity of any building;

(c) Horticulture, orchard and vineyard planting;

(d) Earthworks for the formation of roads and tracks provided the design standards are met (eg. Cut and fill batter is no more than 2m in height etc);

(e) Extraction and excavation of material that does not exceed 2000m² or a quantity of 3000m³; and

(f) Temporary activities where no more than three persons are engaged in the activity.

In summary, the permitted baseline would enable activities that would result in modification to the landscape and ecological values of the site.

4.2.2. Existing Environment

The existing environment includes the Rocky Point Recreation Zone that provides for a 21ha Development Area which is designated for travellers accommodation and clustered dwellings with no minimum allotment size.

4.3. Landscape effects

Baxter Design Group (**BDG**) prepared a Landscape Assessment (**Attachment E**) of the potential effects associated with the proposed subdivision, associated accessways and development. BDG have since prepared an addendum report addressing the amendments to the proposal, and the following assessment is based on this.

The assessment includes a visual assessment from a range of public viewpoints as summarised below:

- 5km north-northeast of the site (Tarras – Cromwell Road): at this distance dwellings would be very difficult to distinguish and perceive within the wider landscape. Future buildings within

building platforms 23 – 26 may potentially be visible and the scale of potential adverse effect is very low – negligible.

- 3.8km north-northeast of the site (Tarras – Cromwell Road): at this distance dwellings would be very difficult to distinguish and perceive within the wider landscape. Future buildings within building platforms 23 – 26 may potentially be visible and the scale of potential adverse effect is very low.

- 2.5km north of the site (Tarras – Cromwell Road): at this distance dwellings would be very difficult to distinguish and perceive within the wider landscape. Future buildings within building platforms 24 – 26 may potentially be visible and the scale of potential adverse effect is very low.

- 1.2km north of the site (Tarras – Cromwell Road): at this distance dwellings would be very difficult to distinguish and perceive within the wider landscape. Future buildings within building platforms 24 – 26 may potentially be visible and the scale of potential adverse effect is very low.

- 800m north of the site (Tarras – Cromwell Road): future buildings within building platforms 24 – 26 may potentially be visible and the scale of potential adverse effect is low.

- 2.6km west of the site (Mount Pisa Road and Luggate – Wanaka Highway): future buildings within building platforms 1 – 9, 10, 20 and 22 – 23 may potentially be visible and the scale of potential adverse effect is very low.

- 2.5km west of the site (Mount Pisa Road and Luggate – Wanaka Highway intersection): future buildings within building platforms 1 – 10, 19, 24, 25 may potentially be visible and the scale of potential adverse effect is low.

- 1.1 – 1.3km east of the site (Lake Dustan): future buildings within building platforms 1 – 7 and 10 may potentially be visible and potential adverse effect is low.

- 235m – 400m north of the site (Bendigo Loop Road): future buildings within building platforms 27 – 30 may potentially be visible and potential adverse effect is low.

With respect to landscape character, the proposal sites within a wider landscape that contains both highly natural and slightly modified landscape elements. As discussed in the Landscape Assessment the proposal introduces a low level of change into the landscape character and does not degrade the quality of the surrounding environment, with the scale of the development appearing as a logical extension of existing residential development to the south, which has been successfully absorbed into the landscape (acknowledging what the Rocky Point Recreation Zone – Development Area anticipates). The proposal introduces a low level of change in the landscape character at the wider macro scale, with pockets of substantial change such as in the locale of proposed Lots 1 – 10. In any case, the potential visibility of future buildings from Lake Dunstan will be reasonably difficult to see or detect by eye and mitigated through proposed design controls and planting which will successfully visually absorb the development into the landscape.

With respect to landscape amenity, the scale, form and topography of the higher areas of the site enable the proposal to be visually absorbed into the landscape, avoiding the lower more visible slopes of the Dunstan Range foothills. The proposal will complement the character and quality of the site and surroundings through the location of the building platforms and proposed design controls. The proposed lots along Bendigo Loop Road are located adjacent to and within the vicinity of landscape that is modified and will therefore be perceived as an extension of that, resulting in a low level of change on the landscape amenity with low adverse effects.

In summary the proposal has been carefully designed to ensure the bulk of the development is contained within the Development Area which is excluded from the ONL and anticipates clustered dwellings, or sensitively located in areas outside the Development Area that reduce or eliminate adverse effects from Lake Dunstan (in comparison with where they could alternatively be located within the

Development Area). The proposed development within the ONL has been located and designed to minimise visibility from Lake Dunstan so as to retain and protect the existing values attributed to the landscape. Given the placement of the proposed lots and associated building platforms, the overall low density scale of development and proposed design controls which go above and beyond the District Plan standards, the proposal mitigate or avoids adverse landscape and visual amenity effects on the ONL.

Adverse effects from the proposal on landscape are low and considered appropriate with respect to the Rocky Point Recreation Zone. Overall, any adverse effects on landscape values are minor.

4.4. Ecological effects

Beale Consulting has prepared an Ecological Assessment (**Attachment H**) (co-authored by Simon Beale and Andrew Wells (of Wildlands Consultants)) to assess the effects of the proposal on the ecological values of Rocky Point[9]. The assessment covers the ecological setting, historic vegetation communities and patters, present day vegetation communities, habitats and indigenous fauna, ecological processes, values and significance, scoring of the magnitude and level of ecological effects of the development, and the proposed measures to avoid, minimise, remediate, offset and compensate for adverse effects associated with the proposal.

It is noted that the site is not within a Significant Natural Area (**SNA**).

As discussed in the Ecological Assessment, a large part of the site is covered in early successional kanuka (*Kunzea serotina)* ahrubland/scrub while open areas within and bordering the shrubland feature very early successional cushionfields dominated by golden scabweed (*Raoulia australis)* and exotic herbfield dominated by scarlet pimpernel (*Anagallis arevensis),* hemlock (*Conium macualtum),* and stonecrop (*Sedum acre).*

Extensive field investigations have been undertaken and the distribution of kanuka shrubland.scrub and cushionfield across the site and locations of recorded threatened species and saline-sodic soils has been mapped (refer Figure 5-2 of the Ecological Assessment). Based on a review of aerial imagery, the pattern of vegetation has changed over time due to changes in land management. Field observations also indicate that the expansion of kanuka is occurring into areas of cushionfield and bare ground, which is evidence that the cushionfield vegetation is a largely human induced early successional community. Wildlands predict that in the absence of any further human intervention, the kanuka dominated shrubland will increase and will be progressively succeeded by a low forest of kowhai, kanuka and *Oleria lineata* and a diverse shrub understorey.

The following 'Threatened' and 'At Risk' plant species were recorded on site: kānuka (*Kunzea serotina*), the pygmy mistletoe (*Korthalsella salicornioides*) on host kānuka trees, *Olearia lineata*, matagouri, golden scabweed *Raoulia australis*, the spring annuals New Zealand mousetail, *Myosurus minimus subsp. novae-zelandiae* and *Myosotis brevis* and the pin cushion *Colobanthus brevisepalus.* The distribution of each plant species, with respect to the development area is detailed at Table 5-1 within the Ecological Assessment.

Two lizards species (McCann;s skink (*Oligosoma maccanni*) and Kawarau gecko (*Woodworthia* "Cromwell")) are widespread through all vegetation types and rocky substrates in moderate to high densities at Rocky Point[10].

[9] The assessment of ecological values and ecological significance of the affected indigenous vegetation and habitats of indigenous fauna was undertaken in accordance with the criteria set out in the Environment Institute of Australia and NZ (EIANZ) Guidelines for Ecological Impact Assessment (2018) and as set out in Schedule 4 of the Partially Operative Regional Policy Statement 2019 and Proposed Regional Policy Statement.

[10] As observed by Dr Mandy Tocher and Samantha King (of Wildlands).

A desktop assessment of terrestrial invertebrate fauna was undertaken by Wildlands (refer to Appendix 4 of the Ecological Assessment (**Attachment H**)). The invertebrate duan likely to be present on the site was predominantly indigenous and includes notable species, defind as locally endemic, known or suspected to be declining, particularly sensitive to habitat loss or predation by introduced mammals, or listed as 'Threatened' or 'At Risk'. The species are listed at Table 6-1 of the Ecological Assessment.

In summary, as discussed in the Ecological Assessment, the key ecological features are:

- Extensive areas of dryland kānuka shrubland/scrub associated with rocky terrain, bluffs and gullies;
- High degree of connectivity between areas of kānuka shrubland/scrub located in Rocky Point with areas of kānuka shrubland/scrub in Bendigo Hills Estate and Bendigo Scenic Reserve;
- Extensive areas of dryland cushionfields dominated by golden scabweed with has a threat classification of At Risk-Declining;
- Presence of the Nationally Critical pygmy mistletoe on host kānuka trees;
- Presence of the Nationally Vulnerable New Zealand mousetail, the forget-me-not Myosotis brevis;
- Presence of the At Risk-Declining pin cushion Colobanthus brevisepalus;
- Relic specimens of the At Risk-Declining Olearia lineata, the At Risk-Declining matagouri and regionally uncommon kōwhai;
- Extensive populations of the At Risk-Declining Kawarau gecko;
- Likely presence of the Nationally Vulnerable eastern falcon (Kārearea);
- Presence of notable invertebrate species associated with cushionfield, exotic herbfield, rocky substrates and grassland.

Overall, a very high score has been assigned to the ecological value of the development area and the affected vegetation communities and habitats present score high to very high. The site is ecologically significant in terms of the assessment criteria set out in Appendix 1 of the National Policy Statement for Indigenous Biodiversity (NPS-IB) with respect to representativeness, rarity/distinctiveness, diversity and pattern and ecological context.

The proposal involves permanent remove of approximately 12,800m² of kanuka shrubland/scrub which equates to approximately 3.5% of the kanuka cover on the site. This removal represents a low magnitude of ecological effect; however the level of effects is scored as moderate when the magnitude of effect (low) is combined with the ecological value (very high). As such biodiversity offsetting is proposed to address the residual adverse effects caused by the permanent loss of kanuka shrubland/scrub.

The proposal also involves the permanent removal of approximately 37,600m² of cushionfield which equates to approximately 26% of the cushionfield cover on the site[11]. The level of ecological effect is very high, due to a high ecological value and a high magnitude of effect associated with the removal. As such, biodiversity offsetting is also proposed to address the residual adverse effects caused by the permanent loss of cushionfield vegetation, which are unable to be avoided, mitigated or remedied.

The proposed biodiversity offset (as described in extensive detail in the Ecological Assessment) has been developed through the use of an offset accounting model and involved the planting of forest and

[11] Approximately 24,500m² of the affected cushionfield is located within the Development Area of the Concept Plan.

shrub species. As set out in the Ecological Assessment, the proposed offset will result in a net gain in biodiversity by recreating plant compositions and structures that were likely present in pre-settlement climax vegetation at the site, and increasing plant diversity by re-introducing a variety of species that would have formerly been key components of the vegetation, but that are now locally extinct and/or very rare. It is anticipated that these plants will also provide a seed source for further spread into the nearby Bendigo Scenic Reserve.

In addition, the proposal includes a covenant to protect the indigenous vegetation and habitats outside the area subject to development, and four specific enrichment planting areas. This will result in the restoration of forest and shrubland communities that are not present at Rocky Point and that will not establish within the next half century without human intervention.

Overall, the proposal represents a defined development area that covers approximately 7% of the land area, with the remainder of the land being subject to protection. Biodiversity offset measures will address the residual adverse effects of the development that cannot be avoided, minimised or remediated, giving rise to a net gain in biodiversity over a 30 year timeframe. Additionally the proposed enrichment planting, ongoing weed and pest control measures and formal protection of the land will give rise to positive effects that will not be achieved otherwise.

Overall, given the considered location of the proposed building platforms and other elements of the development which avoid ecological impacts as far as possible, and taking into account the proposed consent conditions and proposed offset planting, any adverse ecological effects from the proposal will be no more than minor and the net overall effect on ecological values is positive.

4.5. Archaeological and cultural effects

An Archaeological Assessment (**Attachment D**) was undertaken by Chris Jennings of the University of Otago (Southern Pacific Archaeological Research). Although the wide Bendigo area exhibits numerous archaeological sites associated with historic hold mining industry, there are few sites in the vicinity of the site that have been recorded. The sites that were identified during site survey are considered to be associated with activities that relate to early colonial European occupation in the mid-1800s. These are primarily related to the historic farming operations with the exception of the sluicing area which is likely to be associated with exploratory alluvial gold mining activity in the region.

Two of the identified sites being G41/771 (earth bank feature) and G41/772 (stone retaining wall) are located within proposed lots as seen in ***Figure 7*** below.

Figure 7: Location of archaeological features within proposed lots

The formation of the main accessway and provision of access to proposed Lot 2 will likely require the removal of the low earth feature G41/771. Part of G41/772 is located within the boundary of proposed Lot 6 and although the proposal will not affect the feature, ongoing management will be required.

The proposed alignment and formation of the accessway will likely require the partial or full removal of G41/773 (earth bank feature) and may also affect features related to G41/774 (sluicing area).

The Archaeological Assessment (**Attachment D**) makes the following recommendations for the proposal:

- A general archaeological authority under section 44 of the Heritage New Zealand Pouhere Taonga Act 2014 must obtained from Heritage New Zealand prior to road construction and landscaping that will affect sites G41/771 and G41/773;
- Contractors should be briefed by an archaeologist on the identification of further archaeological evidence and the appropriate protocols to follow in the event of any archaeological find;
- Prior to earthworks, detailed recording should be undertaken for sites G41/771 and G41/773 and parts of G41/774 that may be affected by road construction. Recordings should include photographic recording and scaled plan drawings for both sites;
- Monitoring should be undertaken for any sites impacted by earthworks. Any subsurface features, or artefacts discovered during earthworks should be investigated and recorded by an appropriately experienced archaeologist; and
- The landowner who acquires Lot 6 should be made aware by the applicant, that the stone wall feature recorded as G41/772 is an archaeological site protected under the Heritage New Zealand Pouhere Taonga Act 2014. Furthermore, they should be informed that any plans to modify, damage or destroy the wall, will require an archaeological authority.

The applicant is prepared to volunteer the above recommendations as conditions of consent to mitigate any potential adverse effects on archaeological effects on the site.

In relation to cultural effects, as discussed in the Archaeological Assessment (**Attachment D**) although early Māori were active throughout the wider region, these sites are generally situated near larger rivers, specifically the Mata-au/Clutha River, the Kawarau River and smaller water courses such as Bendigo Creek. Based on the regional distribution of these archaeological sites it is unlikely that any Māori sites are present within the assessment area.

The applicant will liaise with Iwi and anticipates that the Iwi authorities will have the opportunity to submit on the application, which will enable a more detailed statement of cultural impacts if necessary.

4.6. Servicing effects

Access

As discussed in Section 1.4.5 above the proposed roading has been designed to avoid rock outcrops and minimises earthworks volumes and extents. Some roads will exceed 1:6 due to the steep terrain of the site and the desire to minimise earthworks, however these sections will be asphalted. Due to the north facing aspect of the site, frost is not expected to be a problem in winter.

Wastewater

As discussed in the Water and Wastewater Assessment (**Attachment G**) the proposal involves onsite secondary level treatment for Lots 1 – 3 and 19 – 30 and a low-pressure sewer reticulation system for the remaining lots. The proposed wastewater system was assessed by CKL as the most efficient system, with reduced visual impact that can be designed to avoid existing vegetation and habitat disturbance. An operation and maintenance agreement will be set up for the communal reticulated scheme to ensure it is managed appropriately in the future.

Stormwater

CKL prepared a Stormwater Management Plan and Flood Risk Assessment (**Attachment O**) which details the stormwater strategy for the development. In summary, the best practicable stormwater management includes a combination of low impact primary and secondary flow management (swales, culverts, downpipes to private network, roof tanks and soakage systems) as discussed in the Stormwater Management Plan.

The proposal is considered to be low contaminant generating and all overland flow paths are accommodated within the natural gullies and water course.

Overall, the proposed stormwater management system does not give rise to adverse effects that are more than minor.

Potable & Firefighting Water

As discussed in Section 1.4.7 above, adequate supply of domestic water will be supplied via the Chinaman's Terrace water scheme, held in tanks in proposed Lot 5 and then pumped around the development via underground pipes.

Consent notice conditions will require sufficient water treatment to ensure safe standards of supply and require firefighting water be provided at the time buildings are constructed on the site.

Power and telecommunications

Power and telecommunications services will be installed in underground.

Overall, any potential servicing effects arising from the proposal on the environment wil not be more than minor.

4.7. Earthworks effects

Any required underground services will follow the existing and proposed access routes wherever possible. Trench widths required to install services will be kept to the minimum, with the appropriate separations, and will be promptly backfilled.

The earthworks will be undertaken in accordance with best practice to ensure any potential adverse effects to the surrounding environment (including sedimentation, runoff, dust etc.) are appropriately mitigated. A consent condition requiring preparation and approval of an environmental management plan prior to works commencing is proposed.

Overall, earthworks effects arising from the proposal are consistent with what could be generated as a permitted activity.

4.8. Positive effects

The proposal will provide economic benefit to the area through construction of the proposal and social benefits from the provision of rural living allotments for residents. The enabling of accommodation facilities across the site will provide for a diverse new offering of accommodation in the district.

The proposed offset and enrichment planting and ongoing formal protection of the balance lot, and retirement from farming, will result in a net ecological gain and a range of positive ecological effects for the reasons discussed in the Ecological Assessment.

Overall, the proposal is considered to represent a net benefit in effects.

4.9. Summary of effects on the environment

The proposal will result in low adverse effects on the environment when taking into account the permitted baseline and what the Rocky Point Recreation Zone provides for. The permitted baseline, as discussed in Section 4.2 above, would enable activities that would likely result in modification to the landscape and ecological values of the site. Some of those permitted activities would not have the benefits and positive effects that will arise from the current proposal.

Overall, the proposal will have adverse effects that are at most minor, and factoring in the offset approach to biodiversity values, there will be significant positive effects.

5. ASSESSMENT UNDER THE RELEVANT OBJECTIVES AND POLICIES

5.1. Central Otago District Plan

The relevant provisions of the Central Otago District Plan are provided and assessed below:

Table 4: Objectives and policies

Provision	Detail	Assessment
Section 4 – Rural Resource Area		
Objective 4.3.1	To recognise that communities need to provide for their social, economic and cultural wellbeing, and for their health and safety at the same time as ensuring environmental quality is maintained and enhanced.	The proposal provides for social and cultural wellbeing through the provision of sites for rural residential living while maintaining environmental quality. The proposal has been carefully designed to maximise the provision for residential activity given the District's ongoing need for housing, but in a manner which minimises adverse effects of such

Provision	Detail	Assessment
		development and provides environmental enhancements that would not otherwise occur. Lot sizes vary across the site in response to the specific opportunities and constraints presented by the environment – increasing the lot size / reducing density where the receiving environment is more sensitive, and locating development more intensively where it has the least impact on the key environmental quality measures including landscape, ecological and heritage. This is a more refined approach in response to the nature of the site, and provides a better outcome for environmental quality than would otherwise be achieved through a more rigid application of standards (such as yards, which are primarily used as a blunt tool to achieve a minimum level of residential amenity for dwellings) that are applicable across the Rural Resource Area. The proposal achieves this objective.
Objective 4.3.2	To protect the Districts outstanding natural landscapes and outstanding natural features, and land in the Upper Manorburn/Lake Onslow Landscape Management Area (including landforms) from the adverse effects of inappropriate subdivision, use and development.	As discussed in the Landscape Assessment (**Attachment E**) the proposal does not give rise to inappropriate adverse effects, ensuring the ONL remains protected, taking into account the development anticipated within the Rocky Point Recreation Zone. While some lots are located outside of the Concept Plan area (the bulk being located within it), these have located to avoid adverse effects on views from Lake Dunstan (noting some areas within the Concept Plan area are more visible than those located outside it) and to minimise removal of indigenous vegetation, While some aspects of the proposal do not comply with the standards for the Rural Resource Area (such as visibility from public places), the activity status of non-compliance with these standards indicates that they are to be assessed on a case-by-case basis to determine the appropriateness of the proposal in the context. Location, in conjunction with design controls and the low density of

Provision	Detail	Assessment
		development protects the landscape values of the ONL. The proposal achieves this objective.
Objective 4.3.3	To maintain and where practicable enhance rural amenity values created by the open space, landscape, natural character and built environment values of the District's rural environment, and to maintain the open natural character of the hills and ranges.	As discussed in the Landscape Assessment (**Attachment E**) the proposal does not give rise to adverse effects on rural amenity. The proposed low density, design controls and sensitively located building platforms maintains the character of the area, again taking into account the development anticipated within the Rocky Point Recreation Zone. Lot sizes vary across the site in response to the specific opportunities and constraints presented by the environment – increasing the lot size / reducing density where the receiving environment is more sensitive, and locating development more intensively where it has the least impact on the landscape values and rural amenity, and particularly when viewed from outside the site. This is a more refined approach in response to the nature of the site, and provides a better outcome for environmental quality than would otherwise be achieved through a more rigid application of the rural standards (such as yards, which are primarily used as a blunt tool to achieve a minimum level of residential amenity for dwellings) that are applicable across the Rural Resource Area. The proposal achieves this objective.
Objective 4.3.4	To maintain and enhance the quality of the District's recreation resources and public access to those resources.	The proposal includes provision of public access. The proposal achieves this objective.
Objective 4.3.5	To maintain and enhance the quality of the District's water resources by avoiding, remedying or mitigating the adverse effects of land use activities adjacent to water bodies.	The proposal does not result in adverse effects on the water quality of Lake Dunstan. The proposal achieves this objective.
Objective 4.3.6	To preserve the natural character of the District's water bodies and their margins.	The nearest future built form provided for by the proposal is located approximately 300m distance, and across SH8, from the shores of Lake Dunstan. This distance, together with design

Provision	Detail	Assessment
		controls and the low density of development, preserves the natural character of Lake Dunstan and its margins. The proposal achieves this objective.
Objective 4.3.7	To maintain the life-supporting capacity of the District's soil resource to ensure that the needs of present and future generations are met.	The proposal does not compromise the life-supporting capacity of the District's soil. The site has a LUC class of 7 and the area being utilised for the development, mainly within an area anticipated for development, does not play a role in sustaining soil resources for present and future generations. The proposal achieves this objective.
Objective 4.3.8	To recognise and provide for the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.	The site does not contain areas of significant indigenous vegetation or significant habitats of indigenous fauna, as scheduled and mapped by the District Plan. However, based on the findings of the updated Ecological Assessment (**Attachment H**), the indigenous biodiversity within the site is ecologically significant (in terms of the assessment criteria set out in Appendix 1 of the NPS-IB) as the representativeness, rarity / distinctiveness, diversity and pattern and ecological context criteria are all triggered. The proposal is not contrary to this policy as it will provide for the protection of large swathes of indigenous vegetation on an ongoing basis - vegetation that would otherwise not be protected as the site is not subject to any rules preventing clearance of indigenous vegetation in association with permitted activities. While there will be some loss of existing indigenous vegetation as a result of the proposal, this will be offset by the proposed planting that will recreate plant compositions that were likely present in pre-settlement climax vegetation and increase plant diversity at the site and in the surrounding area. The proposal is not contrary to this objective.

Provision	Detail	Assessment
Objective 4.3.9	To recognise and provide for an appropriately located development which integrates farming, horticulture, recreational, visitor, residential and lifestyle development and supporting infrastructure in a sustainable manner, but avoids, remedies or mitigates potential adverse effects on: • landscape and amenity values of the rural environment; • natural and physical resources including soils, water and groundwater resources, and existing viticultural areas; • existing lifestyle amenities; • core infrastructural resources; • the functioning of urban areas.	The proposal provides for integrated and comprehensive development while avoiding, remedying or mitigating potential adverse effects on ecological and landscape values. While nothing specifically prevents this objective from applying generally throughout the Rural Resource Area, the cross-referenced policy (4.4.17) relates only to Rural Resource Area (4) (at McArthur Ridge, Alexandra). While there is nothing preventing this objective from being applied outside Rural Resource Area (4) and the proposal is broadly consistent with this objective, it is possible (indeed, highly likely) that this objective is not intended to apply to the Rural Resource Area (2) at Rocky Point. The proposal achieves this objective.
Policy 4.4.1	To recognise the District's outstanding natural landscapes and outstanding natural features and land in the Upper Manorburn/Lake Onslow Landscape Management Area which: (a) Are unique to the district, region or New Zealand; or (b) Are representative of a particular landform or land cover occurring in the Central Otago District or of the collective characteristics and features which give the District it's particular character; or (c) Represent areas of cultural or historic significance in the district, region or New Zealand; or (d) Contain visually or scientifically outstanding geological features; or (e) Have characteristics of cultural, historical and spiritual value that are significant to Kai Tahu ki Otago; (f) Have high natural character values and high landscape quality that can be distinguished from the general landscapes of the Central Otago District and provide protection for them from inappropriate subdivision, use and development.	As discussed in the Landscape Assessment (**Attachment E**), the proposed development recognises and respects the landscape it is within, taking into account the development anticipated by the Rocky Point Recreation Zone. While some lots are located outside of the Concept Plan area (the bulk being located within it), these have located to avoid adverse effects on views from Lake Dunstan (noting some areas within the Concept Plan area are more visible than those outside it) and to minimise removal of indigenous vegetation, While some aspects of the proposal do not comply with the standards for the Rural Resource Area (such as visibility from public places), the activity status of non-compliance with these standards indicates that they are to be assessed on a case-by-case basis to determine the appropriateness of the proposal in the context. Location, in conjunction with design controls and the low density of development protects the landscape values of the ONL, therefore the development is appropriate. The proposal achieves this policy.

Provision	Detail	Assessment
Policy 4.4.2	To manage the effects of land use activities and subdivision to ensure that adverse effects on the open space, landscape, natural character and amenity values of the rural environment are avoided, remedied or mitigated through: (a) The design and location of structures and works, particularly in respect of the open natural character of hills and ranges, skylines, prominent places and natural features, (b) Development which is compatible with the surrounding environment including the amenity values of adjoining properties, (c) The ability to adequately dispose of effluent on site, (d) Controlling the generation of noise in back country areas, (e) The location of tree planting, particularly in respect of landscape values, natural features and ecological values, (f) Controlling the spread of wilding trees. (g) Encouraging the location and design of buildings to maintain the open natural character of hills and ranges without compromising the landscape and amenity values of prominent hillsides and terraces.	As discussed in the Landscape Assessment (**Attachment E**) the proposal avoids or mitigates potential adverse effects on the open space, landscape, natural character and amenity values through: (a) Careful considered building platform locations and design control conditions to maintain landscape values and rural amenity; (b) Increasing the lot size / reducing density where the receiving environment is more sensitive or where it is more visible from outside the site, and locating development more intensively where it has the least impact on the landscape values and rural amenity, and particularly when viewed from outside the site; (c) Effluent will be adequately be disposed of within the wider site (although not necessarily within individual lots) in a manner which minimises adverse effects on landscape, ecological and water quality values; (d) Limited generation of noise, both during construction and on an ongoing basis; (e) Responsive design of replacement and offset planting to not only ensure integration with existing planting patterns and species, but also to improve diversity and reflect likely pre-settlement conditions; (f) Ongoing vegetation maintenance and weed control measures; and (g) Careful considered appropriate building platform locations and, design control conditions to maintain landscape values and rural amenity. The proposal achieves this policy.
Policy 4.4.3	To ensure that the development of infrastructure in the rural environment promotes sustainable management by:	The consent holder will provide and maintain the necessary

Provision	Detail	Assessment
	a. Requiring developers to contribute a fair and reasonable proportion of the costs involved, and b. Maintaining and enhancing the safe and efficient operation of the infrastructure network (including roading), while avoiding, remedying or mitigating adverse effects.	infrastructure for the development at no cost to the community. The proposal achieves the policy.
Policy 4.4.5	To assist the Otago Regional Council in its role of maintaining and enhancing water quality, by ensuring allotments are adequate for effluent disposal requirements and encouraging the use of land management techniques that maintain and/or enhance the life supporting capacity of water.	Requirements for a full assessment of effluent disposal requirements is anticipated as a consent condition and will be completed prior to the occupation of any dwelling. The Wastewater Disposal Assessment provided by Mt Iron Geodrill and the report by CKL (**Attachment G**) demonstrates that appropriate wastewater disposal options are available for the lots proposed. The proposal achieves this policy.
Policy 4.4.6	To ensure that the location, construction and/or operation of land use activities and subdivision make adequate provision for the protection of the soil resource by avoiding, remedying or mitigating the adverse effects of practices which may cause: (a) Erosion, instability or loss of topsoil, (b) Loss of nutrient or incidence of soil contamination, (c) Loss of soils with special qualities, (d) A reduction in vegetation cover and moisture holding capacity, and (e) Soil compaction.	The ground works will be managed by an Environmental Management Plan which will address the matters require by the policy. Extensive indigenous vegetation will remain onsite, and proposed earthworks are limited to roading and minor works to prepare build platforms. Erosion, compaction and the loss of soils will be very limited. The proposal achieves this policy.
Policy 4.4.7	To protect areas of: a. Significant indigenous vegetation, b. Significant habitats of indigenous fauna, c. Significant wetlands, d. Indigenous vegetation or habitats that support a significant indigenous fresh water fishery, and e. Habitats of statutorily managed sports fish and game from the adverse effects of land use activities and subdivision and to promote and encourage, where practicable, the retention, enhancement and reinstatement of indigenous ecosystems within the District.	The site does not contain areas of significant indigenous vegetation or significant habitats of indigenous fauna, as scheduled and mapped by the District Plan. However, based on the findings of the updated Ecological Assessment (**Attachment H**), the indigenous biodiversity within the site is ecologically significant (in terms of the assessment criteria set out in Appendix 1 of the NPS-IB) as the representativeness, rarity / distinctiveness, diversity and pattern and ecological context criteria are all triggered. The proposal is not contrary to this policy as it will provide for the protection of large swathes of indigenous vegetation on an ongoing basis - vegetation that would otherwise not be protected as the site is not subject to any rules preventing clearance of indigenous vegetation in association with permitted

Provision	Detail	Assessment
		activities. While there will be some loss of existing indigenous vegetation as a result of the proposal, this will be offset by the proposed planting that will recreate plant compositions that were likely present in pre-settlement climax vegetation and increase plant diversity at the site and in the surrounding area. The proposal is not contrary to this objective.
Policy 4.4.8	To ensure that the effects associated with some activities including (but not limited to): (a) Noise (including noise associated with traffic generation, night time operations), and vibration, (b) The generation of a high level of traffic, in particular heavy vehicles, (c) Glare, particularly from building finish, (d) A reduction in visual amenity due to excessive signage and the storage of goods or waste products on the site, (e) The generation of odour, dusts, wastes and hazardous substances, and (f) The use and/or storage of hazardous goods or substances do not significantly adversely affect the amenity values and privacy of neighbouring properties or the safe and efficient operation of the roading network.	The Rocky Point Recreation Zone anticipates significant change to the amenity values of the area, and the nearest dwellings on other properties are a sufficient distance from the development proposed that effects on their amenity values will be minimal. Design controls aid in reducing any adverse effects from glare on neighbouring properties. There will be no visible outdoor storage areas or use or storage of hazardous materials will not arise. Any effects from dust can be managed by the environmental management plan. The proposal achieves this policy.
Policy 4.4.9	To recognise that some rural activities, particularly those of a short duration or seasonal nature, often generate noise and other effects that can disturb neighbours by ensuring that new developments locating near such activities recognise and accept the prevailing environmental characteristics associated with production and other activities found in the Rural Resource Area.	Due to the large size of the site, the carefully located development within it, and the proposed ongoing protection of the balance of the site for regenerative indigenous biodiversity purposes, reverse sensitivity effects associated with the proposed residential activity is unlikely to arise. The proposal achieves this policy.
Policy 4.4.10	To ensure that the subdivision and use of land in the Rural Resource Area avoids, remedies or mitigates adverse effects on: (a) The open space, landscape and natural character amenity values of the rural environment in particular the hills and ranges, (b) The natural character and values of the District's wetlands, lakes, rivers and their margins, (c) The production and amenity values of neighbouring properties, (d) The safety and efficiency of the roading network, (e) The loss of soils with special qualities,	The proposal avoids or mitigates potential adverse effects on the character and values of the Rural Resource Area by: (a) Careful locating of all building platforms and accessways, and requiring strict building controls; (b) Minimising the extent of built form that will be visible from beyond the site boundaries and ensuring what is visible is consistent with the character of the surrounding environment;

Provision	Detail	Assessment
	(f) The ecological values of significant indigenous vegetation and significant habitats of indigenous fauna, (g) The heritage and cultural values of the District, (h) The water quality of the District's surface and groundwater resources, and (i) Public access to or along the rivers and lakes of the District, particularly through the use of minimum (and average) allotment sizes.	(c) Providing generous setbacks from boundaries with adjoining properties and protecting (on an ongoing basis) the balance of the site for the purpose of the maintenance and regeneration of indigenous biodiversity; (d) Upgrading the State Highway 8 / Bendigo Loop Road intersection to Diagram E standard prior to titles being issued; (e) The site has no soils with special qualities for the purposes of rural productivity (noting that the saline/sodic soils identified are addressed below as part of the ecological values of the site); (f) Avoiding areas of kanuka tress that host threatened species and areas of saline/sodic soils, and offsetting remaining effects through the plantings of fest and shrubland plant communities to achieve an overall net gain in biodiversity; (g) Avoiding items / areas of archaeological value (though this value is limited) where practicable and recording in detail the items that will be affected by the development, creating a record that would not otherwise exist if left to continue to degrade naturally; (h) Adequately designed low impact stormwater management and wastewater disposal systems; and (i) Public walking tracks are proposed within the site, however these do not provide direct public access to or along lakes and rivers. The proposal achieves this policy.
Policy 4.4.12	To encourage land use practices that avoid, remedy or mitigate weed infestation, in particular wilding tree spread, and the spread of pest plants and animals throughout the district.	The proposal includes ongoing management of pest species as part of the ongoing protection of the site for the maintenance and regeneration of indigenous biodiversity values, and will

Provision	Detail	Assessment
		contribute to avoiding the spread of wildings and other pests. The proposal achieves this policy.
Policy 4.4.13	To promote the provision of public access opportunities to the Districts significant natural and physical land features including areas of value for recreational purposes.	As discussed above, the proposal provides for public walking tracks within the site which will allow the public to recreate on the site. The proposal achieves this policy.
Chapter 12 – District Wide Rules and Performance Standards		
Objective 12.3.1	To promote the safe and efficient operation of the District's roading network.	The proposal will not compromise the safe and efficient operation of the District's roading network as the intersection will be required to be upgraded prior to the lots obtaining titles. The proposal achieves this objective.
Objective 12.3.2	To avoid, remedy or mitigate the adverse effects of noise on the District's amenity values and the health and wellbeing of the District's people.	Taking into account the development anticipated by the Rocky Point Recreation Zone, and the layout and form of the development, any potential effects on any persons' amenity values or health or wellbeing will be avoided, remedied or mitigated. The proposal achieves this objective.
Objective 12.3.3	To avoid, remedy or mitigate the adverse effects of signs on traffic and the general amenity values of the District while recognising that signs are a necessary adjunct to many activities.	Any signage will be minimal and will not adversely affect traffic safety or amenity values. The proposal achieves this objective.
Objective 12.3.5	To ensure that activities avoid, remedy or mitigate nuisance to adjoining properties from odour, dust, lightspill, glare and electrical interference.	The proposed layout and design of the development ensure adjoining properties will be protected from any odour, dust, lightspill, glare and electrical interference during construction and when the development is complete The proposal achieves this objective.
Objective 12.3.6	To recognise the contribution that temporary activities make to the social, economic and cultural wellbeing and health and safety of the District's people and communities while ensuring environmental quality is maintained.	Temporary activities can be undertaken on the site as of right, provided the relevant standards are complied with.
Objective 12.3.7	To ensure that activities avoid reverse sensitivity effects, avoid compromising the operation, maintenance, upgrading and development of the transmission network and avoid risk to people.	No development is proposed adjacent to the transmission network and there is no potential for adverse reverse sensitivity effects. The proposal achieves this objective.

Provision	Detail	Assessment
Policy 12.4.1	To avoid, remedy or mitigate adverse effects on the safe and efficient operation of the roading network by requiring: (a) Safe and efficient access points to the roading network, and (b) Off-road loading and manoeuvring space and facilities, and (c) Off-street parking, where these are appropriate	The roading network will be accessed by the existing Bendigo Loop Road, providing safe and efficient access. The proposal achieves this policy.
Policy 12.4.2	To determine the suitability of noise generating activities in any given locality by having regard to: (a) The specific characteristics and amenity values of the locality from which the noise originates, and (b) The sound pressure level of the proposed activity, and (c) The frequency that the noisy activity takes place, and (d) The length of time that the noise continues, and (e) Any special characteristics of the noise, to ensure that the adverse effects of noise on other activities and the natural and physical resources of the locality (including cumulative effects) reflect standards acceptable to the community.	The proposal will not generate excessive noise that breaches the noise standards.
Policy 12.4.3	To recognise that noise from temporary activities can be reasonably controlled by requiring compliance with noise limits which are less stringent than those applied to other activities.	The proposal does not include any temporary activities that will generate noise exceeding the noise limits.
Policy 12.4.7	To encourage resource users to adopt management practices that avoid, remedy or mitigate the adverse effects of: (a) odour, (b) lightspill and glare, (c) dust, and (d) electrical interference, on the use and enjoyment of neighbouring properties.	The layout and design of the proposal (including restriction of exterior lights and areas of glazing) ensures adjoining properties will be protected from any adverse effects of odour, dust, lightspill, glare and electrical interference. The proposal achieves this policy
Policy 12.4.9	To enable the operation of temporary activities that promote the social, economic and cultural wellbeing, and health and safety of the District's people and communities while ensuring that any adverse effects that exceed performance standards of the District Plan are of a short duration only.	As discussed above, temporary activities can be undertaken on the site as of right, provided the relevant standards are complied with.
Policy 12.4.10	The transmission network is of national significance and nearby activities are therefore to be managed to avoid adverse effects in terms of reverse sensitivity, in terms of compromising the operation, maintenance, upgrading and development of the transmission network and in terms of ensuring that activities that are particularly sensitive to the risks associated with transmission lines are not located in close proximity to those lines.	No development is proposed adjacent to the transmission network and there is no potential for adverse reverse sensitivity effects. The proposal achieves this policy.
Chapter 13 – Infrastructure		
Objective 13.3.2	To enable the efficient operation and development of utilities including the transmission network while ensuring that effects on amenity, heritage, landscape values and public safety are avoided, remedied or mitigated.	All required utilities will be reticulated to lot boundaries in a common services trench, ensuring that effects on amenity, heritage, landscape values and public safety are avoided.

Provision	Detail	Assessment
		The proposal achieves this objective.
Objective 13.3.4	To protect the District's outstanding natural landscapes and outstanding natural features, and land in the Upper Manorburn/Lake Onslow Landscape Management Area (including landforms) from the adverse effects of inappropriate subdivision, use and development.	As discussed in the Landscape Assessment (**Attachment E**) the proposal avoids or mitigates potential adverse effects of the proposal on the ONL, and the development is appropriate within the ONL, taking into account the development anticipated within the Rocky Point Recreation Zone. The proposal achieves this objective.
Objective 13.3.5	To maintain and where practicable enhance rural amenity values created by the open space, landscape, natural character and built environment values of the District's rural environment.	As discussed in the Landscape Assessment (**Attachment E**) the proposal maintains rural amenity values created by the open space, landscape, and natural character of the rural environment, taking into account the development anticipated within the Rocky Point Recreation Zone. The proposal achieves this objective.
Policy 13.4.11	To recognise that some established activities may generate noise and other effects that can disturb neighbours, by ensuring that new developments locating near such activities recognise and accept the prevailing environmental characteristics.	The development is located sufficient distance from boundaries to avoid any adverse sensitivities or reverse sensitivities from arising. The proposal achieves the policy.
Chapter 14 – Heritage Buildings, Places, Sites, Objects and Trees		
Objective 14.3.4	To recognise and provide appropriate protection for the values associated with the District's archaeological sites.	The proposal provides appropriate protection for the archaeological values on the site through the research and assessment of any archaeological values on the site, avoiding items / areas of archaeological value (though this value is limited) where practicable and recording in detail the items that will be affected by the development, creating a record that would not otherwise exist if left to continue to degrade naturally.
Policy 14.4.6	To provide for the conservation of values associated with the District's archaeological sites by: (a) Identifying such registered sites, on the planning maps. (b) Ensuring that works carried out within or near such sites recognise and provide for their values where appropriate. (c) Requiring an assessment of the values associated with any such sites as part of any subdivision or land use consent in circumstances where a significant adverse effect may result, and requiring protection where such values are considered to be significant.	
Chapter 16 – Subdivision		
Objective 16.3.1	To ensure that subdivision avoids, remedies or mitigates adverse effects on the safe and efficient operation of the District's roading network.	Any potential adverse effects on the roading network are avoided by the use of an existing road (Bendigo Loop Road) and intersections, and the proposed access to the development area is suitable. The intersection will be upgraded as discussed above.

Provision	Detail	Assessment
		The proposal achieves this objective.
Objective 16.3.2	To ensure that subdivisions provide all necessary services and infrastructure without adversely affecting the public interest and the ongoing viability of those services and infrastructure.	The proposed subdivision can be adequately serviced as discussed above. The proposal achieves this objective.
Objective 16.3.3	To ensure that subdivision does not facilitate development that may potentially be at risk from hazards.	No hazards have been identified in the planning maps for this property. The proposal achieves this objective.
Objective 16.3.4	To ensure, where appropriate, that amenity values of the District created by the open space, landscape and natural character values, and areas of significant indigenous vegetation, significant habitat of statutorily managed sports fish and game are not adversely affected by subdivision.	This is addressed in detail in objectives and policies in Chapters 4, 12 and 13 above and in the landscape and ecological assessments. The proposal achieves the objective.
Objective 16.3.5	To ensure that subdivision does not facilitate development that may compromise the life-supporting capacity of the District's water and soil resources.	The proposal involves development on a minor percentage of the site. The life-supporting capacity of the district's water and soil resources will not be compromised. The proposal achieves this objective.
Objective 16.3.6	To ensure that subdivision does not facilitate development that may adversely affect heritage and cultural values including cultural values of importance to Kai Tahu ki Otago.	It is not expected that the proposal will have effects that are incompatible with Kai Tahu ki values and this will be confirmed over the process of the application, as discussed in Section 4.4 above.
Objective 16.3.7	To ensure that subdivision contributes to the open space, recreation and reserve needs of the community.	The proposal does not impact on the open space, recreation and reserve needs of the community. As discussed above, public tracks are provided and will enable the public to recreate on the site. The proposal achieves this objective.
Objective 16.3.8	To ensure, where appropriate, that subdivision maintains and where appropriate enhances public access: (a) To and along the margins of the District's lakes and rivers. (b) To the District's reserves and areas of public open space. (c) To sites of heritage and cultural values. (d) To sites of cultural importance to Kai Tahu ki Otago.	To the extent relevant, public access to the Bendigo Scenic Reserve is maintained and public tracks will further enhance the public access in the area. The proposal achieves this objective.
Objective 16.3.9	To ensure that the physical works involved in preparing land that is part of the subdivision avoids, remedies or mitigates adverse effects on: (a) The stability of land.	No natural water courses are affected by the proposal. Physical works involved in preparing land avoids adverse effects on land and

Provision	Detail	Assessment
	(b) Water quality within natural watercourses and the stability of their margins. (c) Neighbouring properties in respect of the effects of noise, dust and vibration.	neighbouring properties due to the distance of the works from the boundaries. No adverse effects from stability, water quality or noise, dust and vibration will arise. The proposal achieves this objective.
Objective 16.3.10	To ensure subdivisions are designed to facilitate an appropriate and co-ordinated ultimate pattern of development having regard to the particular environment within which the subdivision is located.	The development is consistent with and, overall, an improvement on the pattern of development anticipated within the Rocky Point Recreation Zone. The proposal achieves the objective.
Objective 16.3.11	To ensure that subdivision in areas without reticulated foul sewage services does not facilitate development that has an adverse effect on soil, surface and groundwater resources, and public health.	The subdivision can be adequately serviced without adverse effect on soil, water resources, and public health. The proposal achieves this objective.
Policy 16.4.1	To require that all subdivisions have legal and physical access that: (a) Is of a standard that is adequate for the intended use of allotments having regard to current and likely future traffic levels and the safe and convenient movement of vehicles and pedestrians, and (b) That integrates with the existing roading network in a safe and efficient manner, except in circumstances where Council is satisfied that section 321(2) and (3) of the Local Government Act 1974 is to apply or where no new lots are to be created.	The proposed access is appropriate for the traffic level anticipated and will integrate with the existing road network in a safe and efficient manner. The proposal achieves this policy.
Policy 16.4.2	To encourage the use of existing access points to rural State highways and arterial roads to avoid or mitigate adverse effects on the safe and efficient operation of these roads.	The proposal will use an existing access point to the rural state highway, from Bendigo Loop Road. The proposal achieves this policy.
Policy 16.4.3	To require that the land to be subdivided is supplied with services and infrastructure that are adequate for the intended use of the land to be subdivided without the public interest being adversely affected.	The subdivision can be adequately serviced. The proposal achieves this policy.
Policy 16.4.4	To require that subdivisions within unreticulated areas are designed to ensure that each allotment: (a) Has the ability to adequately dispose of effluent and stormwater on site without compromising health, the life-supporting capacity of soil resources, the quality of ground and surface water resources, and the drainage and amenity values of adjoining properties: and that, (b) An adequate supply of water can be provided, where this is appropriate to the intended use of the allotment.	The proposal will ensure adequate provision for water and safe disposal of effluent and stormwater. The proposal achieves this policy.
Policy 16.4.6	To require that all physical works within subdivisions are designed and constructed in accordance with NZS 4404:1981 which is the Council's Subdivision Code of Practice unless Council determines modification of this	All physical works within the proposed subdivision will be

Provision	Detail	Assessment
	code is necessary given the local conditions and particular circumstances affecting the subdivision.	designed and constructed in accordance with NZS 4404:1991. The proposal achieves this policy.
Policy 16.4.7	To require that the design of subdivision, where relevant to the intended use, provides for the following matters: (a) Facilitates convenient, safe and efficient access to all allotments including pedestrian access where appropriate. (b) Facilitates the safe and efficient provision and operation of services and infrastructure. (c) Facilitates access to passive solar energy resources. (d) Facilitates any foreseeable subsequent development or redevelopment including the economic provision of roading and network utility services. (e) Facilitates adequate provision of, or contribution to, the open space, recreational and reserve needs of the community with physical links to existing reserve areas where this is practicable. (f) Facilitates an appropriate level of access to heritage sites, natural features and water bodies where appropriate. (g) Facilitates development which keeps earthworks to a minimum. (h) Facilitates retention of the heritage values of a site or area.	The various relevant components of this policy have been addressed in detail in Section 4 above, and the design of the subdivision outlined in Section 2, takes these matters into account. The proposal achieves this policy.

5.1.1. Conclusion – Objectives and Policies of the CODP

The proposal is consistent with and achieve the relevant objectives and policies from Chapters 4, 12, 13 and 16 of the CODP.

5.2. Regional Policy Statement, Regional Plans and other planning instruments

The Otago Regional Policy Statement (RPS) sets the direction for future management and promotion of the sustainable management of the region's natural and physical resources, as well as providing the policy context for regional plans and establishing the framework for district plans.

The Operative RPS 2019 (ORPS2019) was declared operative on 4 March 2024. Following a 2019 review of the region's freshwater management framework and the introduction in 2020 of new national regulations, the PORPS2019 has now been reviewed, and the Proposed Otago Regional Policy Statement 2021 (PRPS2021) was notified on 26 June 2021. Decisions of the Hearings Panel on provisions of the PRPS2021 were notified on 30 March 2024.. A number of appeals have been received. Where provisions have been appealed, less weight that can be given to these provisions. Provisions under appeal are shown in red text.

The relevant objectives and policies of the ORPS19 and PRPS21 are addressed in ***Tables 5*** and ***6*** below.

Table 5: *ORPS 2019*

Provision	Detail	Assessment
Chapter 1 – Resource Management in Otago is integrated		

Provision	Detail	Assessment
Objective 1.1	**Otago's resources are used sustainably to promote economic, social, and cultural wellbeing for its people and communities**	The proposal provides for economic, social and cultural wellbeing by providing for a range of rural living, accommodation and related activities as anticipated within the Rocky Point Recreation Zone. The proposal achieves this objective.
Policy 1.1.2	**Social and cultural wellbeing and health and safety** Provide for the social and cultural wellbeing and health and safety of Otago's people and communities when undertaking the subdivision, use, development and protection of natural and physical resources by all of the following: a) Recognising and providing for Kāi Tahu values; b) Taking into account the values of other cultures; c) Taking into account the diverse needs of Otago's people and communities; d) Avoiding significant adverse effects of activities on human health; e) Promoting community resilience and the need to secure resources for the reasonable needs for human wellbeing; f) Promoting good quality and accessible infrastructure and public services.	The proposal provides for the social and cultural wellbeing by providing employment during the construction phase, future living opportunities and a range of accommodation and commercial activities. It is not expected that the proposal will result in effects that are incompatible with manawhenua values.
Objective 1.2	**Recognise and provide for the integrated management of natural and physical resources to support the wellbeing of people and communities in Otago**	The proposal provides for a comprehensive development that integrates natural and physical resources through careful design based on the Rocky Point Recreation Zone, and by appropriately managing impacts on nature conservation values and landscape values. The proposal achieves integrated resource management.
Policy 1.2.1	**Integrated resource management** Achieve integrated management of Otago's natural and physical resources, by all of the following: a) Coordinating the management of interconnected natural and physical resources; b) Taking into account the impacts of management of one natural or physical resource on the values of another, or on the environment; c) Recognising that the value and function of a natural or physical resource may extend beyond the immediate, or directly adjacent, area of interest; d) Ensuring that resource management approaches across administrative boundaries are consistent and complementary; e) Ensuring that effects of activities on the whole of a natural or physical resource are considered when that resource is managed as subunits. f) Managing adverse effects of activities to give effect to the objectives and policies of the Regional Policy Statement. g) Promoting healthy ecosystems and ecosystem services;	

Provision	Detail	Assessment
	h) Promoting methods that reduce or negate the risk of exceeding sustainable resource limits.	
Chapter 2 – Kāi Tahu values and interests are recognised and kaitiakitaka is expressed		
Objective 2.1	**The principles of Te Tiriti o Waitangi are taken into account in resource management processes and decisions**	The proposal does not undermine the principles of Te Tiriti o Waitangi and it is not expected that the proposal will have effects that are incompatible with Kāi Tahu ki values, and this will be confirmed over the process of the application. The proposal achieves the objectives and policies relating to Kāi Tahu values and Te Tiriti o Waitangi.
Policy 2.1.1	**Treaty obligations** Promote awareness and understanding of the obligations of local authorities in regard to the principles of Te Tiriti o Waitangi, tikaka Māori and kaupapa Māori.	
Policy 2.1.2	**Treaty principles** Ensure that local authorities exercise their functions and powers, by: a) Recognising Kāi Tahu's status as a Treaty partner; and b) Involving Kāi Tahu in resource management processes implementation; c) Taking into account Kāi Tahu values in resource management decision-making processes and implementation; d) Recognising and providing for the relationship of Kāi Tahu's culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taoka; e) Ensuring Kāi Tahu have the ability to: i. Identify their relationship with their ancestral lands, water, sites, wāhi tapu, and other taoka; ii. Determine how best to express that relationship; f) Having particular regard to the exercise of kaitiakitaka; g) Ensuring that district and regional plans: i. Give effect to the Ngāi Tahu Claims Settlement Act 1998; ii. Recognise and provide for statutory acknowledgement areas in Schedule 2; iii. Provide for other areas in Otago that are recognised as significant to Kāi Tahu; h) Taking into account iwi management plans.	
Objective 2.2	**Kāi Tahu values, interests and customary resources are recognised and provided for**	
Policy 2.2.1	**Kāi Tahu wellbeing** Manage the natural environment to support Kāi Tahu wellbeing by all of the following: a) Recognising and providing for their customary uses and cultural values in Schedules 1A and B; and, b) Safeguarding the life-supporting capacity of natural resources.	

Provision	Detail	Assessment
Policy 2.2.2	**Recognising sites of cultural significance** Recognise and provide for the protection of wāhi tūpuna, by all of the following: a) Avoiding significant adverse effects on those values that contribute to the identified wāhi tūpuna being significant; b) Avoiding, remedying, or mitigating other adverse effects on the identified wāhi tūpuna; c) Managing the identified wāhi tūpuna sites in a culturally appropriate manner.	The site does not include any identified sites of cultural significance or wāhi tūpuna. The Archaeological Assessment (**Attachment D**) identifies general area-wide historic uses (for example oven sites located on banks of Clutha) as Māori transit through site. Specific section on Archaeological, Māori and other values. The following is all it contains if relevance to Iwi cultural values: *Although early Māori were active throughout the wider region, these sites are generally situated near larger rivers, specifically the Mata-au/Clutha River, the Kawarau River and smaller water courses such as Bendigo Creek. Based on the regional distribution of these archaeological sites it is unlikely that any Māori sites are present within the assessment area.* CODP identifies waahi tapu site in Part A of Schedule 19.4 – nothing is listed for Bendigo The area is not subject to a Statutory Acknowledgement and also has no specific mention in the Kāi Tahu ki Otago Natural Resource Management Plan.
Policy 2.2.3	**Wāhi tūpuna and associated sites** Enable Kāi Tahu relationships with wāhi tūpuna by all of the following: a) Recognising that relationships between sites of cultural significance are an important element of wāhi tūpuna; b) Recognising and using traditional place names.	
Chapter 3 – Otago has high quality natural resources and ecosystems		
Objective 3.1	**The values (including intrinsic values) of ecosystems and natural resources are recognised and maintained, or enhanced where degraded**	The values of the ecosystem and land have been recognised as discussed in the Ecological Assessment (**Attachment H**). The proposed compensation planting will maintain these values. The proposal achieves this objective.
Policy 3.1.1	Safeguard the life-supporting capacity of fresh water and manage fresh water to: a) Maintain good quality water and enhance water quality where it is degraded, including for: i. Important recreation values, including contact recreation; and, ii. Existing drinking and stock water supplies; b) Maintain or enhance aquatic: i. Ecosystem health; ii. Indigenous habitats; and,	The proposal does not have any impact on fresh water quality or natural functioning of nearby water bodies. As discussed in the Stormwater Management Plan and Flood Risk Assessment (**Attachment O**), the proposal avoids, remedies and/or mitigates the adverse effects of natural hazards such as flooding. The proposal achieves this policy.

Provision	Detail	Assessment
	iii. Indigenous species and their migratory patterns. c) Avoid aquifer compaction and seawater intrusion; d) Maintain or enhance, as far as practicable: i. Natural functioning of rivers, lakes, and wetlands, their riparian margins, and aquifers; ii. Coastal values supported by fresh water; iii. The habitat of trout and salmon unless detrimental to indigenous biological diversity; and iv. Amenity and landscape values of rivers, lakes, and wetlands; e) Control the adverse effects of pest species, prevent their introduction and reduce their spread; f) Avoid, remedy or mitigate the adverse effects of natural hazards, including flooding and erosion; and, g) Avoid, remedy or mitigate adverse effects on existing infrastructure that is reliant on fresh water.	
Policy 3.1.3	**Water allocation and use** Manage the allocation and use of fresh water by undertaking all of the following: a) Recognising and providing for the social and economic benefits of sustainable water use; b) Avoiding over-allocation, and phasing out existing over-allocation, resulting from takes and discharges; c) Ensuring the efficient allocation and use of water by: i. Requiring that the water allocated does not exceed what is necessary for its efficient use; ii. Encouraging the development or upgrade of infrastructure that increases efficiency; iii. Providing for temporary dewatering activities necessary for construction or maintenance.	The proposal can be adequately serviced in relation to fresh water. The proposal achieves this policy.
Policy 3.1.7	**Soil values** Safeguard the life-supporting capacity of soil and manage soil to: a) Maintain or enhance as far as practicable i. Soil biological diversity; ii. Biological activity in soils; iii. Soil function in the storage and cycling of water, nutrients, and other elements through the biosphere; iv. Soil function as a buffer or filter for contaminants resulting from human activities, including aquifers at risk of leachate contamination; v. Soil fertility where soil is used for primary production; b) Where a) is not practicable, minimise adverse effects; c) Recognise that urban and infrastructure development may result in loss of soil values. d) Control the adverse effects of pest species, prevent their introduction and reduce their spread;	Large scale productive farming or horticulture/viticulture is incompatible with preservation of the natural character/amenity, and the related ecological value, that exists across the site. However, areas of the site (ie. those outside of the identified curtilage areas) will be protected from development and this can be assured through the conditions of consent. Pest species will be managed appropriately. Heritage values are recognised and will be protected. The proposal achieves this policy.

Provision	Detail	Assessment
	e) Retain the soil mantle where it acts as a repository of historic heritage objects unless an archaeological authority has been obtained.	
Policy 3.1.8	**Soil erosion** Minimise soil erosion resulting from activities, by undertaking all of the following: a) Using appropriate erosion controls and soil conservation methods; b) Maintaining vegetative cover on erosion prone land; c) Remediating land where significant soil erosion has occurred; d) Encouraging activities that enhance soil retention.	Where possible, vegetation cover will be maintained. The proposed compensation planting will enhance soil retention. Earthworks will be undertaken in accordance with an Environmental Management Plan to ensure best practice erosion and sediment control measures are implemented. The proposal achieves this policy.
Policy 3.1.9	**Ecosystems and indigenous biological diversity** Manage ecosystems and indigenous biological diversity in terrestrial, freshwater and marine environments to: a) Maintain or enhance: i. Ecosystem health and indigenous biological diversity including habitats of indigenous fauna; ii. Biological diversity where the presence of exotic flora and fauna supports indigenous biological diversity; b) Maintain or enhance as far as practicable: i. Areas of predominantly indigenous vegetation; ii. Habitats of trout and salmon unless detrimental to indigenous biological diversity; iii. Areas buffering or linking ecosystems; c) Recognise and provide for: i. Hydrological services, including the services provided by tall tussock grassland; ii. Natural resources and processes that support indigenous biological diversity; d) Control the adverse effects of pest species, prevent their introduction and reduce their spread.	Ecosystems and indigenous biological diversity are addressed in detail in the Ecological Assessment (**Attachment H**). The proposal maintains and enhances ecosystem health and indigenous biological diversity across the site through avoidance of vegetation removal where possible and proposed offsetting and enrichment planting of a range of native species across the sites. The proposal achieves this policy.
Policy 3.1.11	**Natural features, landscapes, and seascapes** Recognise the values of natural features, landscapes and seascapes are derived from the biophysical, sensory and associative attributes in Schedule 3.	The values of the natural features across the site and landscape have been recognised and are addressed in detail in the Landscape Assessment (**Attachment E**). The proposal achieves this policy.
Policy 3.1.13	**Environmental enhancement** Encourage, facilitate and support activities that contribute to the resilience and enhancement of the natural environment, by where applicable: a) Improving water quality and quantity; b) Protecting or restoring habitat for indigenous species; c) Regenerating indigenous species;	As discussed above and within the Ecological Assessment (**Attachment H**), the proposal introduces a number of new (native vegetation) species to the site and will contribute to the resilience and enhance of the natural environment through improved biological diversity on the site. An Ecological Enhancement and Monitoring Plan

Provision	Detail	Assessment
	d) Mitigating natural hazards; e) Protecting or restoring wetlands; f) Improving the health and resilience of: i. Ecosystems supporting indigenous biological diversity; ii. Important ecosystem services, including pollination; g) Improving access to rivers, lakes, wetlands and their margins, and the coast; h) Buffering or linking ecosystems, habitats and areas of significance that contribute to ecological corridors; i) Controlling pest species.	(to be complied with on an ongoing basis, as required by conditions of consent) includes measures to control species and maintain indigenous vegetation in perpetuity. The proposal achieves this policy.
Objective 3.2	**Otago's significant and highly-valued natural resources are identified and protected, or enhanced where degraded**	The site does not contain identified areas of significant indigenous vegetation however, as discussed in the Ecological Assessment (**Attachment H**) the site does contain kanuka (Scrub and shrubland) and cushionfield species which are ecologically significant.
Policy 3.2.1	**Identifying significant indigenous vegetation and habitats** Identify areas and values of significant indigenous vegetation and significant habitats of indigenous fauna, using the attributes detailed in Schedule 4.	
Policy 3.2.2	**Managing significant indigenous vegetation and habitats** Protect and enhance areas of significant indigenous vegetation and significant habitats of indigenous fauna, by all of the following: a) In the coastal environment, avoiding adverse effects on: i. The values that contribute to the area or habitat being significant; ii. Indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System lists; iii. Taxa that are listed by the International Union for Conservation of Nature and Natural Resources as threatened; iv. Indigenous ecosystems and vegetation types that are threatened in the coastal environment, or are naturally rare; v. Habitats of indigenous species where the species are at the limit of their natural range, or are naturally rare; vi. Areas containing nationally significant examples of indigenous community types; and vii. Areas set aside for full or partial protection of indigenous biological diversity under other legislation; b) Beyond the coastal environment, and in the coastal environment in significant areas not captured by a) above, maintaining those values that contribute to the area or habitat being significant;	As previously discussed, the proposal will enhance the indigenous vegetation across the site through avoidance of indigenous vegetation removal where possible and proposed offsetting and enrichment planting in indigenous species. Through the planting the proposal will maintain overall the indigenous vegetation values and habitat within the site which will contribute to a wider ecological benefit, and fulfils limb (b) of the policy. Limb (g) is fulfilled through the management plan methods which will be assured through the conditions of consent. To the extent relevant, the proposal achieves this policy.

Provision	Detail	Assessment
	c) Avoiding significant adverse effects on other values of the area or habitat; d) Remedying when other adverse effects cannot be avoided; e) Mitigating when other adverse effects cannot be avoided or remedied; f) Encouraging enhancement of those areas and values that contribute to the area or habitat being significant; g) Controlling the adverse effects of pest species, preventing their introduction and reducing their spread.	
Policy 3.2.3	**Identifying outstanding natural features, landscapes and seascapes** Identify areas and values of outstanding natural features, landscapes and seascapes, using the attributes in Schedule 3.	This is a plan making policy. Part of the site is within the identified ONL.
Policy 3.2.4	**Managing outstanding natural features, landscape and seascapes** Protect, enhance or restore outstanding natural features, landscapes and seascapes, by all of the following: a) In the coastal environment, avoiding adverse effects on the values (even if those values are not themselves outstanding) that contribute to the natural feature, landscape or seascape being outstanding; b) Beyond the coastal environment, maintaining the values (even if those values are not themselves outstanding) that contribute to the natural feature, landscape or seascape being outstanding; c) Avoiding, remedying or mitigating other adverse effects; d) Encouraging enhancement of those areas and values that contribute to the significance of the natural feature, landscape or seascape.	As discussed in the Landscape Assessment (**Attachment E**) overall, the proposal protects the values of the ONL, through the design of the subdivision and the building and landscaping controls volunteered and to be locked in via conditions of consent, and taking into account the development anticipated by the Rocky Point Recreation Zone. The proposal achieves the policy.
Chapter 4 – Communities in Otago are resilient, safe and healthy		
Objective 4.3	**Infrastructure is managed and developed in a sustainable way.**	The proposed infrastructure will be developed and managed appropriately and sustainably. To the extent relevant, the proposal achieves this objective.
Policy 4.3.5	Protect infrastructure with national or regional significance, by all of the following: a) Restricting the establishment of activities that may result in reverse sensitivity effects; b) Avoiding significant adverse effects on the functional needs of such infrastructure; c) Avoiding, remedying or mitigating other adverse effects on the functional needs of such infrastructure; d) Protecting infrastructure corridors from activities that are incompatible with the anticipated effects of that infrastructure, now and for the future.	The proposal does not give rise to adverse effects on national or regionally significant infrastructure.

Provision	Detail	Assessment
Objective 4.5	**Urban growth and development is well designed, occurs in a strategic and coordinated way, and integrates effectively with adjoining urban and rural environments**	Not relevant – the proposal does not constitute urban growth or urban development.
Chapter 5 – People are able to use and enjoy Otago's natural and built environment		
Objective 5.1	**Public access to areas of value to the community is maintained or enhanced.**	The proposal enhances public access through the site and within the area via the provisions of public walking tracks. The proposal achieves this objective and policy.
Policy 5.1.1	Maintain or enhance public access to the natural environment, including to the coast, lakes, rivers and their margins and where possible areas of cultural or historic significance, unless restricting access is necessary for one or more of the following: a) Protecting public health and safety; b) Protecting the natural heritage and ecosystem values of sensitive natural areas or habitats; c) Protecting identified sites and values associated with historic heritage or cultural significance to Kāi Tahu; Ensuring a level of security consistent with the operational requirements of a lawfully established activity.	
Objective 5.2	**Historic heritage resources are recognised and contribute to the region's character and sense of identity**	An Archaeological Assessment (**Attachment D**) was undertaken to understand and recognise the archaeological features and heritage values associated with the site, in fulfilment of the policy.
Policy 5.2.1	**Recognising historic heritage** Recognise all the following elements as characteristic or important to Otago's historic heritage: a) Residential and commercial buildings; b) Māori cultural and historic heritage values; c) 19th and early 20th century pastoral sites; d) Early surveying, communications and transport, including roads, bridges and routes; e) Early industrial historic heritage, including mills and brickworks; f) Gold and other mining systems and settlements; g) Dredge and ship wrecks; h) Coastal historic heritage, particularly Kāi Tahu occupation sites and those associated with early European activity such as whaling; i) Memorials; j) Trees and vegetation.	
Policy 5.2.3	**Managing historic heritage** Protect and enhance places and areas of historic heritage, by all of the following: 1) Recognising that some places or areas are known or may contain archaeological sites, wāhi tapu or wāhi taoka which could be of significant historic or cultural value; 2) Applying these provisions immediately upon discovery of such previously unidentified archaeological sites or areas, wāhi tapu or wāhi taoka;	As discussed in the Archaeological Assessment (**Attachment D**) the site recorded are associated with activities that relate to early colonial European occupation in the mid-1800s. The proposal is likely to affect the archaeological values of two recorded sites. The recommendations made in the assessment will form conditions of consent to ensure the historic heritage associated with the site is protected where possible.

Provision	Detail	Assessment
	3) Avoiding adverse effects on those values that contribute to the area or place being of regional or national significance; 4) Minimising significant adverse effects on other values of areas and places of historic heritage; 5) Remedying when adverse effects on other values cannot be avoided; 6) Mitigating when adverse effects on other values cannot be avoided or remedied; 7) Encouraging the integration of historic heritage values into new activities; 8) Enabling adaptive reuse or upgrade of historic heritage places and areas where historic heritage values can be maintained.	The proposal achieves the policy.
Objective 5.3	**Sufficient land is managed and protected for economic production**	The site does not contain highly productive land and is therefore does not necessitate protection for economic production. There is no opportunity for adverse reverse sensitivity effects given the separation from any farming activity. The proposal achieves the policy.
Policy 5.3.1	**Rural activities** Manage activities in rural areas, to support the region's economy and communities, by: 1) Enabling primary production and other rural activities that support that production; 2) Providing for mineral exploration, extraction and processing; 3) Minimising the loss of significant soils; 4) Restricting the establishment of incompatible activities in rural areas that are likely to lead to reverse sensitivity effects; 5) Minimising the subdivision of productive rural land into smaller lots that may result in a loss of its productive capacity or productive efficiency; 6) Providing for other activities that have a functional need to locate in rural areas.	
Objective 5.4	**Adverse effects of using and enjoying Otago's natural and physical resources are minimised**	The proposal minimises adverse effects on the environment through sensitively designed development. All effects are known and understood, and there is no uncertainty about the potential outcomes. The proposal achieves the policy.
Policy 5.4.3	**Precautionary approach to adverse effects** Apply a precautionary approach to activities where adverse effects may be uncertain, not able to be determined, or poorly understood but are potentially significant or irreversible.	
Policy 5.4.5	**Pest plants and animals** Control the adverse effects of pest species, prevent their introduction, reduce their spread and enable the removal and destruction of material for biosecurity purposes, to safeguard all of the following: a) The viability of indigenous species and habitats for indigenous species; b) Ecosystem services that support economic activities; c) Water quality and water quantity; d) Soil quality;	This is addressed in detail in the Ecological Assessment (**Attachment H**). The proposal does not introduce pest species, rather native vegetation that will enhance the ecosystem services. To the extent relevant, the proposal achieves this policy.

Provision	Detail	Assessment
	e) Human and animal health; f) Recreation values; g) Landscapes, seascapes and natural character; h) Primary production.	
Policy 5.4.6	**Offsetting for indigenous biological diversity** Consider indigenous biological diversity offsetting, when: a) Residual adverse effects of activities cannot be avoided, remedied or mitigated; b) The offset achieves no net loss and preferably a net gain in indigenous biological diversity; c) The offset ensures there is no loss of individuals of Threatened taxa other than kānuka (Kunzea robusta and Kunzea serotina), and no reasonably measurable loss within the ecological district to an At Risk-Declining taxon, other than mānuka (Leptospermum scoparium), under the New Zealand Threat Classification System ("NZTCS"); d) The offset is undertaken where it will result in the best ecological outcome, preferably; i. Close to the location of development; or ii. Within the same ecological district or coastal marine biogeographic region; e) The offset is applied so that the ecological values being achieved are the same or similar to those being lost; f) The positive ecological outcomes of the offset last at least as long as the impact of the activity, preferably in perpetuity; g) The offset will achieve biological diversity outcomes beyond results that would have occurred if the offset was not proposed; h) The delay between the loss of biological diversity through the proposal and the gain or maturation of the offset's biological diversity outcomes is minimised.	The proposal includes biological diversity offsetting as discussed in detail in the Ecological Assessment (**Attachment H**) to address the residual adverse effects associated with the proposal. The offset aligns with the directives of the National Policy Statement for Indigenous Biodiversity, specifically Appendix 3 which sets out the principles for biodiversity offsetting. The proposal achieves this policy.
Policy 5.4.6A	**Biological Diversity Compensation** Consider the use of biological diversity compensation: a) When: i. Adverse effects of activities cannot be avoided, remedied, mitigated or offset; and ii. The residual adverse effects will not result in 1. The loss of an indigenous taxon (excluding freshwater fauna and flora) or of any ecosystem type from an ecological district or coastal marine biogeographic region; 2. Removal or loss of viability of habitat of a threatened or at risk indigenous species of fauna or flora under the New Zealand Threat Classification System ("NZTCS"); 3. Removal or loss of viability of an originally rare or uncommon ecosystem type that is	The proposal does not include biological diversity compensation.

Provision	Detail	Assessment
	associated with indigenous vegetation or habitat of indigenous fauna; 4. Worsening of the NZTCS conservation status of any threatened or at risk indigenous freshwater fauna. b) By applying the following criteria: i. The compensation is proportionate to the adverse effect; ii. The compensation is undertaken where it will result in the best practicable ecological outcome, preferably; 1. Close to the location of development; 2. Within the same ecological district or coastal marine biogeographic region; iii. The compensation will achieve positive biological diversity outcomes that would not have occurred without that compensation; iv. The positive ecological outcomes of the compensation last for at least as long as the adverse effects of the activity; and v. The delay between the loss of biological diversity through the proposal and the gain or maturation of the compensation's biological diversity outcomes is minimised.	

Table 6: ORC PRPS 2021

Provision	Detail	Assessment
Part 1 – Mana whenua		
Objective MW-O1	**Principles of Te Tiriti o Waitangi** **The principles of Te Tiriti o Waitangi are given effect in resource management processes and decisions, utilising a partnership approach between councils and Papatipu Rūnaka to ensure that what is valued by *mana whenua* is actively protected in the region.**	As discussed above in relation to the PORPS provisions, the proposal does not undermine the principles of Te Tiriti o Waitangi and it is not expected that the proposal will have effects that are incompatible with Kāi Tahu ki values, and this will be confirmed over the process of the application. The proposal achieves the objectives and policies relating to Kāi Tahu values and Te Tiriti o Waitangi.
Policy MW-P1	**Treaty obligations** Promote awareness and understanding of the obligations of local authorities in regard to the principles of Te Tiriti o Waitangi, tikaka Māori and kaupapa Māori.	
Policy MW-P2	**Treaty principles** *Local authorities* exercise their functions and powers in accordance with Treaty principles, by: 1) recognising the status of Kāi Tahu and facilitating Kāi Tahu involvement in decision-making as a Treaty partner, 2) including Kāi Tahu in resource management processes and implementation to the extent desired by mana whenua, 3) recognising and providing for Kāi Tahu values and resource management issues, as identified by *mana whenua*, in resource management decision-making processes and plan implementation,	

Provision	Detail	Assessment
	4) recognising and providing for the relationship of Kāi Tahu culture and traditions with their ancestral lands, *water*, sites, wāhi tapu, and other taoka by ensuring that Kāi Tahu have the ability to identify these relationships and determine how best to express them, 5) ensuring that *regional* and *district plans* recognise and provide for Kāi Tahu relationships with Statutory Acknowledgement Areas, tōpuni, *nohoaka* and customary fisheries identified in the NTCSA 1998, including by actively protecting the mauri of these areas, 6) having particular regard to the ability of Kāi Tahu to exercise kaitiakitaka, 7) actively pursuing opportunities for: a. delegation or transfer of functions to Kāi Tahu, and b. partnership or joint management arrangements, and 8) taking into account iwi management plans when making resource management decisions.	
Part 2 – Integrated management		
Objective IM-O1	**Long term vision (mō tātou, ā, mō kā uri ā muri ake ne)** The management of natural and physical resources ~~in Otago~~, by and for the people of Otago, in partnership with ~~including~~ Kāi Tahu, ~~and as expressed in all resource management plans and decision making,~~ achieves a healthy~~,~~ and resilient~~, and safeguarded~~ natural environment, ~~systems, and~~ including the ecosystem services it provides ~~they offer,~~ and supports the well-being of present and future generations~~, mō tātou, ā, mō kā uri ā muri ake nei~~.	The proposal provides for social wellbeing through the provision of sites for residential and travellers' accommodation, and related activities, taking into account the Rocky Point Recreation Zone, while maintaining environmental quality and safeguarding the natural systems of the area. The proposal achieves this objective.
Objective IM-O2	**Ki uta ki tai** The management of n~~N~~atural and physical resources ~~management and decision making in Otago~~ embraces ki uta ki tai, recognising that the *environment* is an interconnected system, which depends on its connections to flourish, and must be managed ~~considered~~ as an interdependent whole	The proposal recognises the environment holistically through the development enabled by the Rocky Point Recreation Zone and the recognition of the potential impacts of development on the environment and its interconnected components. The proposal achieves this objective.
Objective IM-O3	**~~Environmentally s~~Sustainable impact** Otago's communities provide for their social, economic and cultural well-being in ways ~~carry out their activities in a way~~ that support or restore ~~preserves~~ environmental integrity, form, functioning, and *resilience*, so that the life-supporting capacities of air, *water*, soil, and ecosystems are sustainably managed, ~~and indigenous *biodiversity* endure~~ for future generations.	The proposal does not compromise the life-supporting capacity of the District's air, water, soil, ecosystems, or indigenous biodiversity. Consent conditions are volunteered to ensure that impacts are managed appropriately, and the environment remains, overall, sustainable for indigenous

Provision	Detail	Assessment
		biodiversity and environmental integrity. The proposal achieves this objective.
Policy IM-P13	**Managing cumulative effects** In resource management decision-making, recognise and manage the impact of cumulative effects on the form, functioning and resilience of Otago's environment (including resilience to climate change) and the opportunities available for future generations. ~~Otago's environmental integrity, form, function, and *resilience*, and opportunities for future generations, are protected by recognising and specifically managing the cumulative effects of activities on natural and physical resources in plans and explicitly accounting for these effects in other resource management decisions.~~	Cumulative effects will be limited when considering what the Rocky Point Recreation Zone provides for. Otago's environmental integrity, form, function, and resilience, and opportunities for future generations will remain protected. The proposal achieves this policy.
Part 3 – Freshwater		
Policy LF-FW-P15	**Stormwater ~~and wastewater~~ discharges** Minimise the adverse effects of direct and indirect discharges of stormwater ~~and wastewater~~ to fresh water by: ~~1) except as required by LF-VM-O2 and LF-VM-O4, preferring discharges of wastewater to land over discharges to water, unless adverse effects associated with a discharge to land are greater than a discharge to water, and~~ 2) requiring: ~~(a) all sewage, industrial or trade waste to be discharged into a reticulated wastewater system, where one is available,~~ (aa) integrated catchment management plans for management of stormwater in urban areas, (b) all stormwater to be discharged into a reticulated system, where one is made available by the operator of the reticulated system, unless alternative treatment and disposal methods will result in the same or improved outcomes for freshwater, (c) implementation of methods to progressively reduce unintentional stormwater inflows to ~~the frequency and volume of wet weather overflows and minimise the likelihood of dry weather overflows occurring for reticulated stormwater and~~ wastewater systems, ~~(d) on-site wastewater systems to be designed and operated in accordance with best practice standards,~~ (e) that any stormwater ~~and wastewater~~ discharges do not prevent water bodies from ~~to~~ meeting any applicable water quality standards set for FMUs and/or rohe, and (f) the use of water sensitive ~~urban~~ design techniques ~~to avoid or mitigate the potential adverse effects of contaminants on receiving~~	Requirements for a full assessment of effluent disposal requirements is anticipated as a consent condition and will be completed prior to the occupation of any dwelling. Required standards will be met. The assessment provided by Mt Iron Geodrill and CKL (**Attachment G**) demonstrates that wastewater disposal (onsite and communal) options are available for the lots proposed and wastewater can be discharged to land. Vegetation is being retained wherever possible to control stormwater. The proposal achieves this policy.

Provision	Detail	Assessment
	~~water bodies from the subdivision, use or development of land,~~ wherever practicable, and 3) promoting the reticulation of stormwater ~~and wastewater~~ in urban areas where appropriate, and (a) promoting source control as a method for reducing contaminants in discharges and the use of good practice guidelines for managing stormwater.	
Policy LF-FW-P16	**Discharges containing animal effluent, sewage, greywater and industrial and trade waste** Minimise the adverse effects of direct and indirect discharges containing animal effluent, sewage, greywater and industrial and trade waste to fresh water by: 1) phasing out existing discharges containing sewage or industrial and trade waste directly to water to the extent practicable, 2) requiring: (a) new discharges containing sewage or industrial and trade waste to be to land, (b) discharges of animal effluent from land-based primary production to be to land, (c) that all discharges containing sewage or industrial and trade waste are discharged into a reticulated wastewater system, where one is made available by its owner, unless alternative treatment and disposal methods will result in improved outcomes for fresh water, (d) implementation of methods to progressively reduce the frequency and volume of wet weather overflows and minimise the likelihood of dry weather overflows occurring from reticulated wastewater systems, (e) on-site wastewater systems and animal effluent systems to be designed and operated in accordance with best practice standards, (f) that any discharges do not prevent water bodies from meeting any applicable water FMUs and/or rohe, 3) to the greatest extent practicable, requiring the reticulation of wastewater in urban areas, and promoting source control as a method for reducing contaminants in discharges.	As discussed in the various reports, the proposed wastewater disposal systems will be designed in accordance with best practice standards and will minimise any potential adverse effect on the environment. To the extent relevant, the proposal achieves this policy.
Land and soil		
Objective LF-LS-O11	**Land and soil** ~~The life-supporting capacity of Otago's soil resources is safeguarded and t~~The availability and productive capacity of highly productive land for primary production is ~~maintained~~ protected now and for future generations.	The proposal does not compromise the life-supporting capacity of the district's soil. The site has a LUC class of 7 and the proposal results in development of the Rocky Point Recreation Zone with large areas revegetated or protected. The proposal achieves this objective.

Provision	Detail	Assessment
Objective **LF-LS-O12**	**Use, development and protection ~~of land~~** ~~The use of land in Otago maintains soil quality and contributes to achieving environmental outcomes for fresh water.~~ The use, development, and protection of land and soil: (1) safeguards the life-supporting capacity of soil, (2) contributes to achieving environmental outcomes for fresh water, and (3) recognises the role of these resources in providing for the social, economic, and cultural well-being of Otago's people and communities.	Soil quality will be maintained, and native vegetation will be maintained where possible, enhanced through compensation planting areas and protected in perpetuity. This will assist with preventing soil erosion and overland flow into water sources. The proposal achieves this objective.
Policy LF-LS-P17	**Soil values** Maintain the ~~mauri,~~ health and productive potential of soils, to the extent reasonably practicable by managing the use and development of land in a way that is suited to the ~~natural~~ soil characteristics and that sustains mauri through healthy: 1) soil biological activity and biodiversity, 2) soil structure, and 3) soil fertility.	Beyond the area required to establish building platforms and access the site will be protected from development. The mauri, health and productive potential of soils will therefore be maintained. The proposal achieves this policy.
Policy LF-LS-P18	**Soil erosion** Minimise soil erosion, and the associated risk of sedimentation in water bodies, resulting from land use activities by: 2) maintaining vegetative cover on erosion-prone land, to the extent practicable, and 1) implementing ~~effective~~ management practices to ~~retain topsoil in situ and~~ minimise the potential for soil to be discharged to water bodies, including by controlling the timing, duration, scale and location of soil exposure, and 2) promoting activities that enhance soil retention.	The proposal makes provision for the protection of soil resource by its low density and footprint of development (comparative to what is anticipated within the 'Development Area' of the Rocky Point Recreation Zone), restrictive curtilage areas and compensation planting and protection. Extensive areas of indigenous vegetation will remain onsite, and proposed earthworks are limited to roading and minor works to prepare build platforms. Erosion, compaction and the loss of soils will be limited. The proposal achieves this policy.
Policy LF-LS-P19	**Highly productive land** Maintain the availability and productive capacity of highly productive land by: 1) identifying highly productive land based on the following criteria: (a) ~~the capability and versatility of the land to support primary production based on the Land Use Capability classification system,~~ (b) ~~the suitability of the climate for primary production, particularly crop production, and~~ (c) ~~the size and cohesiveness of the area of land for use for primary production, and~~ (d) land must be identified as highly productive land if: (i) it is in a general rural zone or rural production zone, and	As previously discussed, the site has a LUC 7 soils and therefore the proposal has no impact on highly productive land. The proposal achieves this policy.

Provision	Detail	Assessment
	(ii) it is predominately LUC 1, 2 or 3 land, and (iii) it forms a large and geographically cohesive area, (e) land may be identified as highly productive land if: (i) it is in a general rural zone or rural productive zone, and (ii) (ii) it is not LUC 1, 2 or 3 land, and (iii) it is or has potential to be highly productive land for land-based primary production in Otago, having regard to the soil type, the physical characteristics of the land and soil, and the climate, and (f) land must not be identified as highly productive land if it was identified for future urban development on or before 17 October 2022, and 2) prioritising the use of highly productive land for land-based primary production ~~ahead of other land uses~~ in accordance with the NPS-HPL~~, and~~ 1) ~~managing urban development in rural areas, including rural lifestyle and rural residential areas, in accordance with UFD-P4, UFD-P7 and UFD-P8.~~	
Policy LF-LS-P21	**Land use and fresh water** ~~Achieve the improvement or maintenance of fresh water quantity or quality~~ The health and well-being of waterbodies and freshwater ecosystems is maintained to meet environmental outcomes set for Freshwater Management Units and/or rohe by: 1) reducing or otherwise maintaining the adverse effects of direct and indirect discharges of contaminants to water from the use and development of land, and 2) managing land uses that may have adverse effects on the flow of water in surface water bodies or the recharge of groundwater, 3) recognising the drylands nature of some of Otago and the resulting low water availability, and 1) maintaining or, where degraded, enhancing, the habitat and biodiversity values of riparian margins..	The discharge of contaminants is not anticipated by the proposal. No natural water courses are affected by the proposal. The Water and Wastewater Assessment (**Attachment G**) demonstrates that wastewater disposal options are available for the development. The proposal achieves this policy.
Ecosystems and indigenous biodiversity		
Objective **ECO-O1**	**Indigenous biodiversity** Otago's indigenous biodiversity is healthy and thriving and any overall decline in condition, ~~quality,~~ quantity and diversity is halted.	The values of indigenous biodiversity is recognised as detailed in the Ecological Assessment (**Attachment H**). The proposal includes offsetting and enrichment planting which will assist in maintaining and improving Otago's indigenous biodiversity. The proposal achieves this objective.
Objective **ECO–O2**	**Restoring ~~or~~and enhancing** Restoration and enhancement activities result in an ~~A net~~ overall increase in the extent and occupancy of Otago's	The proposal will enhance indigenous biodiversity of the area.

Provision	Detail	Assessment
	indigenous biodiversity ~~results from restoration or enhancement~~.	The proposal achieves this objective.
Objective **ECO-O3**	**Kaitiakitaka and stewardship** Mana whenua exercise their role ~~are recognised~~ as kaitiaki of Otago's indigenous biodiversity, and Otago's communities are recognised as stewards, who are responsible for: 1) te hauora o te koiora (the health of indigenous biodiversity), te hauora o te taoka (the health of species and ecosystems that are taoka), and te hauora o te taiao (the health of the wider environment), while **1)** providing for te hauora o te takata (the health of the people).	While it is not expected that the proposal will have effects that are incompatible with mana whenua values, and the applicant will consult with the Mana whenua over the process of the application, as discussed above, and taking into account the findings of the archaeological expert.
Policy ECO-P1	**Kaitiakitaka** ~~Recognise the role of~~ Enable Kāi Tahu to exercise their role as kaitiaki of Otago's indigenous biodiversity by: 1) ~~involving~~ partnering with Kāi Tahu in the management of indigenous biodiversity to the extent desired by mana whenua, 1A) working with Kāi Tahu to identify ~~and the identification of~~ indigenous species and ecosystems that are taoka, 2) incorporating the use of mātauraka Māori in the management and monitoring of indigenous biodiversity, and 1) ~~providing for~~ facilitating access to and use of indigenous biodiversity by Kāi Tahu, including mahika kai, according to tikaka.	
Policy ECO-P3	**Protecting significant natural areas and taoka** Outside the coastal environment, and e~~E~~xcept as provided for by ECO–P4 and ~~ECO–P5~~ECO-P5A, protect significant natural areas and indigenous species and ecosystems that are taoka by: 1) first avoiding adverse effects that result in: ~~(a) any reduction of the area or values (even if those values are not themselves significant) identified under ECO–P2(1), or~~ (aa) loss of ecosystem representation and extent, (ab) disruption to sequences, mosaics, or ecosystem function, (ac) fragmentation of significant natural areas or the loss of buffers or connections within an SNA, (ad) a reduction in the function of the significant natural area as a buffer or connection to other important habitats or ecosystems, or (ae) a reduction in the population size or occupancy of Threatened or At Risk (declining) species that use an significant natural area for any part of their life cycle, (b) any loss of ~~Kāi Tahu~~ taoka values identified by mana whenua as requiring protection under ECO-P2(2), and	The themes in this policy are addressed in detail in the Ecological Assessment (**Attachment H**). The biodiversity effects management hierarchy has been implemented. Building platforms and access routes have been carefully located to avoid adverse effects wherever possible. Areas of indigenous vegetation will be maintained and enhanced through compensation planting and ongoing protection. The proposal achieves this policy.

Provision	Detail	Assessment
	2) after (1), applying the ~~biodiversity~~ effects management hierarchy (in relation to indigenous biodiversity) ~~in ECO–P6~~ to areas and values other than those covered by ECO-P3(1), and 1) prior to significant natural areas and indigenous species and ecosystems that are taoka being identified and mapped in accordance with ECO–P2, adopt a precautionary approach towards activities in accordance with ~~IM–P15~~IM-P6(2).	
Policy ECO-P6	**Maintaining indigenous biodiversity** Outside the coastal environment and excluding areas protected under ECO-P3, manage ~~Maintain~~ Otago's indigenous biodiversity ~~(excluding the coastal environment and areas managed under ECO–P3)~~ by: (1) applying the following biodiversity effects management hierarchy (in relation to indigenous biodiversity) to manage significant adverse effects on indigenous biodiversity), and (2) requiring the maintenance of indigenous biodiversity for all other adverse effects of any activity, and (3) notwithstanding (1) and (2) above, for regionally significant infrastructure and nationally significant infrastructure that is either renewable electricity generation or the National Grid avoid, remedy or mitigate adverse effects to the extent practicable ~~applying the following biodiversity effects management hierarchy in decision-making on applications for resource consent and notices of requirement:~~ ~~1) avoid adverse effects as the first priority,~~ ~~2) where adverse effects demonstrably cannot be completely avoided, they are remedied,~~ ~~3) where adverse effects demonstrably cannot be completely avoided or remedied, they are mitigated,~~ ~~4) where there are residual adverse effects after avoidance, remediation, and mitigation, then the residual adverse effects are offset in accordance with APP3, and~~ ~~5) if biodiversity offsetting of residual adverse effects is not possible, then:~~ ~~(a) the residual adverse effects are compensated for in accordance with APP4, and~~ ~~(a) if the residual adverse effects cannot be compensated for in accordance with APP4, the activity is avoided.~~	As discussed in the Ecological Assessment (**Attachment H**) the biodiversity offsetting effects management hierarchy has been implements and the proposal includes offsetting that result in a positive ecological effects. The proposal achieves this policy.
Policy ECO-P8	**Restoration and E~~n~~hancement** The extent, occupancy and condition of Otago's indigenous biodiversity is increased by: 1) restoring and enhancing habitat for indigenous species, including taoka and mahika kai species, 2) improving the health and resilience of indigenous biodiversity, including ecosystems, species, ~~important~~ ecosystem function, and intrinsic values, ~~and~~	As discussed in the Ecological Assessment (**Attachment H**) the proposed offsetting and enrichment planting will increase the diversity of the homogenous kanuka shrubland. Ongoing protection, monitoring and maintenance will also be achieved. The proposal achieves this policy.

Provision	Detail	Assessment
	3) buffering or linking ecosystems, habitats and ecological corridors, ki uta ki tai and 4) prioritising all the following for restoration: (a) significant natural areas whose ecological integrity is degraded, (b) threatened and rare ecosystems representative of naturally occurring and formerly present ecosystems, (c) areas that provide important connectivity or buffering functions, (d) areas of indigenous biodiversity on native reserves and Māori land where restoration is advanced by the Māori landowners, 1) any other priorities specified in regional biodiversity strategies or any national priorities for indigenous biodiversity restoration.	
Policy ECO-P9	**~~Wilding conifers~~** ~~Reduce the impact of wilding conifers on indigenous biodiversity by:~~ ~~1) avoiding afforestation and replanting of plantation forests with wilding conifer species listed in APP5 within:~~ ~~(a) areas identified as significant natural areas, and~~ ~~(b) buffer zones adjacent to significant natural areas where it is necessary to protect the significant natural area, and~~ ~~(a) supporting initiatives to control existing wilding conifers and limit their further spread.~~	No assessment required.
Policy ECO-P10	**Integrated approach ~~management~~** Manage indigenous biodiversity and the effects on it from subdivision, use and development in an integrated way, which means: ~~Implement an integrated and co-ordinated approach to managing Otago's ecosystems and indigenous biodiversity that:~~ (1) ensur~~es~~ing any permitted or controlled activity in a regional plan or district plan rule does not compromise the achievement of ECO-O1, (2) recognis~~es~~ing the interactions ki uta ki tai (from the mountains to the sea) between the terrestrial environment, fresh water, and the coastal marine area, including: (a) the migration of fish species between fresh and coastal waters, and (b) the effects of land-use activities on coastal biodiversity and ecosystems, (2A) acknowledging that climate change will affect indigenous biodiversity and managing activities which may exacerbate the effects of climate change, (3) providing for the coordinated management and control of subdivision, use and development, as it affects indigenous biodiversity across administrative boundaries, ~~promotes collaboration between~~	The proposal represents an integrated approach to managing indigenous biodiversity and will overall result in positive outcomes as discussed in the Ecological Assessment (**Attachment H**).

Provision	Detail	Assessment
	~~individuals and agencies with biodiversity responsibilities,~~ (4) working towards aligning strategies and other planning tools required or provided for in legislation that are relevant to indigenous biodiversity, ~~supports the various statutory and non-statutory approaches adopted to manage indigenous biodiversity,~~ (5) recognis~~es~~ing the critical role of people and communities in actively managing the remaining indigenous biodiversity occurring on private land, and (6) adopt~~s~~ing regulatory and non-regulatory regional pest management programmes.	
Policy ECO-P11	**Resilience to climate change** Promote the resilience of indigenous biodiversity to climate change, including at least by: (1) allowing and supporting the natural adjustment of habitats and ecosystems to the changing climate, and (2) considering the effects of climate change when making decisions on: (g) restoration proposals, and (h) managing and reducing new and existing biosecurity risks, and (3) maintaining and promoting the enhancement of the connectivity between ecosystems, and between existing and potential habitats, to enable migrations so that species can continue to find viable niches as the climate changes, and (4) recognising the role of indigenous biodiversity in mitigating the effects of climate change.	The ecologists have considered the changing climate in their assessments.
Historic heritage		
Objective HCV-HH-O3	**Historic heritage resources** Otago's unique historic heritage contributes to the region's character, sense of identity, and social, cultural and economic well-being, and people's understanding and appreciation of it is enhanced, and that it is protected ~~is preserved~~ for future generations against inappropriate subdivision, use and development.	The Archaeological Assessment **Attachment D**) recommends methods for the protection of the historic retaining wall and a consent condition is volunteered to ensure this occurs. The proposal achieves this policy.
Policy HCV-HH-P5	**Managing historic heritage** Except as provided for in EIT-INF-P13, p~~P~~rotect historic heritage from inappropriate subdivision, use and development by: 1) requiring the use of accidental discovery protocols in accordance with APP11, 2) avoiding adverse effects on areas or places which have been identified as having ~~with~~ special or outstanding historic heritage values or qualities, except that in circumstances (a) to (f) below, they are remedied or mitigated to the extent practicable: (a) where HCV-HH-P6 applies, or (b) a project has significant public benefit that outweighs the loss of historic heritage, or	

Provision	Detail	Assessment
	(c) the activity has functional or locational constraints and has a significant public benefit, (d) the area or place is already impacted by an existing, lawfully established activity, or (e) there is significant risk to safety or property, or (f) any adverse effects are minor and relate to work necessary to adapt a historic heritage building to modern use. 3) Avoiding, remedying or mitigating ~~significant~~ adverse effects on other areas or places with historic heritage values or qualities, ~~4) avoiding, as the first priority, other adverse effects on areas or places with historic heritage values or qualities,~~ ~~5) where adverse effects demonstrably cannot be completely avoided, remedying or mitigating them, and~~ 1) ~~recognising that for infrastructure, EIT-INF-P13 applies instead of HCV-HH-P5(1) to (5).~~	
~~Policy HCV-HH-P6~~	**~~Enhancing historic heritage~~** ~~Enhance places and areas of historic heritage wherever possible through the implementation of plan provisions, decisions on applications for resource consent and notices of requirement and non-regulatory methods.~~	No assessment required.
Natural features and landscapes		
Objective NFL-O1	**Outstanding ~~and highly valued~~ natural features and landscapes** The areas and values of Otago's outstanding ~~and highly valued~~ natural features and landscapes are identified, and the use and development of Otago's natural and physical resources results in: ~~1)~~ the protection of them from inappropriate subdivision, use and development ~~outstanding natural features and landscapes, and~~ **1)** ~~2) the maintenance or enhancement of highly valued natural features and landscapes.~~	As discussed in the Landscape Assessment (**Attachment E**) the proposal mitigates or avoids adverse landscape and visual amenity effects on the ONL and therefore protects the values of the ONL overall. The proposal achieves this objective and policy.
Policy NFL-P2	**Protection of outstanding natural features and landscapes** Protect outstanding natural features and landscapes from inappropriate subdivision, use and development by: 1A) avoiding exceeding the landscape capacity of the natural feature or landscape, 1) maintaining ~~avoiding adverse effects on~~ the values that contribute to the natural feature or landscape being considered outstanding, even if those values are not themselves outstanding, ~~and~~ 2) avoiding, remedying or mitigating other adverse effects and 1) managing the adverse effects of infrastructure on the values of outstanding natural features and landscapes in accordance with EIT-INF-P13.	
Urban form and development		
Objective	**Development in rural areas**	The proposal provides for development within and

Provision	Detail	Assessment
UFD-O4	Development in Otago's rural areas occurs in a way that: ~~1) avoids impacts on significant values and features identified in this RPS,~~ ~~2) avoids as the first priority, land and soils identified as highly productive by LF–LS–P19 unless there is an operational need for the development to be located in rural areas,~~ ~~3) only provides for urban expansion, rural lifestyle and rural residential development and the establishment of sensitive activities, in locations identified through strategic planning or zoned within district plans as suitable for such development; and~~ 4) provides for the ongoing use of rural areas for primary production and rural industry, and ~~outside of areas identified in (3), maintains and enhances the natural and physical resources that support the productive capacity, rural character, and long-term viability of the rural sector and rural communities.~~ 1) 4A) does not compromise the long term viability of primary production and rural communities.	surrounding the Rocky Point Recreation Zone which specifically provides for a "Development Area" and anticipates residential and travellers' accommodation and related activities. The site does not contain highly productive soils and the proposal does not impact significantly on the values and features identified in the RPS, including nature conservation landscape, and heritage values The proposal achieves this objective.
Policy UFD-P7	**Rural Areas** The management of development in rural areas: ~~1) provides for the maintenance and, wherever possible, enhancement of important features and values identified by this RPS,~~ 2) ~~outside areas identified in (1),~~ maintains ~~the productive capacity, amenity and character of~~ rural areas as places where people live, work and recreate and where a range of activities and services are required to support these rural functions, and provide for social and economic wellbeing within rural communities and the wider region, 3) prioritises land-based ~~enables~~ primary production ~~particularly on land or soils identified as~~ on highly productive land in accordance with ~~LF–LS–P19~~the NPS-HPL, except as provided for in (5) below, ~~4) facilitates rural industry and supporting activities,~~ 5) enables the use by Kāi Tahu of Native Reserves and Māori Land, for papakāika, kāika, nohoaka, marae and marae related activities in accordance with MW-P4~~directs rural residential and rural lifestyle development to areas zoned for that purpose in accordance with UFD–P8~~, 6) restricts the establishment of non-rural ~~residential~~ activities~~, sensitive activities, and non-rural businesses~~ which could adversely affect, including by way of reverse sensitivity or fragmentation, the productive capacity of highly productive land, or existing or anticipated primary production and rural industry activities except as provided for in (5) or the NPS-HPL.~~, and~~ 1) ~~otherwise limits the establishment of residential activities, sensitive activities, and non-rural businesses to those that can demonstrate an operational need to be located in rural areas.~~	The proposal provides for the maintenance of important features and values identified by the RPS. The proposal does not create reserve sensitivity issues or adversely affect primary production potential, being located on land with a low productivity and LUC rating. The proposal achieves this policy.

Provision	Detail	Assessment
Policy UFD-P8	**Rural lifestyle ~~and rural residential zones~~ development** The establishment, development or expansion of rural lifestyle ~~and rural residential zones~~ only occurs where: ~~1) the land is adjacent to existing or planned urban areas and ready access to employment and services is available,~~ 2) ~~despite the direction in (1), also~~ it avoids land identified for future urban development in a relevant plan or land reasonably likely to be required for its future urban development potential, where the rural lifestyle or rural residential development would foreclose or reduce efficient realisation of that urban development potential, 3) it minimises impacts on existing or anticipated primary production, rural industry and other rural activities ~~rural production potential, amenity values~~ and the potential for reverse sensitivity effects ~~to arise~~, 4) it avoids~~, as the first priority,~~ highly productive land ~~identified in accordance with LF-LS-P16~~ except as provided for in the NPS-HPL, 5) the suitability of the area to accommodate the proposed development is demonstrated, including: (a) capacity for servicing by existing or planned development infrastructure (including self-servicing requirements), (b) particular regard is given to the individual and cumulative impacts of ~~domestic~~ water supply, wastewater disposal, and stormwater management including self-servicing, on the receiving or supplying environment and impacts on capacity of development infrastructure, if provided, to meet other planned urban area demand, and (c) likely future demands or implications for publicly funded services including emergency services and additional infrastructure, and (a) ~~provides for the maintenance and wherever possible, enhancement, of important features and values identified by this RPS.~~	The proposal does not necessarily include the establishment, development or expansion of rural lifestyle or rural residential zones, rather it is giving effect to the Rocky Point Recreation Zone. To the extent relevant, the proposal does not negatively impact on rural production potential, amenity values, nature conservation values, or give rise to reverse sensitivity effects. To the extent it is relevant, the proposal achieves the policy.

5.2.1. Conclusion – Objectives and Policies of the ORPS2019 and PRPS2021

The proposal is not contrary to the relevant objectives and policies of the regional instruments.

5.3. Kai Tahu ki Otago Natural Resource Management Plan 2005

The relevant provisions of Kai Tahu ki Otago Natural Resource Management Plan 2005 are assessed in ***Table 7*** below.

Table 7: Kai Tahu ki Otago Natural Resource Management Plan provisions

Provision	Detail	Assessment
Section 5.2: Objectives applying to the whole of the Otago Region.		

Provision	Detail	Assessment
5.2 (i)	The rakātirataka and kaitiakitaka of Kāi Tahu ki Otago is recognised and supported.	Kāi Tahu ki Otago will be consulted with during the course of this application and will have the opportunity to submit on the application. Taking into account the findings of the Archaeological Assessment it is not expected that the proposal will have effects that are incompatible with Kāi Tahu ki Otago values and this will be confirmed over the process of the application, as discussed in Part 4.4 above and in relation to the relevant RPS provisions in Part 5.3 above.
5.2 (iii)	The mana of Kāi Tahu ki Otago is upheld through the management of natural, physical, and historic resources in the Otago Region.	
5.2 (iv)	Kāi Tahu ki Otago have effective participation in all resource management activities within the Otago Region.	
10.3. Wahi Tapu in the Clutha/Mata-au Catchment		
10.3.3.1.	To require that wāhi tapu sites are protected from further loss or destruction.	No wahi tapu sites are located within the site of the proposal, and therefore will not be subject to further loss or destruction. The proposal achieves this policy.
10.3.3.2.	To require accidental discovery protocols for any earth disturbance activities.	Accidental discovery protocols will be followed throughout the earthworks phase. The proposal achieves this policy.

5.4. Te Tangi a Tuira – The Cry of the People 2008

The relevant provisions of Te tangi a Tuira – The Cry of the People 2008 are assessed in ***Table 8*** below.

Table 8: Te Tangi a Tauira provisions

Provision	Detail	Assessment
3.4.12: Mahinga kai – mahi ngā kai		
Policy 4	Promote the protection, restoration, and enhancement of indigenous biodiversity.	Overall the proposal provides for the enhancement of indigenous biodiversity as far as possible as discussed in the Ecological Assessment (**Attachment H**), while enabling an efficient development. To this extent the proposal achieves this policy.
3.5.8. Earthworks		
3.5.8 (1)	Consent applicants who are undertaking earthworks may be required to enter into Accidental Discovery Protocol and monitoring agreements with Ngāi Tahu ki Murihiku, stating that any earthworks, fencing, landscaping, or other such activity has the potential to uncover archaeological sites. Procedures and processes associated with such an occurrence should also be outlined.	Accidental discovery protocols will be complied with as a requirement of consent conditions. The proposal achieves this policy.

Provision	Detail	Assessment
3.5.8 (6)	Oppose any earthworks activity application whereby the adverse effects on cultural values are considered too significant.	It is not considered that the proposal would result in effects that are incompatible with cultural values, given the mitigation measures to be implemented during construction, and the adherence to the accidental discovery protocol.
3.5.7. Subdivisions		
3.5.7 (6)	Encourage appropriate subdivision activities that protect and even enhance natural, ecological, and cultural values.	The proposal protects natural, ecological, and cultural values. Planting of indigenous vegetation will occur in appropriate locations across the site. The proposal achieves this policy.

5.5. National Environmental Standard – Assessing and Managing Contaminants in Soil

In accordance with the National Standard for Assessing and Managing Contaminants in the Soil, all applications for resource consent need to be determined if they apply under this National Environmental Standard (NES).

The regulations apply if any of the following activities are undertaken:

(a) remove or replace an underground fuel storage system or any of its parts

(b) sample the soil to determine contamination

(c) disturb the soil (earthworks)

(d) subdivide the land

(e) change the use of the land.

Upon review of the Otago Regional Council HAIL database, there are no identified HAIL sites or activities, and the site history, anecdotal evidence and historical aerial photography confirm that the site has only been used as pastureland. The required earthworks will not expose people to contaminated soils and therefore are unlikely to give rise to any risk to human health.

The proposal does not require resource consent under or any further assessment against the NES.

5.6. National Policy Statement – Indigenous Biodiversity

The NPS for Indigenous Biodiversity (NPS-IB) was gazetted in July 2023, following the lodgement of the Application. As the site is not within an identified Significant Natural Area (SNA) in the ODP, the relevant provisions are those relating to indigenous biodiversity outside of SNAs. A full assessment of all of the provisions of the NPS-IB are set out in Attachment B, while key relevant provisions to this proposal are assessed below.

The single objective of the NPS-IB is:

The objective of this National Policy Statement is:

(a) to maintain indigenous biodiversity across Aotearoa New Zealand so that there is at least no overall loss in indigenous biodiversity after the commencement date; and

(b) to achieve this:

(i) through recognising the mana of tangata whenua as kaitiaki of indigenous biodiversity; and

(ii) by recognising people and communities, including landowners, as stewards of indigenous biodiversity; and

(iii) by protecting and restoring indigenous biodiversity as necessary to achieve the overall maintenance of indigenous biodiversity; and

(iv) while providing for the social, economic, and cultural wellbeing of people and communities now and in the future.

The key policy relating to indigenous biodiversity outside of SNAs is Policy 8:

The importance of maintaining indigenous biodiversity outside SNAs is recognised and provided for.

"Maintaining indigenous biodiversity" is defined in Clause 1.7:

Maintaining indigenous biodiversity requires:

(a) the maintenance and at least no overall reduction of all the following:

(i) the size of populations of indigenous species:

(ii) indigenous species occupancy across their natural range:

(iii) the properties and function of ecosystems and habitats used or occupied by indigenous biodiversity:

(iv) the full range and extent of ecosystems and habitats used or occupied by indigenous biodiversity:

(v) connectivity between, and buffering around, ecosystems used or occupied by indigenous biodiversity:

(vi) the resilience and adaptability of ecosystems; and

(b) where necessary, the restoration and enhancement of ecosystems and habitats.

Clause 3.16 provides implementation guidance for indigenous biodiversity outside SNAs:

(1) If a new subdivision, use, or development is outside an SNA and not on specified Māori land, any significant adverse effects of the new subdivision, use, or development on indigenous biodiversity outside the SNA must be managed by applying the effects management hierarchy.

(2) All other adverse effects of any activities that may adversely affect indigenous biodiversity that is outside an SNA (other than indigenous biodiversity on specified Māori land (see clause 3.18)), must be managed to give effect to the objective and policies of this National Policy Statement.

(3) Every local authority must make or change its policy statements and plans to be consistent with the requirements of this clause.

As set out in Ecological Assessment, the proposal is consistent with maintaining indigenous biodiversity as it will result in a net gain in biodiversity values. In addition, it will have the effect of improving the connectivity between, and therefore the resilience of, indigenous biodiversity due to the size and location of the offsetting and enrichment planning sites proposed as part of the application, as well as the ongoing protection of the remaining onsite biodiversity.

Clause 3.16 further sets out how indigenous vegetation outside SNAs is to be managed and requires that the effects management hierarchy must be applied to manage any significant adverse effects of

new subdivision, use or development on indigenous biodiversity. All other adverse effects (i.e. all those that are not significant) must be managed to give effect to the objectives and policies of the NPS-IB.

The effects management hierarchy is defined in Section 1.6 of the NPS-IB (Interpretation):

(a) ***adverse effects are avoided where practicable; then***

(b) ***where adverse effects cannot be avoided, they are minimised where practicable; then***

(c) ***where adverse effects cannot be minimised, they are remedied where practicable; then***

(d) ***where more than minor residual adverse effects cannot be avoided, minimised, or remedied, biodiversity offsetting is provided where possible; then***

(e) ***where biodiversity offsetting of more than minor residual adverse effects is not possible, biodiversity compensation is provided; then***

(f) ***if biodiversity compensation is not appropriate, the activity itself is avoided.***

The extent to which the proposal addresses (a)-(f) of the effects management hierarchy is set out in Table 9 below.

Table 9: *Assessment of proposal against the effects management hierarchy from NPS-IB*

Effects Management Hierarchy Provision	Assessment of proposal
(a) Adverse effects are avoided where practicable	• Areas of saline/soils as identified by soil scientist Roger Gibson and the cushionfields associated with these areas have been avoided. • Kānuka trees and shrubs known to be hosting the Nationally Critical pygmy mistletoe have been avoided. If any trees are consequently identified in the development area that host pygmy mistletoe, these will be flagged in advance of the works and avoided if practicable. • Areas of more mature kānuka shrubland/scrub and associated vegetation communities that are in a more advanced stage of natural succession and generally have higher ecological values have been avoided. This includes scrub in the gullies and rock outcrops with relic kōwhai. • Habitat favoured by populations of the nationally threatened Myosurus minimus subsp. Novaezelandiae and Myosotis brevis have been avoided. Habitats favoured by these plants mostly exist outside of the development area around the margins of kānuka shrubland/scrub with southerly aspects where there is minimal cover of exotic grasses and forbs. • Specimens of At Risk-Declining Olearia lineata and kowhai, matagouri and mingimingi have been avoided and clumps of porcupine shrub and korokia have been avoided owing to their scarcity at a local level, their habitat value for indigenous lizards and invertebrate fauna and their distinctiveness. • Only a few individual porcupine shrub and korokia are likely to be removed. • Stacked rock habitat of high value to lizards has been avoided and implementation of setbacks or no disturbance zones around rock outcrops and loose rock piles is proposed. • On-site quarrying of rock for road metal will be avoided. • Rock and gravel will be imported from weed free sources to avoid the introduction of new weed species.
(b) where adverse effects cannot be avoided, they	• Formulating a development design that minimises where practicable the development footprints for dwellings, curtilages, roads, water tanks,

Effects Management Hierarchy Provision	Assessment of proposal
are minimised where practicable	laydown areas, car parks and wastewater disposal facilities. The development is to be actively managed through consent notice conditions in order to minimise adverse effects on biodiversity values. No vegetation or rock outcrops shall be disturbed or removed beyond the development footprints. • Implementing site controls that require all works associated with construction of dwellings and supporting infrastructure including machinery movements and storage, laydown and parking areas to take place within construction zones clearly defined on the ground. • Clearly defining accessways on the ground to confine the movements of construction machinery and vehicles. • Prohibiting the moving or use of rock slabs for construction purposes. • Installing underground services within road footprints. • Trimming of indigenous woody vegetation where possible during construction as opposed to complete removal of trees and shrubs. • Retention of root beds of felled trees and shrubs to minimise off-site effects caused by erosion. • Siting of water and diesel tanks and other heavy construction related plant and material at designated sites to prevent damage to vegetation outside of the development footprints
(c) where adverse effects cannot be minimised, they are remedied where practicable	• Uplifting and transposing Raoulia australis cushion plants hosting pin cushion (At Risk-Declining) and transposing into cushionfield located in the mapped saline/sodic soils beyond the development area. • Creating schist rock habitats, under the supervision of a herpetologist, ahead of the development works through retrieving and hand placing of slab rocks across areas naturally impoverished of rock, on open and sunny sites, outside of high foot traffic areas and outside of building platforms and curtilage areas as well as across uphill and downhill road batters. The rocks should be stacked so that a variety of lizard cervices and basking platforms are created and protected from wet weather. Any additional specific measures required under the Lizard Management Plan will also be implemented. This may include undertaking lizard salvage and relocation. • Stacking of cleared woody vegetation around the edges of kanuka shrubland/scrub outside of the development area or in open spaces, including the offset sites (See Section 11.7) to provide additional habitat for invertebrates. • The development area shall be monitored over the duration of the works and over the duration of the maintenance period (2 years) to detect whether any problem weed species that currently do not occur on the property have been accidentally introduced to the area. All necessary steps will be undertaken to eradicate these weeds. • Ongoing weed and pest control will be undertaken by the Rocky Point service company. • Placing a ban on cats and controlling hedgehogs to reduce predation on lizards and invertebrates. • Placing restrictions on the use of herbicides and pesticide, insecticides within and outside of the curtilage areas.
(d) where more than minor residual adverse effects cannot be avoided, minimised, or remedied, biodiversity offsetting is provided where possible	• A total of 5.7ha of offset planting (as described in detail in Section 1.4.3 above) to offset the loss of kanuka and cushionfield within the development site, resulting in a net gain of indigenous biodiversity as a result of the proposal.

Effects Management Hierarchy Provision	Assessment of proposal
(e) where biodiversity offsetting of more than minor residual adverse effects is not possible, biodiversity compensation is provided	• The offsetting is addressing the residual adverse effects, however the following positive benefits are proposed in addition to the offsetting: • Land at Rocky Point outside of the development area which comprises approximately 91% of the land area of the property will be subject to a covenant requiring the protection of indigenous vegetation and habitats for indigenous fauna. • Enrichment plantings are proposed at four locations on the site that will lead to restoration of vegetation communities through reintroduction of forest and shrub species, a number of which do not currently exist on the site. • Other positive benefits arising from the ongoing management of the land as set out in Section 12 of the Ecological Assessment.
(f) if biodiversity compensation is not appropriate, the activity itself is avoided	• The biodiversity compensation proposed is appropriate.

The table above demonstrates that, following avoidance, minimisation, remediation and offsetting, there will not be more than minor residual adverse effects. However, in order to provide further positive ecological outcomes outside of the offsetting model outcomes, specific compensation measures are proposed.

Overall, the proposal in its entirety, which includes avoidance, minimisation, remediation, and offsetting measures, will result in a net gain in biodiversity values and therefore will have positive effects on indigenous biodiversity.

The proposal therefore achieves the policy of recognising and providing for the importance of maintaining indigenous biodiversity outside SNAs.

Table 10: Assessment of proposal against the policies of the NPS-IB

2.2 Policies	Assessment
Policy 1: Indigenous biodiversity is managed in a way that gives effect to the decision making principles and takes into account the principles of the Treaty of Waitangi.	While this policy is primarily a plan-making policy, tangata whenua have been engaged with via the submission process. To the extent that it is relevant, the proposal achieves the policy.
Policy 2: Tangata whenua exercise kaitiakitanga for indigenous biodiversity in their rohe, including through: a) managing indigenous biodiversity on their land; and b) identifying and protecting indigenous species, populations and ecosystems that are taonga; and c) actively participating in other decision-making about indigenous biodiversity.	While this policy is primarily a plan-making policy, Kāi Tahu whānau exercise kaitiakitaka in the Mata-Au catchment and have provided input via the submission process. The submission did not raise any specific concerns about indigenous biodiversity. To the extent that it is relevant, the proposal achieves the policy.
Policy 3: A precautionary approach is adopted when considering adverse effects on indigenous biodiversity.	The effects of the proposal on indigenous biodiversity are clearly understood. The application includes a comprehensive Ecological Assessment (**Attachment H**) that sets out the

	effects of the proposal on indigenous biodiversity in detail and concludes that there will be an overall net gain in biodiversity values as a result of the proposal. Granting the application is therefore consistent with a precautionary approach. The proposal achieves the policy.
Policy 4: Indigenous biodiversity is managed to promote resilience to the effects of climate change.	The proposal will result in a net gain in indigenous biodiversity through offsetting and enrichment planting. In addition to the protection of the remainder of the balance lot. The additional planting, plus the ongoing management of all areas, will promote its resilience to the effects of climate change (such as increases in drought occurrence). The proposal achieves the policy.
Policy 5: Indigenous biodiversity is managed in an integrated way, within and across administrative boundaries.	The site does not cross administrative boundaries. The proposal recognises the interconnectedness of the environment by providing for coordinated management of the ongoing protection of the indigenous biodiversity. The proposal achieves the policy.
Policy 6: Significant indigenous vegetation and significant habitats of indigenous fauna are identified as SNAs using a consistent approach.	The site is not within an identified SNA as defined[12].
Policy 7: SNAs are protected by avoiding or managing adverse effects from new subdivision, use and development.	The site is not within an identified SNA as defined.
Policy 8: The importance of maintaining indigenous biodiversity outside SNAs is recognised and provided for.	This policy is assessed in detail in above.
Policy 9: Certain established activities are provided for within and outside SNAs.	The site is not within an identified SNA as defined and the proposal does not involve an established activity as defined[13].
Policy 10: Activities that contribute to New Zealand's social, economic, cultural, and environmental wellbeing are recognised and provided for as set out in this National Policy Statement.	The proposal contributes to well-being through the provision of housing in a desirable location and in a manner which avoids, remedies and mitigates adverse effects on the environment. The proposal achieves the policy.

[12] **SNA**, or **significant natural area**, means: *(a) any area that, after the commencement date, is notified or included in a district plan as an SNA following an assessment of the area in accordance with Appendix 1; and (b) any area that, on the commencement date, is already identified in a policy statement or plan as an area of significant indigenous vegetation or significant habitat of indigenous fauna (regardless of how it is described); in which case it remains as an SNA unless or until a suitably qualified ecologist engaged by the relevant local authority determines that it is not an area of significant indigenous vegetation or significant habitat of indigenous fauna.*

[13] **Established** activity means*: an activity (including maintenance, operation, and upgrade) that: (a) is in, or affects, an SNA; and (b) is not a new subdivision, use, or development.*

Policy 11: Geothermal SNAs are protected at a level that reflects their vulnerability, or in accordance with any pre-existing underlying geothermal system classification.	The site is not within a geothermal SNA as defined.
Policy 12: Indigenous biodiversity is managed within plantation forestry while providing for plantation forestry activities	No plantation forestry occurs on the site.
Policy 13: Restoration of indigenous biodiversity is promoted and provided for.	The proposal restores and enhances indigenous biodiversity on the site.
Policy 14: Increased indigenous vegetation cover is promoted in both urban and nonurban environments.	The proposal will increase the indigenous vegetation cover on the site.
Policy 15: Areas outside SNAs that support specified highly mobile fauna are identified and managed to maintain their populations across their natural range, and information and awareness of highly mobile fauna is improved.	While there are currently no provisions in any plans or policy statements relating to highly mobile fauna, the site likely supports the highly mobile fauna species pīhoihoi / NZ pipit and karearea / eastern falcon (as identified in Appendix 2). In addition, the proposed ongoing management of the site's indigenous biodiversity will result in additional knowledge of the land over time. The proposal achieves the policy to the extent practicable.
Policy 16: Regional biodiversity strategies are developed and implemented to maintain and restore indigenous biodiversity at a landscape scale.	This is a policy or plan-making policy for the regional council.
Policy 17: There is improved information and regular monitoring of indigenous biodiversity.	The Ecological Assessment (**Attachment H**) sets out the effects of the proposal on indigenous biodiversity in detail and has therefore improved the available information. In addition, the proposed ongoing management of the site's indigenous biodiversity, and the sites of the offsetting and compensation planting, will result in additional knowledge of the land over time. The proposal achieves the policy to the extent practicable.

5.7. National Policy Statement – Highly Productive Land

The National Policy Statement – Highly Productive Land (**NPS-HPL**) requires that regional councils map as "highly productive land" any land in its region that is in a general rural zone or rural production zone; is predominantly LUC 1, 2, or 3 land; and forms a large and geographically cohesive area. The mapping is to be notified and when operative, territorial authorities must map the highly productive land in their districts. Until the regional council's mapping is operative, each territorial authority and consent authority must apply the NPS-HPL as if references to highly productive land were references to land zoned general rural or rural production; and is LUC 1, 2, or 3 land; but is not identified for future urban development or subject to a Council initiated, or an adopted, notified plan change to rezone it from general rural or rural production to urban or rural lifestyle.

The Manaaki Whenua mapping identifies the soils of the site within LUC 6 and LUC 7, and therefore the site does not constitute “highly productive land” under the NPS-HPL’s definition and under Clause 3.5(7)(a)(ii).

No further assessment is required.

5.8. Overall conclusion – objectives and policies of the relevant planning instruments

Based on the above assessment it is concluded that the proposal is consistent with and achieves the relevant objectives and policies of the District Plan and the relevant regional and national planning instruments.

6. NON-COMPLYING ACTIVITY - SECTION 104D ASSESSMENT

Pursuant to section104D of the Resource Management Act if a proposal is a Non-Complying activity then it must pass at least one of the tests of either section 104D(1)(a) or section 104D(1)(b) before an application can be assessed to make a decision under section 104B of the Act. If the application fails both tests of section 104D then consent cannot be granted.

6.1. Section 104D(1)(a) – Adverse effects on the environment will be minor

Section 104D(1)(a) of the Act requires that the Council be satisfied that the adverse effects of the activity on the environment will be minor, in order to grant a resource consent for a Non-Complying Activity.

Pursuant to section 104(2), when forming an opinion for the purposes of section 104D(1)(a), a council may disregard an adverse effect of the activity on the environment if the plan or a national environmental standard permits an activity with that effect.

Consent is sought for a number of activities and their effects are assessed in Section 3 above. The conclusion from Section 4 (assessment of the effects on the environment) is that the effects on the environment of allowing the proposal will be no more than minor, and factoring in the offset approach to biodiversity values, there will be significant positive effects.

The test of s104D(1)(a) is therefore passed.

6.2. Section 104D(1)(b) – Proposal will not be contrary to the objectives and policies of the District Plan

Section 104D(1)(b) of the Act requires the Council be satisfied that the application will not be contrary to the objectives and policies the relevant operative and proposed plans (where there are both).

The proposal is assessed against the relevant objectives and policies in Section 5.1 above, and in addition the assessment has been undertaken in the context of the higher order NPS-IB. That assessment concludes that the proposal is not contrary to the objectives and policies of the District Plan.

Accordingly, the proposal passes both tests in Section 104D of the Act and consent can be granted.

7. PART 2 OF THE RESOURCE MANAGEMENT ACT 1991

7.1. Section 5 – Purpose

The purpose of the Act is “to promote the sustainable management of natural and physical resources”. Section 5(2) of the Act defines “sustainable management” as:

… 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 … 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.

The proposal addresses the matters in section 5(2)(a)-(c) of the Act. The applicant has taken care to avoid or mitigate any potential adverse effects of the proposal on nature conservation values, landscape values and heritage values through the design of the proposal and the location of the identified building platforms and accessways, while giving effect to the zoning (Rocky Point Recreation Zone) and contributing to meeting the increasing needs of residents and visitors within the District.

7.2. Section 6 – Matters of national importance

In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the following matters national importance. The following matters are relevance to this proposal;

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

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;

As discussed in the Landscape Assessment (**Attachment E**) the proposal protects the values of the ONL and protects the wider indigenous biodiversity values through design and offset planting. Careful design has ensured the proposal does not constitute inappropriate subdivision, use or development of the land or impact on the historic heritage of parts of the wider site. The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga is not impacted by this proposal.

The proposal is therefore consistent with s6.

7.3. Section 7 – Other matters

The relevant matters of Section 7 of the Act that should be considered as follows:

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:

The proposal accords with the relevant matters as the development of the land for the activities recognised by the Rocky Point Recreation Zone is an efficient use of resources, while maintaining the amenity values and intrinsic values of the ecosystems. The quality of the environment is not compromised by the proposal.

8. WHERE THE ACTIVITY INCLUDES THE USE OF HAZARDOUS SUBSTANCES AND INSTALLATIONS, AN ASSESSMENT OF ANY RISKS TO THE ENVIRONMENT WHICH ARE LIKELY TO ARISE FROM SUCH USE:

Not applicable.

9. A DESCRIPTION OF THE MITIGATION MEASURES (SAFEGUARDS AND CONTINGENCY PLANS WHERE RELEVANT) TO BE UNDERTAKEN TO HELP PREVENT OR REDUCE THE ACTUAL AND POTENTIAL EFFECT:

No mitigation measures are necessary.

10. SECTION 95A ASSESSMENT AND IDENTIFICATION OF AFFECTED PERSONS

Section 95A of the RMA requires a decision on whether or not to publicly notify an application.

The steps set out below, in the order given, are used to determine whether to publicly notify an application for a resource consent.

Step 1 – Mandatory public notification

Step 1 requires public notification where this is requested by the applicant, or the application involves the exchange of recreation reserved land under s15A of the Reserves Act 1977.

In this circumstance, the applicant requests public notification. Therefore, the following further statutory steps regarding notification are not required to be further addressed or considered.

11. WHERE THE SCALE OR SIGNIFICANCE OF THE ACTIVITY'S EFFECT ARE SUCH THAT MONITORING IS REQUIRED, A DESCRIPTION OF HOW, ONCE THE PROPOSAL IS APPROVED, EFFECTS WILL BE MONITORED AND BY WHOM.

No monitoring is required apart from that normally undertaken by a Council in monitoring consent conditions.

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **1156487**
Land Registration District **Otago**
Date Issued 29 May 2024

Prior References
993471

Estate Fee Simple
Area 64.3195 hectares more or less
Legal Description Lot 1 Deposited Plan 596985
Registered Owners
TKO Properties Limited

Interests

Subject to Section 11 Crown Minerals Act 1991

Subject to Part IVA Conservation Act 1987

Irrigation Agreement under the Public Works Amendment Act 1910 (affects part formerly Lot 3 DP 353225)

836846 Land Improvement Agreement pursuant to Section 30 Soil Conservation and Rivers Control Act 1941 - 23.8.1993 at 9.46 am (affects part formerly Lot 3 DP 353225)

5009824.9 Conservation Covenant pursuant to Section 77 Reserves Act 1977 - 2.10.2000 at 2:44 pm (affects part formerly Lot 3 DP 353225)

Appurtenant to part formerly Lot 13 DP 391334 herein is a right to convey power & water and a right to occupy for bore & pump specified in Easement Certificate 5296615.3 - 26.7.2002 at 12:23 pm

Appurtenant to part formerly Lot 13 DP 391334 herein is a right to convey water created by Transfer 5296615.5 - 26.7.2002 at 12:23 pm

5439435.1 Gazette Notice declaring the adjoining road State Highway 8 to be a Limited Access Road - 18.12.2002 at 9:00 am

5700852.2 Notice pursuant to Section 91 Transit New Zealand Act 1989 - 21.8.2003 at 9:00 am (affects part formerly Lot 3 DP 353225)

5700852.3 Notice pursuant to Section 91 Transit New Zealand Act 1989 - 21.8.2003 at 9:00 am (affects part formerly Lot 3 DP 353225)

5700852.4 Notice pursuant to Section 91 Transit New Zealand Act 1989 - 21.8.2003 at 9:00 am (affects part formerly Lot 3 DP 353225)

5700864.1 Notice pursuant to Section 91 Transit New Zealand Act 1989 - 21.8.2003 at 9:00 am (affects part formerly Lot 3 DP 353225)

Appurtenant to part formerly Lot 13 DP 391334 herein is a right of way created by Easement Instrument 5905279.9 - 20.2.2004 at 9:00 am

The easements created by Easement Instrument 5905279.9 are subject to Section 243 (a) Resource Management Act 1991

Land Covenant in Transfer 6011256.3 - 20.5.2004 at 9:00 am (affects part formerly Lot 13 DP 391334)

Land Covenant in Transfer 6015512.3 - 24.5.2004 at 9:00 am (affects part formerly Lot 13 DP 391334)

6048887.4 Partial Surrender of the right to store water and the right to convey water over part herein specified in Easement Certificate 5296615.3 as appurtenant to Lot 1 DP 316124 - 21.6.2004 at 9:00 am

Land Covenant in Easement Instrument 7780662.13 - 11.4.2008 at 9:00 am (affects part formerly Lot 13 DP 391334)

Subject to a right (in gross) to convey electricity over part marked B on DP 596985 in favour of Aurora Energy Limited created by Easement Instrument 7868547.1 - 7.7.2008 at 9:00 am

Subject to a right (in gross) to convey electricity and to transform electricity over part marked A on DP 598985 in favour of Aurora Energy Limited created by Easement Instrument 7868547.2 - 7.7.2008 at 9:00 am

7988472.6 Consent Notice pursuant to Section 221 Resource Management Act 1991 - 6.11.2008 at 9:00 am

Appurtenant hereto is a right of way created by Easement Instrument 7988472.10 - 6.11.2008 at 9:00 am

The easements created by Easement Instrument 7988472.10 are subject to Section 243 (a) Resource Management Act 1991

Land Covenant in Easement Instrument 7988472.13 - 6.11.2008 at 9:00 am

10838358.3 Surrender of the right of way created by Easement Instrument 7988472.10 over part lot 4 marked A, B and C DP 396297 - 5.7.2017 at 2:31 pm

Appurtenant hereto is a right of way created by Easement Instrument 10838358.12 - 5.7.2017 at 2:31 pm

The easements created by Easement Instrument 10838358.12 are subject to Section 243 (a) Resource Management Act 1991

12117575.4 Consent Notice pursuant to Section 221 Resource Management Act 1991 - 27.7.2021 at 2:45 pm

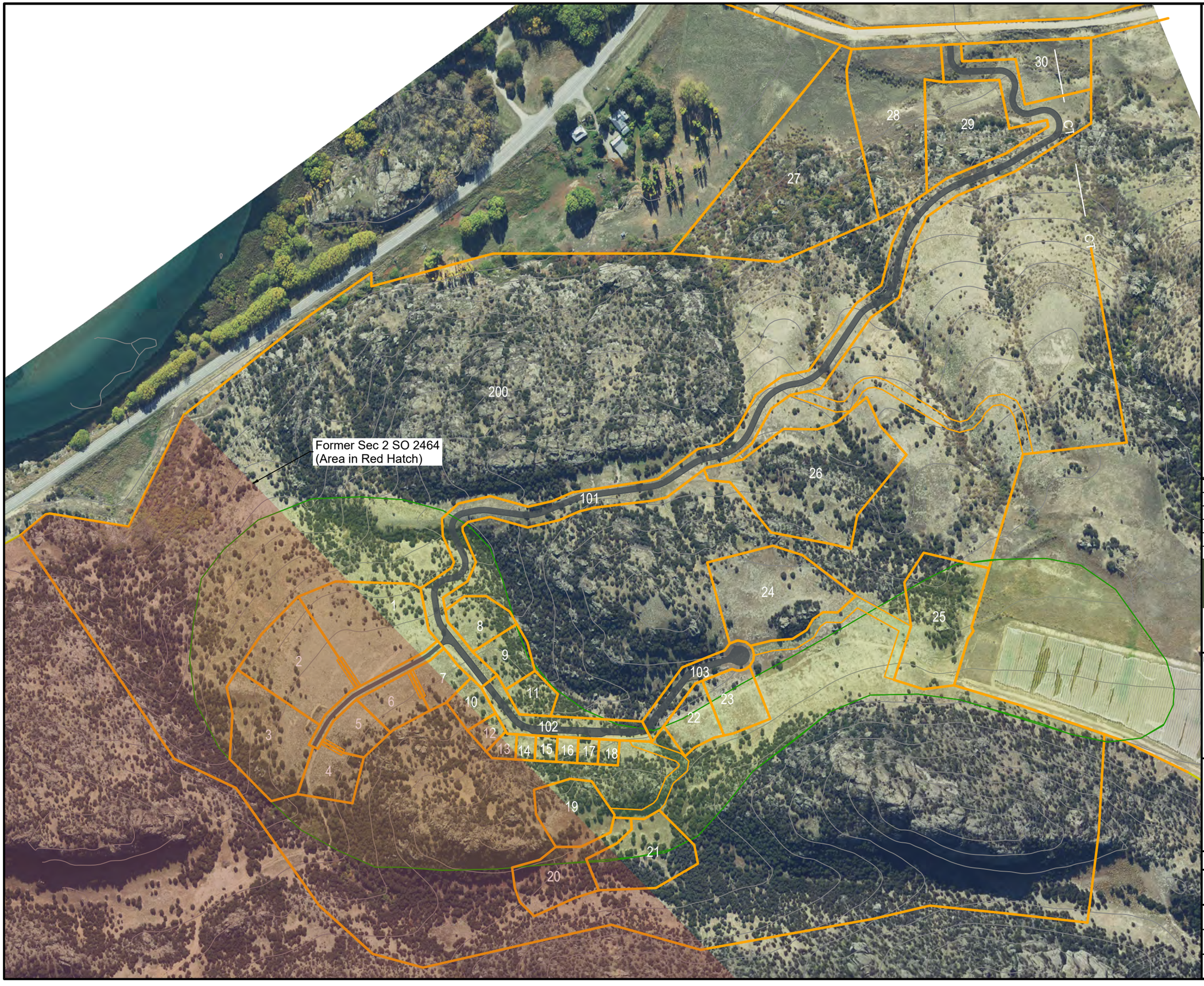
Appurtenant hereto is a right of way and a right to convey water created by Easement Instrument 12117575.5 - 27.7.2021 at 2:45 pm

12612359.5 Mortgage to Killarney Capital Limited - 5.12.2022 at 2:58 pm

12793229.1 Variation of Mortgage 12612359.5 - 1.8.2023 at 12:17 pm

Appurtenant hereto is a right of way and a right to convey water created by Easement Instrument 12965659.2 - 29.5.2024 at 11:13 am

The easements created by Easement Instrument 12965659.2 are subject to Section 243 (a) Resource Management Act 1991



Notes:

1) Lots 101-103 to Vest as Road

2) Area marked --A-- is approximate extent of area designated as "Development Area" on CODC District Plan Schedule 19:16.

3) Areas and dimensions are subject to survey.

4) Aerial image on Sheet 1 has been sourced from Landpro Ltd. Detailed aerial on Sheets 2-4 C Hughes and Assoc Ltd UAV.

5) Residential building platforms have varying sizes.

6) Refer Landscape Architect design guidelines for site coverage and other building restrictions for specific sites.

7) Lots 24, 29-30 are intended for commercial use.

8) Proposal includes minor boundary adjustment with Lot 2 DP 523873.

REVISION	DETAIL	DATE
B	Subdivision layout	29 Nov 2022
C	Layout	30 Jan 2023
D	Lots 29,30 & tracks	3 Feb 2023
E	Entrance and Lots 30-32	11 May 2023
F	Road alignments and Platforms	9 June 2023

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WANAKA
LEVEL 3, 80 ARDMORE ST
P.O. BOX 599
03 443 5052

CROMWELL
17A MURRAY TERRACE
P.O. BOX 51
03 445 0376

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Project

ROCKY POINT
TKO Properties Ltd
Overall layout

Title

Proposed Subdivision
of Lot 1 DP 596985.

FOR CONSENT

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5925	MJS	LP2000	
Drawing No:	Sheet No:	Revision:	Date Created:
W1665	1	G	June 2024

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Project

ROCKY POINT
TKO Properties Ltd
Enlargement 1

Title

Proposed Subdivision
of Lot 1 DP 596985.

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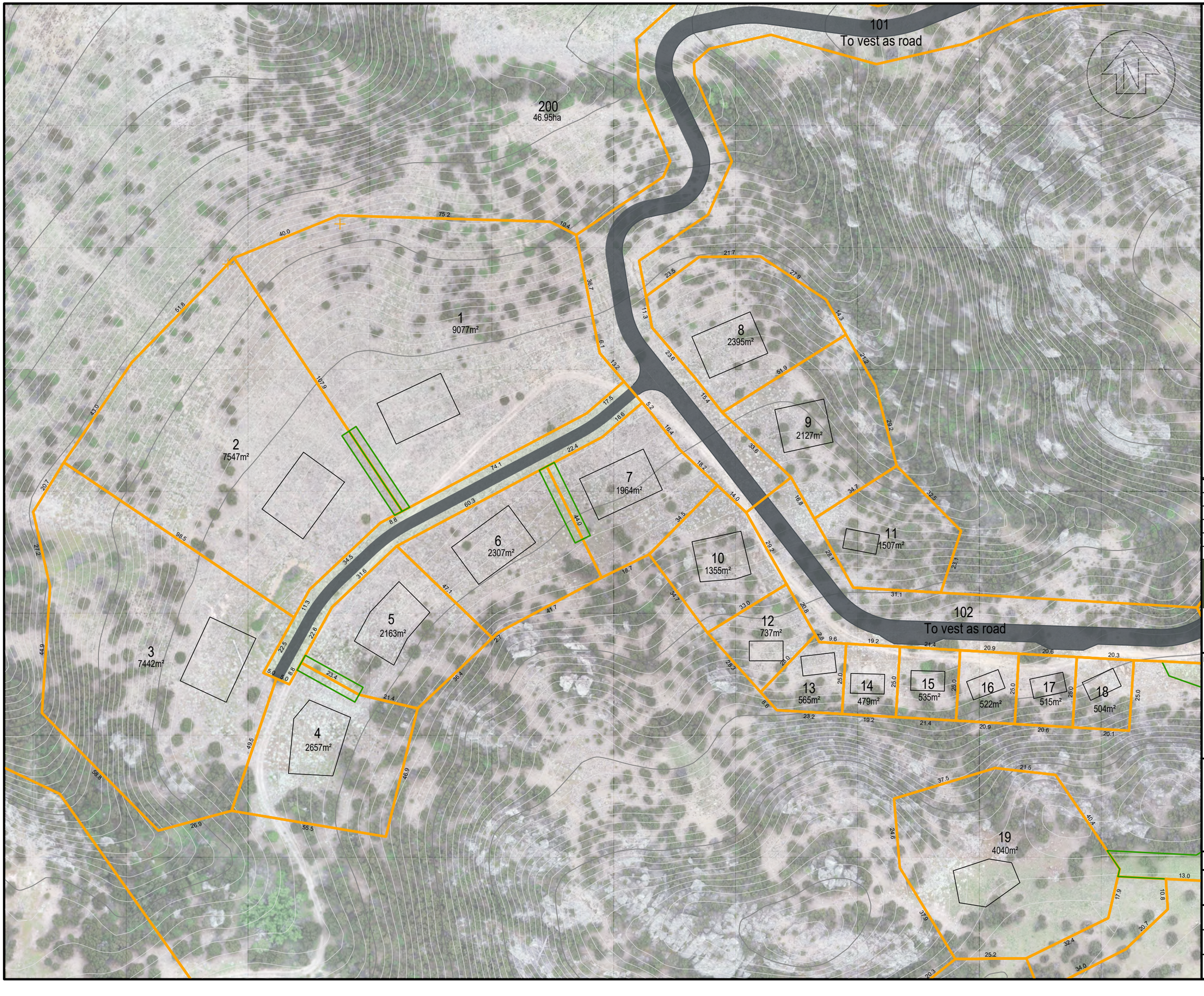
5925	MJS	LP2000	
Drawing No:	Sheet No:	Revision:	Date Created:
W1665	2	G	July 2024



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Project

ROCKY POINT
TKO Properties Ltd
Enlargement 2

Title

Proposed Subdivision
of Lot 1 DP 596985.

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Drawing No:	Sheet No:	Revision:	Date Created:
W1665	3	G	July 2024

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F	Road alignments and Platforms	9 June 203

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Project

ROCKY POINT
TKO Properties Ltd
Enlargement 3

Title

Proposed Subdivision
of Lot 1 DP 596985.

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Drawing No:	Sheet No:	Revision:	Date Created:
W1665	4	G	July 2024

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REVISION	DETAIL	DATE
B	Subdivision layout	29 November 2022

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Project

ROCKY POINT
TKO Properties Ltd
Enlargement 4

Title

Proposed Subdivision
of Lot 1 DP 561457.

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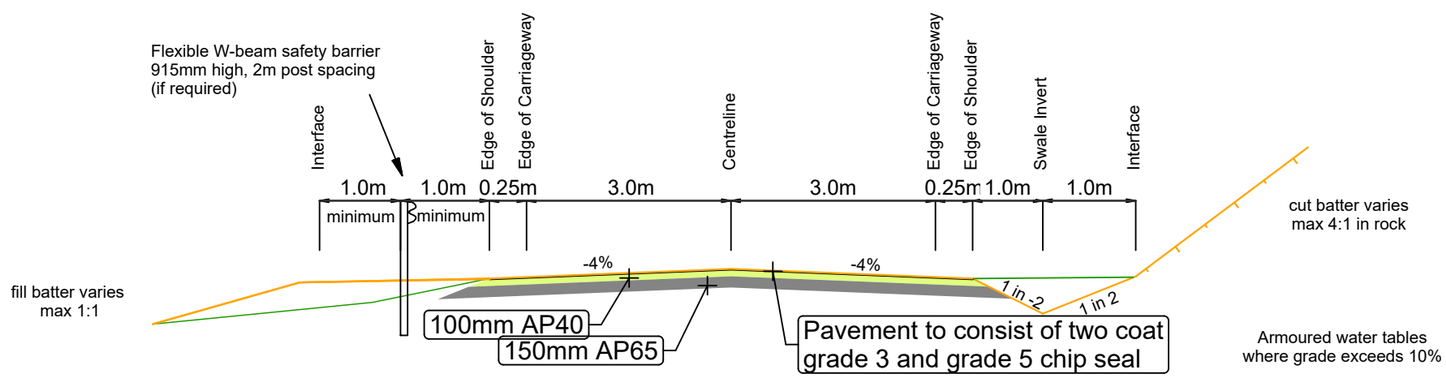
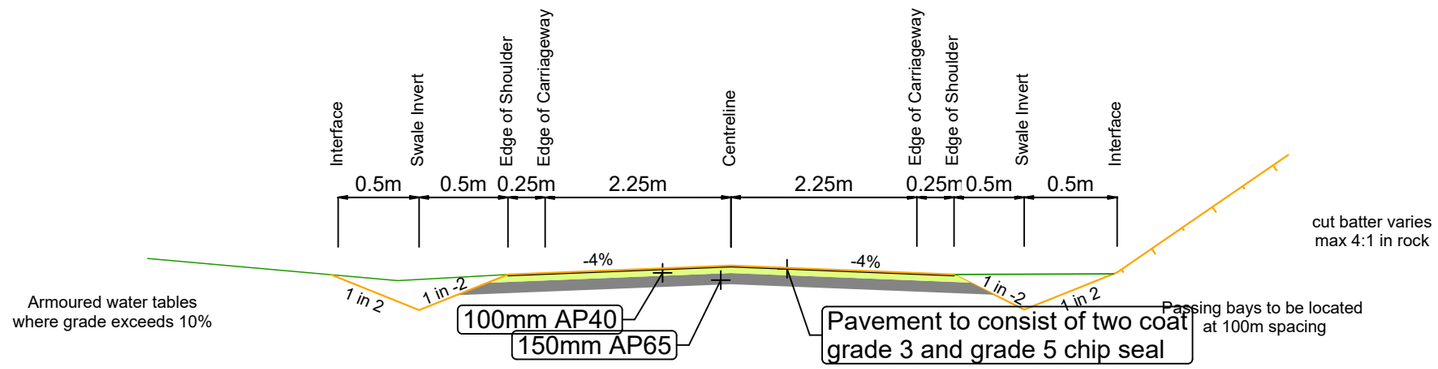
W1665	5	G	July 2024

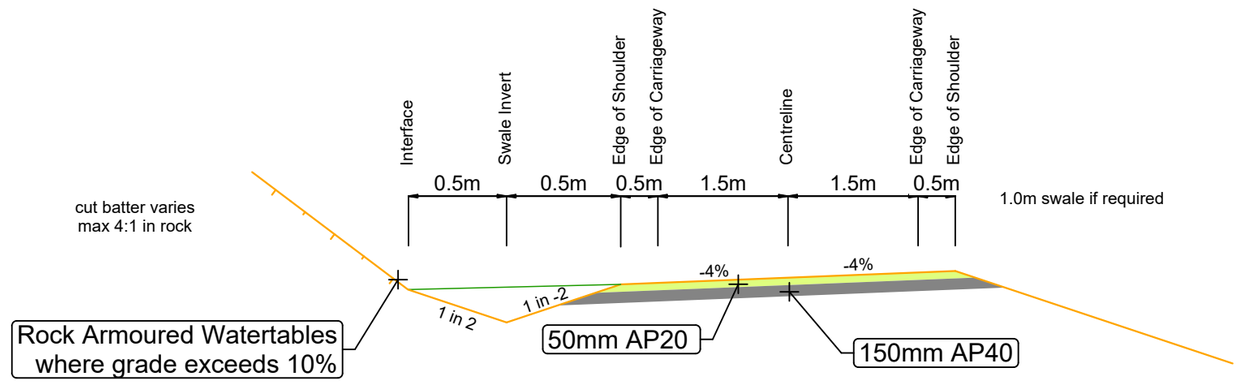


Typical Road Section 6.0m Carriageway
Road to vest
Legal width 20.00m

NOTE: Final pavement design
sunject to site specific CBR testing



Typical Road Section 4.5m Carriageway
Shared Right of Way
Legal width 10.00m



Typical Road Section 3.0m Carriageway - Single Crossfall
Unsealed Private Driveway

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REVISION	DETAIL	DATE

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Project

ROCKY POINT
TKO Properties Ltd
Cross Sections

Title

Proposed Subdivision
of Lot 1 DP 596985.
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5925	MJS	LP2000	
Drawing No:	Sheet No:	Revision:	Date Created:
W1665	5	A	March 2024

BEFORE THE COMMISSIONERS APPOINTED BY THE CENTRAL OTAGO DISTRICT COUNCIL

UNDER	the Resource Management Act 1991
IN THE MATTER	of RC230179 an application for a 33-lot subdivision at Rocky Point on Tarras-Cromwell Road (SH8)
BETWEEN	**TKO PROPERTIES LIMITED**
	Applicant

STATEMENT OF EVIDENCE OF CHRIS JENNINGS

Dated: 27/06/2024

TODD & WALKER law
LAWYERS | NOTARY PUBLIC

Solicitor acting
G M Todd / B B Gresson
PO Box 124 Queenstown 9348
P: 03 441 2743
graeme@toddandwalker.com
ben@toddandwalker.com

Statement of evidence of Chris Jennings

Introduction

[1] My full name is Christopher Gregg Jennings.

[2] I am the Senior Archaeologist of Southern Pacific Archaeological Research (SPAR), a research unit and consultancy based in the Archaeology Programme at the University of Otago.

[3] My qualifications include a BA(Hons) and MA in Anthropology from the University of Otago and a PhD from the University of Queensland. I have over 15 years of experience in the heritage sector.

[4] I am a member of the New Zealand Archaeological Association (NZAA) and currently serve as its president. I want to note that my involvement in this project predated my taking this role, and I am not representing NZAA in any capacity as part of this project.

[5] I have been instructed by TKO Properties Limited to give expert archaeological evidence regarding RC230179, an application for a 33-lot subdivision at Rocky Point on Tarras-Cromwell Road (SH8).

Code of conduct for expert witnesses

[6] While this is not an Environment Court hearing, I have read and agree to comply with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2023. This evidence is within my area of expertise, except where I state that I am relying on material produced by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope of evidence

[7] My evidence will address:

(a) my original archaeological assessment of the proposal;

(b) the archaeological matters raised by submitters; and

(c) the archaeological matters raised by the Central Otago District Council in its section 42A report.

Executive summary

[8] I have assessed the effects the proposed subdivision will have on archaeological sites present in the project area. Two sites in poor condition would be affected by the proposed development.

[9] I have reviewed the archaeological matters raised by submitters and provided a responding analysis to them.

[10] The Heritage and Archaeological Effects section of the Central Otago District Council, in its planning officer's section 42A report, is generally consistent with my recommendations for managing the project archaeology, although with a few caveats.

Archaeological assessment

[11] I have prepared the assessment report entitled: "Archaeological assessment of proposed Rocky Point Subdivision, Central Otago"

[12] This report was prepared in accordance with Heritage New Zealand Pouhere Taonga's (HNZPT) guidelines for writing archaeological assessments.

[13] Prior to field investigations, I conducted initial desk-based research for Lot 1 DP 561457 (the Project Area), the adjacent Lot 2 DP 561457, and the surrounding area. This included Geographical Information System (GIS) analysis of historical maps and aerial photographs and background historical research.

[14] Following the desktop research, I undertook a survey of the Project Area, undertaken concurrently with an inspection of Lot 2 DP 561457. This was carried out over two days on 15-16 November 2022. The archaeological survey targeted features previously identified during earlier land surveying work in the area. The survey also included a general survey of topography accessible by driving tracks throughout the two lots.

[15] Four archaeological sites were identified within Lot 1 DP 561457 during the survey and recorded on ArchSite, the NZAA national database of archaeological sites. These sites consisted of:

(a) G41/771: An earth bank feature, potentially an animal enclosure in a degraded condition.

(b) G41/772: A stone retaining wall feature in good condition.

(c) G41/773: An earth bank feature, potentially a reservoir or animal enclosure, in a degraded condition.

(d) G41/774: An area with remnants of tailings, probably indicative of minor gold workings and in poor condition.

[16] Although no evidence that would provide construction dates for any of these features was identified, they likely relate to operations on the historic Morven Hills Station and later Bendigo Station or exploratory alluvial gold mining.

[17] The potential effects related to the development of the proposed subdivision would likely include the modification or destruction of G41/771 and G41/773. This would be managed through the archaeological authority process under the Heritage New Zealand Pouhere Taonga Act (2014).

Analysis of submissions

[18] Two submissions have raised concerns related to archaeological sites in the Project Area.

[19] Submitter: Central Otago Environmental Society (COES)

(a) The COES submission stated that the assessment does not cover the effects of the subdivision on sites G41/297 and G41/19. These sites were considered in the archaeological assessment. The sites are located outside the boundaries of the proposed subdivision and not likely to be affected by any related works. One site (G41/297) is a structure recorded on the neighbouring property and was not considered further. The other site (G41/19) was

recorded using non-physical evidence (the 1863 survey map) and cannot be considered a reliable indicator of archaeological evidence.

(b) I would also note that these sites are located adjacent to the far northwest boundary of the proposed subdivision and separated from the actual lots to be built on by rocky terrain that is not to be developed.

(c) The COES submission also noted that the proposed recreational track network was not subject to an archaeological survey and that it should be archaeologically assessed for effects on remaining archaeological values. The recreational track was not specifically assessed during fieldwork as it was added in a later revision to the proposed development plan. However, the entire area was subject to GIS analysis, and parts of the recreational track network were either incidentally assessed or unable to be accessed due to vegetation.

(d) I agree that the remainder of the network could be further assessed; however, vegetation clearance would be required to inspect the entire proposed track network adequately. Archaeological monitoring could be undertaken during the construction of the tracks should they be included in the final development.

[20] Submitter: Department of Conservation (DOC)

(a) The DOC submission noted that part of the applicant has not considered that the proposed development is under a conservation covenant. This covenant, as it relates to heritage, notes maintaining the historic values of the land, as referred to in "The Rich Fields of Bendigo" by Jill Hamel (1993).

(b) Although the boundaries of the covenant were not considered in the archaeological assessment, my assessment of the values associated with the sites remains unchanged.

(c) Only sites G41/771 and G41/773 are likely to be affected by the project. Both of these sites are in poor condition due to exposure and weathering and will continue to deteriorate regardless of whether the subdivision goes ahead or not. The archaeological authority process through the Heritage New Zealand Pouhere Taonga Act (2014) allows for these sites to be recorded in detail (i.e. mapped, photographed, etc) at a point prior to continued deterioration, effectively preserving them by record.

(d) Only two of the four sites are enclosed within the boundaries of the covenant, G41/771 and G41/772. Neither was included in Hamel's report, and only G41/771 is likely to be affected by development related to the project. This site is in poor condition and will continue to deteriorate due to natural weather processes.

(e) The DOC submission (point 9) states that the proposed methods to avoid, remedy or mitigate adverse effects on the historic heritage are sufficiently appropriate to address the adverse effects. However, without intervention, these sites will continue to degrade further.

(f) These features have little in the way of amenity value, and I believe that their archaeological information potential would be best preserved by record. ArchSite, the New Zealand Archaeological Association's national inventory of archaeological sites, retains information on destroyed sites, so any contextual value of these features would not be lost.

Response to planning officer's section 42A report

[21] The 42A planner's report notes that G41/771 is in "fair" condition. This was a data entry error on my part when creating the ArchSite record under the "Statement of Condition" section (a drop-down menu with limited options). The assessment report (Section 5) noted the banks as degraded and the condition of this feature as "poor" (Section 6, Table 1), which was the intended assessment of the site's condition.

[22] The 42A planner's report has a footnote (13) on page 30, for G41/774, noting that the potential site area extends into the adjoining gullies. This is indeed the case, as the point (blue star) on ArchSite refers to a single coordinate for the relocation of the site.

[23] I agree with point 6.86 of the section 42A report that suggests it would be appropriate to adopt an accidental discovery protocol (ADP) to manage unidentified archaeological material that may be present within the Project Area.

[24] Section 6.89 of the report indicates that covenant the planning officer considers the recommendations I proposed in the assessment to be inadequate to address the values of item G41/771 due to its location within the DOC covenant area. I would like to note that:

(a) This site was not specifically named or included in the criteria for the covenant, and my assessment indicates it is in poor condition and has limited information potential.

(b) The covenant, while protecting it from development impacts provides no additional ongoing measures of protection. Without intervention this site will continue to degrade from exposure to weather and vegetation growth.

Conclusions

[25] Four archaeological sites were recorded within the Project Area during the archaeological assessment. Of these four, only two are likely to be affected by development of the subdivision, G41/771 (earth bank feature) and G41/773 (earth bank feature). Both of these sites are in poor condition and degrading.

[26] G41/771 and G41/772 are located within a DOC covenant affording them protection from development in addition to protections of pre-1900 sites under the Heritage New Zealand Pouhere Taonga Act (2014). This covenant does not provide management for the ongoing preservation of the sites.

[27] Although G41/771 is located within the boundaries of the covenant, the site will continue to degrade without intervention. Detailed recording of the site prior to further development or degradation is an appropriate response, effectively preserving the site "by record." This would also be appropriate for site G41/773, not within the covenant boundaries.

[28] Modification or destruction of archaeological sites is regulated through the authority process under the Heritage New Zealand Pouhere Taonga Act (2014).

LANDSCAPE ADDENDUM REPORT

BAXTER DESIGN GROUP

Introduction

1. In this addendum I update the landscape assessment previously undertaken and address matters raised in the original Sec 42a report prepared for this application.

2. In describing the potential scale of adverse effects, I refer to the NZILA scale of effects, attached to this as my Appendix B

Involvement in the Project

3. I have been involved with this project since November 2021. I am very familiar with the site and surrounding landscape. The role of Baxter Design during the consent application involved providing masterplanning, detail layouts of the proposed residential building platforms ('RBP's'), creating appropriate design controls and undertaking a landscape assessment of the potential effects of the proposed subdivision.

4. The following attachments are included in my addendum:

Attachment A:	Revised Scheme Plan	*Baxter Design - 4371-SK125*
Attachment A1:	Summary of Changes	*Baxter Design - 4371-SK135*
Attachment B:	District Plan	*Central Otago District Council*
Attachment C:	Schedule 19.16	*Central Otago District Council*
Attachment D:	Existing Landscape Component Analysis	*Baxter Design - 4371-SK58*
Attachment E:	Lots 1 - 18 – Site Plan	*Baxter Design - 4371-SK130*
Attachment F:	Lots 19 - 21 – Site Plan	*Baxter Design - 4371-SK131*
Attachment G:	Lots 22 - 25 – Site Plan	*Baxter Design - 4371-SK132*
Attachment H:	Lot 26 – Site Plan	*Baxter Design - 4371-SK133*
Attachment I:	Lot 27- 30 – Site Plan	*Baxter Design - 4371-SK134*
Attachment J:	Photo Location Map	*Baxter Design - 4371-SK41*
Attachment K1:	Landscape Assessment Viewpoint 1	*Baxter Design - 4371-SK42A*
Attachment K2:	Landscape Assessment Viewpoint 2	*Baxter Design - 4371-SK42B*
Attachment K3:	Landscape Assessment Viewpoint 3	*Baxter Design - 4371-SK42C*
Attachment K4:	Landscape Assessment Viewpoint 4	*Baxter Design - 4371-SK42D*
Attachment K5:	Landscape Assessment Viewpoint 5	*Baxter Design - 4425-SK42E*
Attachment K6:	Landscape Assessment Viewpoint 6	*Baxter Design - 4371-SK42F*
Attachment K7:	Landscape Assessment Viewpoint 7	*Baxter Design - 4425-SK42G*
Attachment K8:	Landscape Assessment Viewpoint 8	*Baxter Design - 4425-SK42H*
Attachment K9:	Landscape Assessment Viewpoint 9	*Baxter Design - 4425-SK42I*
Attachment K10:	Landscape Assessment Viewpoint 10	*Baxter Design - 4425-SK42J*
Attachment L:	Scheme Plan	C H Hughes & Assoc
Attachment M:	Rocky Point – Schedule of Lots	*Baxter Design - 4371-SK129*
Attachment N:	Ecology Mapping	*Baxter Design - 4371-SK127*

SUMMARY OF AMENDMENTS TO THE APPLICATION UNDERTAKEN POST APPLICATION

5. Following receipt of the original Council Sec 42a report amendments and submissions to the application have been made. These can be summarised as such:

- The reduction of the overall number of lots on site from 33 to 30,
- The building platforms Lots 1 – 9 have been reduced in size and locations adjusted to more appropriately sit in the landscape. The reworking of these platforms reduce the required earthworks required to achieve the prescribed RLs,
- An additional lot, Lot 10, has been proposed as an alternative to the previous Lot 14 to provide a building platform that requires less earthworks and further avoids potentially sensitive visual receptors,
- The 'Cabins' have been rearranged to avoid unnecessary removal of Kanuka and provider a tighter footprint by aligning the aspect of each cabin,
- Lots 21 and 22 have been proposed as an alternative to the former Lots 27 and 30 in an area of the site with no sensitive visual or ecological receptors,
- Lots 23-25 from the former scheme plan have been removed to ensure no development is proposed on ecologically sensitive saline soil environment,
- Proposed residential lots along Bendigo Loop Road have had the proposed building platforms and curtilage areas reduced with building platforms re-arranged to be more sympathetic to the existing topography. An additional residential lot has also been proposed along Bendigo Loop Road,
- The proposed hospitality lot (Lot 30) along Bendigo Loop Road has been moved further east, to increase the distance to existing residential dwellings,
- A public walking track and carpark has been proposed to increase public walking access to both key viewing points within the site and provides the opportunity for interpretative signage to share the cultural and ecological history of the site.
- From the previous scheme, Lots 14, 23, 24, 25, 27, and 30 have been removed.
- The Design Control document (Attached to this addendum as Appendix A) has been reviewed and updated to further control the form and materiality of built form within the site,
- The permitted dwelling sizes are set out on Appendix A, described by way of site coverage on Residential Building Platforms (RBP's). In general, the permitted size of dwellings has been substantially reduced and none have been increased.
- More clarity and definitions have been included in the Design Control document, in regards to what is permitted in regards to all building form, scale, colour and claddings.
- The definition of 'Curtilage Areas' and what is permitted within those areas, has been clarified and defined.
- Building from heights for Lots 1-10, 25 and 26 have been restricted to a monopitch roof sloping from a maximum of 3m to a maximum of 3.8m. These heights have been selected to give the built form a 'low an long' form blending with the colours and topography of the hillside.
- In regards to the monopitch ('flat') roofs permitted on the aforementioned lots, the required orientation and slope of those roofs has been appended on the Attachments
- Lots 19-23 are restricted to a gable roof form with a maximum roof height of 4.5m
- Lot 24 – the communal/commercial building – has design controls to ensure its overall form is that of a typical farm building, with a limited cladding form a gabled form and a maximum height of 4.5m

- The residential lots along Bendigo Loop Road are limited to a maximum height of 5.0m with a gabled form
- Additional rules on verandas, decks, and curtilage areas have been detailed in Appendix A

BACKGROUND

6. Under the Central Otago District Plan, the site sits within the Rural Resource Area 2 and subject to the Rocky Point Recreation Zone and Landscape Protection Area (Concept Plan in Schedule 19.16)". Under Section 4, the District Plan describes the Rural Resource Area as:

   "*The Rural Resource Area comprises the rural environment of the District. This area has been identified as distinct from the urban areas of the District on the basis of its environmental character. The amenity values of the rural environment are dominated by Central Otago's unique, semi-arid landscape of broad basins separated by low mountain ranges with sparse vegetation, covered in tussock grassland and exotic pasture, and broken by schist rock outcrops. District Plan as an outstanding natural landscape or outstanding natural feature. These values can be enhanced by human made elements which include orchards and vineyards; homesteads accompanied by stands of trees (often poplars); remnant stone cottages; small irrigation and stock water dams and water races; energy generation facilities; and shelter belts of trees."*

7. A portion of the site sits within an Outstanding Natural Landscape (ONL) overlay identified as elevated areas providing a visual backdrop to Lake Dunstan near Bendigo. The ONL sits outside the Rocky Point Recreation Zone as shown in the Concept Plan in Schedule 19.16.(Refer Attachment B).

8. Section 4.2 of the District Plan outlines significant resource management issues of the Rural Resource Area. The most relevant points are 4.2.1 Outstanding Natural Landscapes and Outstanding Natural Features, 4.2.2 "Central Otago's Unique and Distinctive landscape" and 4.2.15 "Development in Rural Areas." This Landscape Assessment addresses the proposed additional development in the context of these key sections of the District Plan.

DESCRIPTION OF THE WIDER LANDSCAPE + SITE

9. For this application, the 'site' refers to the area in and around the 'Rocky Point Recreation Zone' (approximately 18.2ha), identified on schedule 19.16 of the Central Otago District Plan, and located on Lot 1 DP 561457 (Refer Attachment B and C).

DESCRIPTION OF THE WIDER LANDSCAPE

10. The site is located on the lower western slopes of the Dunstan Mountain Range, approximately opposite the point at which the Clutha River flows into Lake Dunstan, at the south end of a broad valley/basin landscape (Refer to Attachment A) that extends north beyond Tarras. The site is located approximately 13.5km north of Cromwell and 15km south of Tarras.

11. To the north of the site the landscape character is largely an open pastoral landscape, within a valley landscape that includes the land east of the Pisa Mountain Range, extending across the Clutha River to the Dunstan Mountain Range and up the Tarras 'valley'. This landscape is occupied by a mix of pastoral and intensive farming, including viticulture, traditional grazing and dairy farms. Large pivot dairy irrigators

substantially cover this flat landscape The Clutha River sits within an incised river terrace, west of the site. Residential dwellings and agricultural buildings are scattered throughout that open flat pastoral area to the north and northeast of the site.

12. To the east of the site is the area known as Chinaman's Bluff. Located at the southern end of the flats described above. The 'Chinaman's Bluff' locale / landscape describes that rolling terraced landform that extends approximately 6.5km east from the site, south of Bendigo Loop Road. The landscape character here is one of an intensively developed viticultural landscape occupying the terraces and north facing escarpments at the foot of the Dunstan Range, one of the larger viticultural areas in the southern lakes / Central Otago area, reputably producing some of the highest quality wine in the region.

Google Earth Screenshot 2023 showing viticultural development along Chinaman's Bluff East of Site

13. The landscape character of the western lower slopes of the Dunstan Mountain Range, within which the site is located, retains a relatively natural character, flanked by the Chinaman's Bluff viticultural landscape to the east and the development adjacent to Lake Dunstan, south of the site.

14. South of the site the landscape character is characterised by relatively steeply rising land above the lake, clad in predominantly Kanuka scrubland with occasional rocky cliffs and outcrops amongst historic river terraces. Development and man-made modification of that landscape is mostly contained to the lower foothills and flats along the eastern edge of Lake Dunstan, on the lower slopes of the Dunstan Range foothills. In the last 10 years there has been considerable modification undertaken within that landscape, including gravel roads, extensive viticulture, small scale communal development, scattered lifestyle residential development and public recreation areas.

15. The residential dwellings described above are typically found on the flat open terraces between vegetated gullies, rocky outcrops, vineyards and rural development. Access to that development from the State Highway winds up a mix of sealed and gravel roads. The principle residential developments include Bendigo Downs and The Boulders, with large-scale sections and defined building platforms. A large distillery complex is also currently under construction in this landscape. The architecture of residential dwellings is consistent in their bulk, location, material and colour palettes, with the use of steel, concrete,

glazing, and natural stone utilised on the façades of buildings. Colours are typically dark and of a low reflective colour, with these dwellings blending recessively into the surrounding vegetation and stone outcrops. This is an expected outcome of considered development within an Outstanding Natural Landscape and is appropriate in that landscape.

16. Directly west of the site, over SH8, is Lake Dunstan, including the lake and the outlet of the Clutha River at the head of Lake Dunstan, where the Clutha River transitions over a wide delta into the north end of the lake.

17. Further west of the site, across Lake Dunstan, the landform rises up away from the lake edge, onto flat pastoral land, predominantly in rural and viticulture land use directly across from the site, with established lakeside residential development. That landform transitions west to hills that become progressively steeper and more rugged, up to the Pisa Range tops. That open pastoral landscape provides a visual contrast to the brown, semi-arid hills which form an integral part of the enclosing visual character of the surrounding landscape.

18. The landscape character of the wider Dunstan Range is characterised by rocky outcrops, dense swathes of Kanuka that follow natural gullies and minor ridgelines within the landscape, with a simple vegetative cover sculptured over time by a low rainfall and exposure to prevailing winds.

DESCRIPTION OF SITE CHARACTER (refer Attachment D)

19. The site is located southeast of the intersection of Bendigo Loop Road and SH8. The site is currently accessed from the north from Bendigo Loop Road, off State Highway 8, via a gravel farm track rising from the basin floor, up to the lower slopes and up to the general location of the proposed development and from the south, via a roughly formed farm track north of Lakefront Terrace.

20. In general, the landscape character of the site is highly complex and displays a mix of rocky outcrops, steep escarpments, steep gullies, rock fields, plateaus and valleys, all with a mix of vegetative cover that is generally consistent over the site, defined by a limited selection of species.

21. To assist the description of the landscape character of the site over such a complex landscape, this report reduces the site landscape into identifiable components, as shown on Attachment D. The landscape character of those components are described below:

22. The Rolling Flats: The lower part of the site, adjacent to Bendigo Loop Road, is a small landscape component, comprised of a series of minor terraces, adjacent to the road. Vegetative cover is sparse over this landscape, a mix of scattered Kanuka and Sweet Briar, indicative of the site's overall dry, arid nature, with small grassland species, cushion plants, and minor rocky outcrops covering the landscape, with small scrubland species within the narrow gullies. The topography rises sharply up to the south from this landscape.

23. Kanuka Escarpments: This is relatively steep land, flanking the flats described above, a series of small ridges and gullies covered in a mix of Sweet Briar and Kanuka, with exposed ridges on the upper portion of this component.

View Looking South the 'Elevated Rock Knoll' from SH8

24. Elevated Rocky Knoll: This is a significant component the wider site landscape character, being the bulk of the northern portion of the site and the eastern 'bookend' of the Dunstan Range landscape and its confluence with Lake Dunstan. The landscape character of this component is defined by steeply rising landform, with a consistent cover of Kanuka amongst broken rock forms, rock outcrops and in general an natural, unmodified craggy landscape

View from SH8 towards lower slopes of Elevated Rocky Knoll from SH8 (source: Google Maps)

25. Minor Ridgelines and Gullies: Located above the Kanuka Escarpments described above, this landform transitions onto a larger series of ridge and gulley. Kanuka cover is considerably less here (possibly removed for grazing purposes) as the grade decreases. The open portions of this landscape cover are covered in a mix of native and exotic grasses, with swathes of cushion plants, the Kanuka cover largely restricted to the gullies.

26. Upper Valley: This landscape component crosses the site east to west, connecting the Plateau to a smaller flat area on the eastern boundary of the site and out to the wider vineyard landscape above Bendigo Loop Road. This valley sits between two significantly large elevated rocky knolls and a hillocky landform. The eastern end of the valley landform opens up to terraces adjacent to the site, those terraces largely developed for viticulture and extending east from the site. This valley is largely screened from wider views by enclosing landform to the north and south. Vegetation cover within the valley is sparse, with the predominant cover being small species of grass and cushion plants, flanked by Kanuka-covered escarpments, gullies and slopes that frame it. A farm access track runs through the valley, a continuation of the farm track described above, continuing to the eastern boundary of the site. This valley encloses to the west, dropping down to The Plateau described below.

Elevated view across Upper valley looking north

27. The 'Plateau': This landscape component is a substantial natural plateau, located on the western edge of the site. The landform of The Plateau drops gently to the west across the upper open potions of the plateau, before dropping steeply towards the State Highway and Lake Dunstan. The Plateau is visually and physically bordered by two densely vegetated Kanuka gullies. The Plateau is sparsely covered in vegetation, with the vegetation cover including largely in cushion plants. This plateau views west across Lake Dunstan and the Clutha River Delta, towards the Pisa Range. Vegetative cover increases as the land slopes down to the west, with dense Kanuka in gullies and around the larger rocky knolls. A vehicle access track and electrical transmission lines run southwest to northeast across the plateau.

View Looking Southwest Across Plateau

Drone Photo looking east over the Plateau and Upper Valley (top left-hand corner of photo)

28. Minor Southern Valley: This landscape component is located south of the landscape component described above as the Upper valley. This small landscape is a relatively small flat, enclosed by rising land to the south and dropping down to the Upper valley to the North. The landform is relatively flat across with open areas of grass and sweeps of Kanuka within and enclosing. The landscape character of this area is relatively small and intimate in scale. There is no evidence of human modification within this area, aside from grazing and the landscape character is remains relatively natural.

Photo looking east over Minor Southern valley

29. Elevated Rocky Knolls: Located on the southern portions of the site two knolls provide significant landscape features. These landforms are abrupt with steely rising faces, clad in a continuous Kanuka cover with rocky outcrops, ledges and striated rock form visible. The western Rocky Knoll is the larger of the two, being a highly visible landscape feature from views further afield. The larger of the two rocky knolls is visible in the centre of the above photograph.

30. In general, the landscape of the site described above occupies the lower half of what is known as the Dunstan Range. The Dunstan Range stands as the dominant visible background to the site, with a distinctive and abrupt ridgeline visible from most northern views. In general, the site is around 400m above sea level, with parts of the Dunstan Range ridgeline rising up to 950 – 1000m above sea level.

OVERALL SITE LANDSCAPE CHARACTER

31. In summary, it is likely that some Kanuka removal has been undertaken over time for the purpose of grazing however the site retains a distinctive natural landscape character, with a low level of human modification. The site remains reasonably rugged in character with the landscape forms of gullies, minor ridges, and rocky knolls throughout the entire site providing a strong cohesive landscape that is easily identifiable. The more exposed rocky knolls and lower minor ridges have an arid and exposed natural character. Low lying areas and valleys within the site are sheltered from wider views by large rocky knolls and dense Kanuka vegetation, giving some parts of the site a more locally 'enclosed' character. The predominant vegetation pattern found throughout the site is Kanuka, with other smaller scrubland species such as Dog Rose (*Rosa canina*) and Matagouri (*Discaria toumatou*) evident, with some areas of the invasive weed species Sweet Briar evident on the lower northern slopes. Smaller grassland species and cushion plants are found through the site where areas of the landform are more exposed, such as minor ridges and flats. Man-made modification on the site is restricted largely to rough vehicle tracks, electrical transmission lines, historic kanuka clearance and farm fencing on boundaries.

DESCRIPTION OF THE PROPOSAL (refer Attachment C)

32. The application seeks to subdivide Lot 1 DP 561457 into 30 lots containing RBP's and a further balance allotment. A Scheme Plan for this subdivision was prepared in January 2023 by CHA Surveyors (Refer to Attachment L). These lots and their respective areas, building platform areas, and site coverages are summarised in Attachment M.

33. The proposed development is largely contained within the area known as the Rocky Point Recreation Zone in the Central Otago District Plan aside from building platforms located within proposed Lots 20, 21, 24, 26-30.

34. Of the 30 proposed lots containing dwellings / buildings, these can be further described as:

    - 20 residential allotments with specified RBP's on proposed Lots 1-10, 19-23, 25-29;
    - 8 small residential allotments (referred to as 'cabins' in this addendum and the Design Control documents), with specified RPB's on proposed Lots 11-18 and;
    - A single communal facility on a specified RBP on proposed Lot 24
    - A hospitality development on Lot 30

35. In general, the character of the proposed development, the location of the future dwellings and other structures respond to the site character and a requirement to maintain and protect the existing landscape character and landscape values of the site. No lot boundaries will not be evident on the site on completion as each lot will have a designated RBP. To that end, where appropriate, the proposed RBP's are not all rectangular in shape, with several being crafted to fit the landform within which they are to be located and to that end, the size of the proposed RBP's will vary according to the landform they sit in.

36. Within the Attachments attached to this report are plans for each development area as set out below, with an indicative masterplan for each area described and a plan showing proposed earthworks and building platforms (residential and communal).

37. The overall character of the proposed development will be one of appropriately scaled and clad dwellings and communal facilities located within a natural landscape, avoiding the usual trappings of traditional

rural-residential development. The principal components of the proposed development can be summarised as follows:

- All proposed future dwellings are to be located on level RBP's on prescribed and approved landform shape.
- The locations of all proposed future dwellings and communal facilities have been selected to minimise potential adverse effects and to maintain the landscape character of the site.
- All structures will be subject to Design Controls, specifically crafted to address and maintain the existing site character. The purpose of these controls will be to facilitate a contiguous and appropriate architectural and landscape outcome (both in form and scale) over the site.
- As part of the Design Controls roof shape Attachments E-H show, on each RBP, the orientation of the monopitch (flat) roofs.
- Land-shaping works are proposed on all development areas (refer to Attachments E-H), to enable flat building areas. The scale, shape and form of these earthworks have been designed to minimise disturbance to the wider landscape character and to enable a clear picture of the proposed form of the development.
- The traditional trappings of development such as residential fencing, large scale ornamental planting and domestic gardens etc. will be restricted by way of proposed design controls
- Kanuka will be maintained as the predominant tree species in order to maintain the existing landscape character and to avoid any reduction in the existing vegetative cover that forms a significant part of the landscape character of the site. Additional planting species have also been selected by an ecologist to support the

38. The areas and 'groups' of the proposed development are described below:

39. Proposed lots 1 – 10 (refer Attachment E): Residential dwellings are to be located on the western edge of the site on the 'plateau' landscape described above. The proposed 10 lots have been arranged to follow the existing contours of the plateau site, located generally at the rear, and avoiding the steep drop off of the plateau that extends to the southwest within the zone. Proposed Lot 1 has a residential building platform (RBP) of 400m^2, Lots 2 and 3 have a building platform (RBP) of 450m^2, proposed lots 4, 5, 6, and 7 have RBPs of approximately around 400m^2 , varying slightly as the RBPs have been shaped to follow the underlying landform. Proposed RBP 8, 9, and 10, are to be 360m^2, 373m^2 and 279m^2 respectively, reflecting the landform on which these are to be located.

40. As with all proposed RBP's, these lots will have a level building platform and prescribed datum ensuring that built form is appropriately located within the landscape. Earthworks for lots 1-10will be done prior to title. (Refer to Attachment E). Within this area of development, as with other areas, additional Kanuka planting is proposed and, where small areas of Kanuka are to be removed for the purpose of shaping those RBP's, new Kanuka planting will be undertaken to match or exceed the loss of existing Kanuka. Additional Kanuka planting is also proposed between and around proposed RBP's for the purpose of mitigation, privacy and overall amenity. It is noted that from a fire management perspective, there are limited areas where replanting can practicably occur.

41. A single private road will access proposed Lots 1-6, running along the contour and joining with the principal access road at the western end of this 'cluster' of dwellings, being effectively a cul – de sac.

42. Domestic activities will be contained by way of defined curtilage areas. As with many of the proposed lots, the title boundaries extend often well past proposed curtilage areas. Therefore, within the proposed title boundaries, the extent of domestic activity is clearly defined, with protected areas of Kanuka and landscape occupying substantial portions of the titles.

43. Amendments to Proposed Lots 1 – 10 following application: Several matters in regards to the claddings and extent of glazing were raised in the CODC planning officer's report[1] in regards to Visual and Landscape effects. To address those concerns the proposed Design Control documentation has been revised and attached to my addendum as Appendix A. The amendments for proposed lots 1-10 contained in the Design Controls include:

    - Clarity in the proposed dwelling sizes by way of site coverage, reducing the permitted building footprints to that described in the Design Controls, with Lots 1 – 7 permitting a maximum dwelling size of exceed 220m^2, Lots 8 and 9 permitting a maximum dwelling size of 200m^2 and Lot 10 permitting a maximum lot size of 150m^2.
    - Dwelling form and height to still maintain a monopitch form, sloping towards the northwest, with the lower elevation at 3 metres in height sloping up to 3.8 metres in height at rear.
    - A glazing restriction on the north-western elevation of 60% of that elevation.
    - A reduction in curtilage areas and building platforms on the previously proposed Lots 1-9 has realigned these lots with the underlying landform, reducing the overall required earthworks aiding in blending the built form with the surrounding landscape.

44. Proposed Lots 11 – 18 (refer Attachment E): Accessed from the northwest from the road climbing up from proposed Lots 1-10, the Proposed RBPs for lots 11-18 are substantially smaller in size than others (all RBPs for 11-18 being 84m2 in size, 7 x 12m). These allow for a cluster of small 'cabin' styled dwellings to be located within this part of the site. These lots are to be located on the southern side of a small valley (being the western end of the Upper Valley described above). From a landform perspective, this area of the site is discrete, and screened from wider more distant viewpoints.

45. Dwellings on proposed Lots 11-18 will differ from the larger stand – alone residential dwellings on other lots in that these structures (cabins) are to be built on piles only, touching the land more 'lightly' than the larger residential dwellings on the Plateau and Upper Valley Areas. Carparking will be located immediately adjacent to the access road only, with access to the cabins by paths. Proposed curtilage restrictions within this cluster of chalets are more restrictive, largely preserving the natural landscape and prohibiting gardens, fencing and suchlike.

46. Amendments to Proposed Lots 11-18 following application: The Design Controls (Appendix A) for these 8 cabins are tailored to the site and the desired outcome. These lots have all been adjusted to reduce impacts on existing Kanuka. The proposed design controls specify weatherboard clad structures with gabled roof forms and allow for a limited amount of decking around the structures, outside of the platforms. These lots have no curtilage area and are only permitted a deck out no more than 2.5m from the front of the cabin, restricting the impacts on surrounding vegetation whilst providing a practicable outdoor living area.

[1] Central Otago District Council – report of Planning Officer Paras 6.11-6.23

47. Proposed Lots 19-21 (refer Attachment F): The dwellings on proposed Lots 19-21 are standalone dwellings located on relatively flat land, accessed from the north from the principal access road that extends through the Upper Plateau.

48. The proposed RBP on Lot 19 is also to be located on a relatively open saddle landform with the RBP tailored to fit the site landform located within a small 'valley' form between 2 knolls which rise approximately 8-10 metres to both the west and east side of this plateau.

49. The proposed RBPs on Lots 20 and 21 are located within the minor southern valley also access from the north from the principle access road, The RBPs have been located on large flat areas within the valley with the proposed RBPs shaped to align with the existing topography to further minimise earthworks. These proposed RBPs have been located in an area of the site which has no visually sensitive receptors, being screened by the surrounding ridges from wider views.

50. Amendments to Proposed Lots 14 and 20 following application: Lot 14 has been removed from the original application, being replaced by a new Lot 10. Lot 20 has been renumbered to Lot 19. Two additional lots (Lots 20 and 21) were added nearby in the rear southern valley. The RBP for Lot 19 (former Lot 20) has been adjusted to tightly follow the existing sire conditions including avoiding existing rocky outcrops. Its size was adjusted to 272m^2 with 91% site coverage, giving clarity to the exact location and size of future dwellings on these lots.

51. Proposed Lots 22, 23 and 25 (refer Attachment G and H): Accessed from the west, from a road continuing up the 'valley' from Lots 1-19, 3 residential dwellings are to be located along the southern edge and eastern end of the Upper Valley. The proposed RBP's will be shaped into the base of the slope that extends along this valley, running along the contour at roughly the same level. Proposed RBPs for Lots 22 and 23 have been shaped to follow the natural form of the upper valley. The RBP for Lot 25 was curated to avoid ecologically sensitive soils and the RBP shaped to follow the natural underlying contours of the existing land. Access to Lot 25 is via a driveway which also follows the natural flow of the landscape and avoids the saline soils.

52. Amendments to the Proposed Lots 22, 23 and 25 (Formerly Lots 21-26) following application: Following the application, Lots 21 and 22 were re-numbered to Lots 22 and 23. Following further ecological study the previous Lots 22, 23, 24 were removed to avoid potential disturbance of ecologically sensitive saline soils and aid in reducing the potential mass of built form on the valley. Similar to the amendments made to Lots 1-9, the Design Controls for Lot 25 specify (a) a reduction in building footprint by way of site coverage (b) a decrease in proposed height (mono -pitch 3-4m) and clarity in regards to permitted glazing on north-facing elevations (60% maximum).

53. Amendments to Proposed Lot 27 following application: This lot has been removed

54. Proposed Lot 24 (refer Attachments G): The proposed development on Lot 28 was renumbered to Lot 24 following the removal of lots. This RBP is proposed to be a small 'communal' facility for the purpose of functions / events. The proposed RBP for this lot sits north of a small knoll, on relatively flat land, with access from a lower elevation south of the site, off the principal road that traverses the Upper Plateau. The Design Controls have been specifically tailored to this site, encouraging a gabled roof line with specific cladding controls.

55. Amendments to Proposed Lot 24 following application: The Design Controls now specify a site coverage of 50% on this proposed RBP, giving a maximum building footprint of 250m^2 with the Design Controls specifying a proposed height of 4.5 metres, a principal gable form running west-east and specific cladding in either schist stone or corrugated iron.

56. It is understood that the future use on this site may include temporary events such as a weddings, small corporate events, residents' meetings and other one-off similar events by way of example. To that end, a specific set of Design Controls have been tailored for future structures on the proposed RBP. The overlying intent of these controls is to ensure an appropriate scale and character of development on this BP, with a distinctly 'Central Otago' flavour to the structure. Those design controls can be summarised as follows:

    - A future building shall not exceed 4.5m in height above the prescribed datum for that RBP.
    - The principal building form shall be in a traditional gable form running west – east across the site, with verandah and lean to's encouraged.
    - Wall claddings shall be in either aged or coloured mid grey corrugated iron and or horizontal weatherboard (in a clear stain and left to weather).

57. Proposed Lot 26 (refer Attachment H): Dwellings on the original proposed scheme Lot 29 has been renumbered to 26. This lot is located on the flatter upper portions of a north facing ridge, to be accessed from the principal access road that climbs up from Bendigo Loop Road. The dwelling on this proposed RBP is a stand-alone, occupying selected small open areas of land, within the wider Kanuka clad ridge and valley character of that landscape. The proposed RBP for Lots 26 is tailored to the site being 465m^2. The location of these lots has been selected in clearings to minimise the removal of existing vegetation and to allow appropriately scaled level RBP to be formed on this site with controls over curtilage, the management of Kanuka and, like other lots, subject to landscape and architectural controls.

58. Amendments to Proposed Lot 26 (Formally Lots 29 and 30) following application: Upon receiving feedback from submitters and the council report, lot 30 from the original scheme was removed in order to aid in reducing any perceived visual disruption of the landscape. The Design Controls for lot 26 now specify a site coverage of 56% on the RBP, giving a maximum building footprint of 260m^2 with the Design Controls specifying a decrease in proposed height (mono -pitch 3- 3.8m) and clarity in regards to permitted glazing on the northern elevations (60% maximum).

59. Proposed Lots 27 – 30 Formally 31, 32 and 33 (refer Attachment I) and amendments: The revised scheme plan proposers three residential lots are to be located on the minor terrace within the 'Rolling Flats' area, at the northern entry to the site and accessed directly from Bendigo Loop Road. The dwellings on these lots will be visually and physically separated from the other proposed lots, being part of the Bendigo Loop Road landscape corridor. The proposed lots vary in size, with shaped RBPS that are specific to each site enabling dwellings up to 350m^2 and with Design Controls that allow a more traditional residential outcome and amenity whilst still ensure the overall look and feel is consistent with the wider Rocky Point Site. The proposed hospitality (Lot 30) has been shifted further east to provide greater distance from existing residential housing.

60. As part of this assessment, an inventory of existing Kanuka vegetation has been conducted outlining the levels of existing Kanuka over the entire site. The area of existing Kanuka on each proposed RBP and

curtilage areas are outlined in Attachment N. This inventory reflects the areas for proposed RBPs and curtilage areas that have been tailored to greatly reduce the level of disturbance on existing Kanuka vegetation.

LANDSCAPE ASSESSMENT

61. The structure of this report is based on a 'proposal-based' assessment and will follow the concept and principles of the *Te Tangi a Te Manu – Aotearoa New Zealand Landscape Assessment Guidelines.*

62. The methodology is consistent with the Guidelines and includes the following tasks:

    - Desk-top research and site visits – including assessing potential visibility from surrounding public and private views
    - A review of the CODC District Plan policies, objectives and assessment matters
    - Consideration throughout the design process on measures to avoid, remedy and mitigate potential adverse effects and promote positive effects.

63. The effects rating scale used in this assessment is a modification of the NZILA 7-point scale of effect, which is summarised below:
    - Very high, High, Moderate-High, Moderate, Moderate-Low, Low and Very Low.

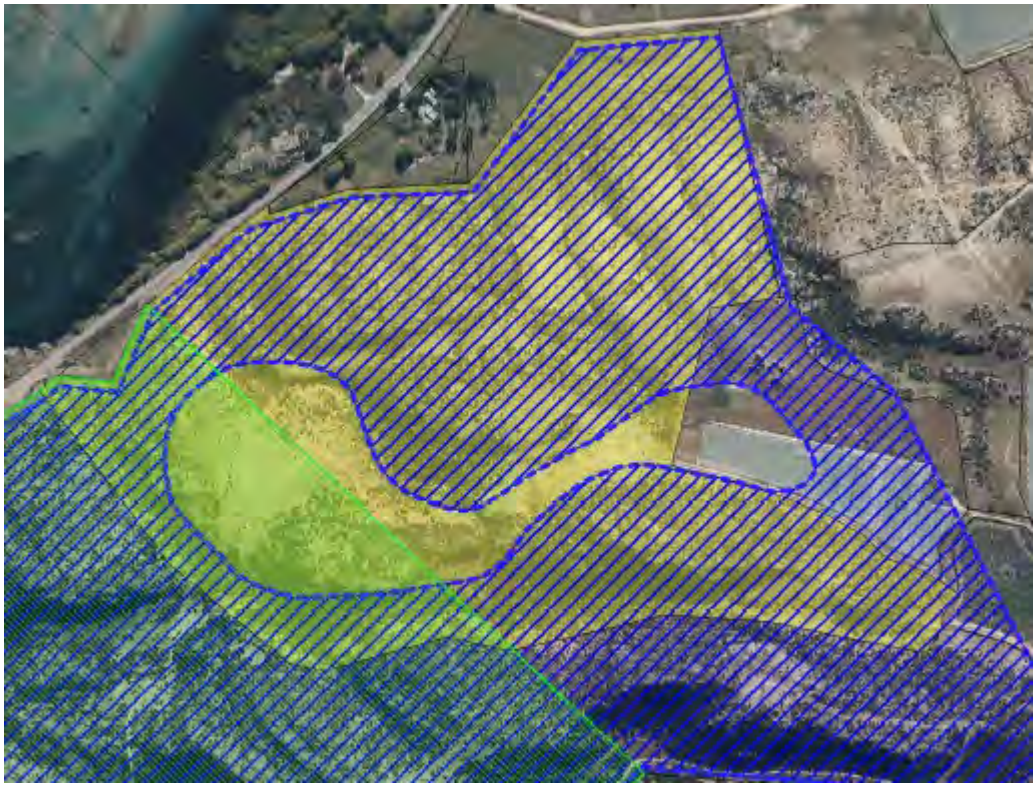
64. Attachments K1-K10 show the Landscape Assessment Photos, accompanied by Attachment J which shows the locations where those photos were taken.

Landscape Classification

65. Under the Central Otago District Plan, the site is located within a "Rural Resource Area". Under Section 4, the District Plan describes the Rural Resource Area as:

    "*The Rural Resource Area comprises the rural environment of the District. This area has been identified as distinct from the urban areas of the District on the basis of its environmental character. The amenity values of the rural environment are dominated by Central Otago's unique, semi-arid landscape of broad basins separated by low mountain ranges with sparse vegetation, covered in tussock grassland and exotic pasture, and broken by schist rock outcrops. This landscape retains a high natural character and has significant scenic values and some of it is identified in this District Plan as an outstanding natural landscape or outstanding natural feature. These values can be enhanced by human-made elements which include orchards and vineyards; homesteads accompanied by stands of trees (often poplars); remnant stone cottages; small irrigation and stock water dams and water races; energy generation facilities; and shelter belts of trees."*

66. Under the Central Otago District Plan, a portion of the Lots are located partially or wholly outside the Rocky Point Recreation Zone in the ONL. These are 20-21 (partial), 24 and 26-30 (refer Attachment B).



Excerpt From Planning Officers report showing the location of the ONL (blue striped line

67. Section 4.2 of the District Plan outlines the significant resource management issues of the Rural Resource Area. The most relevant points are 4.2.1 Outstanding Natural Landscapes and Outstanding Natural Features, 4.2.2 "Central Otago's Unique and Distinctive landscape" and 4.2.15 "Development in Rural Areas." This Landscape Assessment will address key matters raised in those sections throughout the report.

VISUAL ASSESSMENT

VISIBILITY / VIEWPOINTS / ASSESSMENT DISCUSSION (refer to Attachment J for all viewpoint locations & Attachments K1-K10 for photographs)

68. Generally, the viewpoints (public) towards the proposed development are from considerable distance, aside from views from SH8 and Bendigo Loop Road to that portion of the development directly adjacent to Bendigo Loop Road at the northern portion of the site (lots 27-30). Specific views, potential visibility and potential effects are described below:

VIEWPOINT 1 – VIEW FROM TARRAS CROMWELL ROAD – SH8 (Attachment K1)

69. Viewpoint 1 from the intersection of Bendigo Loop Road and Tarras-Cromwell Highway (SH8), located approximately 5km north-northeast of the proposed development. This viewpoint represents the first viewing point of the development heading south on SH8 towards Cromwell.

70. This image shows the site amongst the overlying Kanuka covered lower foothills of the Bendigo Mountain Range. The foreground of the image shows the heavily modified nature of the valley flat, with fence lines,

and agricultural and viticulture land uses present. The valley flat is predominately a mixture of exotic grasses and pasture, with the occasional cluster of trees for shelter belts. The few buildings that are present in the valley consist of residential dwellings or agricultural-related structures. Towards the foothills of the Bendigo Mountains, human activity is visible, albeit at distance, on the terrace above Bendigo, with vineyards and buildings scattered along those flats and terraces landscape. Farm tracks, roadways, and infrastructure such as large power pylons are also potentially visible.

71. At this distance the proposed development, taking into account the Design Controls to be applied to dwellings on these proposed RBP's in regards to their form, scale and colour and the surrounding Kanuka Landscape, dwellings would be very difficult to distinguish and perceive within the wider landscape. This matter, being the mitigating effects of distance and dark coloured dwellings, is relevant in regards to the wider mitigation and scale of potential adverse effects for other lots proposed in this application and will come up regularly in my addendum.

72. From this viewpoint an existing dwelling, which utilises modern design and dark colours in a similar manner to the proposed Rocky Point design controls, and located at the front of the terrace slightly to the north west of the site, cannot be seen with the naked eye.

73. By way of example, similar dark coloured residences and other structures that exist on the land south of the site, on elevated terraces above SH8, east of Lake Dunstan, on both Bendigo Downs Drive and from a variety of private accesses. From western viewpoints being the Lake, Pisa Moorings or SH6, those structures are very difficult to detect without aids or advice and have no adverse effects on the landscape character or amenity values of that landscape. I concur that those terraces are modified and do not exhibit the more natural character of the site however the natural character and vegetative cover of the site provides a visual 'wrap' around the low dark coloured structures proposed in this application.

Summary:
Distance to site:5 km
Structures on former BPs potentially visible from this location: 24, 25, 26, 27, 28, 29, 30

Structures on BPs potentially visible subsequent to amendments following application: 23, 24, 25, 26.

Scale of potential adverse effects: VERY LOW - NEGLIGIBLE

VIEWPOINT 2 – VIEW FROM TARRAS CROMWELL ROAD SH8 (Attachment K2)

74. Viewpoint 2 from Tarras-Cromwell Highway (SH8), located approximately 3.8km north-northeast of the proposed development.

75. Viewpoint 2 shows a similar landscape to that described above.
76. As is described with the previous viewpoint, the significant distance between the site and the viewppint, the existing houses in front of and to the north east of the Rocky Point site cannot readily be identified with the naked eye.

77. Lot 23 is also indicated from this viewpoint. However it will be partially obscured by a ridgeline in front and as such, is likely to only have a portion of the top of the building or roofing visible.

78. At this distance the proposed development, taking into account the scale of structures, their colour and form and the retention of that Kanuka covering, would be very difficult to distinguish and perceive within the wider landscape. Given that, it is considered from this viewpoint the potential adverse effects will be Very Low.

Summary:
Distance to site:3.8 km
Structures on former BPs potentially visible from this location: 24, 25, 26, 27, 28, 29, 30
Structures on BPs potentially visible subsequent to amendments following application: 23, 24, 25, 26.

Scale of potential adverse effects: VERY LOW

VIEWPOINT 3 – VIEW FROM TARRAS CROMWELL ROAD SH8 (Attachment K3)

79. Viewpoint 3 (Attachment K) from Tarras-Cromwell Highway (SH8), approximately 2.5km north of the proposed development.

80. As above, the bulk of the proposed development will be screened from this view by existing landform. At this distance the proposed development, taking into account the scale of structures, their colour and form and the retention of that Kanuka covering, would be very difficult to distinguish and perceive within the wider landscape. Given that, it is considered from this viewpoint the potential adverse effects will be Very Low. The current level of coherence, naturalness and scenic value of the lower foothills and the Dunstan Mountain Range are retained.

Summary:
Distance to site:2.5 km

Structures on former BPs potentially visible from this location: 24, 25, 26, 28, 29, 30

Structures on BPs potentially visible subsequent to amendments following application: 25, 24, 26.

Scale of potential adverse effects: VERY LOW

VIEWPOINT 4 – VIEW FROM TARRAS CROMWELL ROAD SH8 (Attachment K4)

81. Viewpoint 4 (Refer to Attachment L) from the Tarras-Cromwell Highway (SH8 approximately 1.2km north of the proposed development. This viewpoint is indicative of partially screened/open views towards the proposals for vehicle users and tourists moving along SH8 from the north.

82. This image shows a similar landscape to that described above in 1 & 2, albeit at a closer distance

83. As above, the bulk of the proposed development will be screened from this view by existing landform. At this distance the proposed development, taking into account the scale of structures, their colour and form and the retention of that Kanuka covering, would be very difficult to distinguish and perceive within the wider landscape. Given that, it is considered from this viewpoint the potential adverse effects will be Very Low. The current level of coherence, naturalness and scenic value of the lower foothills and the Dunstan Mountain Range will be retained.

Summary:
Distance to site:1.2km
Structures on former BPs potentially visible from this location: 24, 25, 26, 28, 29, 30

Structures on BPs potentially visible subsequent to amendments following application: 24, 25, 26.

Scale of potential adverse effects: VERY LOW

VIEWPOINT 5 – VIEW FROM BENDIGO STATION HOMESTEAD ENTRY ON SH8 (Attachment K5)

84. Viewpoint 5 from the entrance to the Bendigo Station Homestead off Tarras-Cromwell Highway (SH8) approximately 800m from the northern boundary of the proposed development. At this location, the viewer has passed from the open agricultural landscapes around SH8 and into a more modified landscape in the vicinity of the Bendigo Station homestead, a landscape typified by established enclosing exotic trees and glimpses of agricultural buildings.

85. From this location views of the previous proposed development will be restricted to include glimpses of the proposed communal development immediately south of Bendigo Loop Road (approximately 425m), portions of dwellings located on proposed RBPs 29 and 30 (elevated, 510 metres distance) and a dwelling on proposed Lot 33 (390 metres)

86. Following amendments to the proposal, the previously labelled Lots 24, 25, 26 and 30 have been removed with Lot 26 being renumbered to Lot 25 and Lots 28 and 29 being renumbered to lots 24 and 26 respectively. The RBPs for Lots 25 and 26 have been further refined and reduced to follow the underlying topography of the site to reduce earthworks and reduce potential unnecessary removal of Kanuka.

87. Taking into account the modified landscape within which this viewpoint lies, the scale of structures, their colour and form, potential adverse effects are considered to be low. The existing level of coherence, naturalness and scenic value of the landscape will be retained.

Summary:
Distance to site: Varies – see above
Structures on former BPs potentially visible from this location: 24, 25, 26, 28, 29

Structures on BPs potentially visible subsequent to amendments following application: 25, 24, 26.

Scale of potential adverse effects: LOW

VIEWPOINT 6 – VIEW FROM CROMWELL – LUGGATE ROAD SH6 (Attachment K6)

88. Viewpoint 6 shows a typical view looking east towards the proposed development from the intersection of Mount Pisa Road and Luggate–Wanaka Highway (SH6) at approximately 2.6km west of the proposed development with the closest potentially visible dwellings being those on proposed Lots 1-9, being that

area referred to in this report as the Lake Plateau. From this view some minor glimpses may also be seen (albeit difficult to detect) of future dwellings on RBPs 10 and 20. This photograph typifies views towards the site from this road, with many views from SH6 at greater distance

89. Dwellings on Lots 1-9, being those on the area referred to as the 'Plateau' are potentially the most visible, being a cluster of dwellings on a clear plateau. The proposed design controls, both architectural and landscape, are restrictive, allowing a very limited palette of materials and only Kanuka planting. To that end, that cluster will present itself to distant western views as a continuous mass of dark coloured forms and, taking that and the viewing distance into account, will be reasonably difficult to perceive.

90. The cabins (proposed Lots 11-18) will be hidden within topography and not visible from this view. Dwellings on proposed lots 10 and 20, although potentially visible from these views, will be very difficult to detect as (along with the controls) they are to be located on small platforms discretely located within surrounding landforms. Interestingly, from these views there are several built dark coloured consented dwellings on slopes above the eastern shore of Lake Dunstan, all of which are very difficult, albeit impossible, to perceive from these distances.

91. It is also noted that none of the proposed dwellings on the site will be visible from SH8, or any of the established legal roads above the State Highway, where it flanks the eastern shores of Lake Dunstan.

92. Following the application, the revised scheme plan has amended the RBPs for Lots 1 – 9 with a reduction of the proposed platform sizes and the adjustment of these platforms to align with the underlying contours of the site. These changes reduced the earthworks required to provide a level platform and further reduced the removal of existing vegetation when compared to the original scheme. Further design controls restricting the maximum height of built form and level of glazing ensures the mass of dark coloured forms is ensured to reduce any perceiving of built form on the hill side. The design controls have also set back glazing from the lake-side elevation to further reduce the likelihood of glare being visible.

93. The revised scheme plan removed former Lots 14 and 27 from the more prominent locations. Lot 20 has been renumbered to lot 19, and has had the RBP refined further to fit within the natural features of the site. The proposed design controls also further restrict the maximum building height of the monopitch roof from 4.0m to 3.8m ensure the low and long form of any built structure.

94. The revised scheme plan has removed lots 23-25 and renumbered Lots 21 – 22 to Lots 22 – 23. These lots have had the RBPs reduced and further shaped to fit with the underlying topography of the site. The design controls imposed on these lots ensures the dark coloured forms are very difficult, albeit impossible, to perceive from these distances

95. Taking the above into account, the current level of coherence, naturalness and scenic value of the lower foothills and Dunstan Mountain Range will be retained.

Summary:
Distance to site: Varies – approximately 2.6km.
Structures on former BPs potentially visible from this location: 1 - 9, 14, 20 - 27

Structures on BPs potentially visible subsequent to amendments following application: 1 – 9, 10, 20, 22 - 23

Scale of potential adverse effects: VERY LOW

VIEWPOINT 7 – VIEW FROM LUGGATE - CROMWELL ROAD (Attachment K7)

96. Viewpoint 7 shows the existing view from the intersection of Mount Pisa Road and Luggate–Wanaka Highway (SH6). This viewpoint is located approximately 2.5km west of the proposed development.

97. The viewpoints, description and assessment from this view point reach similar conclusions to those discussed above for Viewpoint 6, with a similar number of structures potentially visible from this location, being structures on proposed Lots 1-9, 10, 12-18, 19, 24+25. Potential adverse effects are mitigated by the contiguous and restrictive design controls, distance of views and the overall integration of structure into landscape. The matter of cumulative effects is potentially relevant but is mitigated by those measures described above. Put simply, the structure will be very difficult to detect without optical aids.

98. As discussed above, subsequent amendments to the scheme plan have removed former Lots 14, 27 and 30. The revised RBPs for Lots 1 – 9 result in building platforms and dark low and long built form that is more difficult to detect against the boarder context of the Kanuka landscape. The proposed additional Lot 10 is not seen to generate any additional effects given it is consistent with the reduced shaped RBPs of Lots 1 – 9 and is subservient to the same design controls.

99. As with the previous scheme plan, the re-arranged cabins remain potentially visible, however given the proposed scale and materiality of these cabins as well as the relatively undisturbed vegetation around each platform, these are determined to be very difficult to identify against the wider landscape.

100. Taking the above into account, the current level of coherence, naturalness and scenic value of the lower foothills and Dunstan Mountain Range will be retained.

Summary:
Distance to site: Varies – approximately 2.5km.

Structures on former BPs potentially visible from this location: 1-9, 10 -19, 14, 27, 28, 30

Structures on BPs potentially visible subsequent to amendments following application: 1 – 10, 19, -24, 25

Scale of Potential adverse effects: LOW

VIEWPOINT 8 – VIEW FROM LAKE DUNSTAN (Attachment K8)

101. The viewpoint shows a typical view towards the site from the upper end of Lake Dunstan, looking east towards the site. The distance at which the proposed development may be seen from the lake varies but is generally around 1.1-1.3km to the closest proposed RBP. Dwellings on proposed lots 1-7, 10 and 20

are all potentially visible from the surface of Lake Dunstan. With regards to proposed lots 1-7, the same mitigation principles apply as those discussed above. Appropriately clad buildings, at an appropriate scale, within the existing and proposed Kanuka plantings, as proposed, will be difficult to detect from lake views. The same applies to future buildings on proposed lots 10 and 19 however these will be even more difficult to detect as these are on considerably smaller building platforms and smaller and discrete curtilage areas. Lot 19 (formerly 20) has been moved backward and further behind the ridge in front, making it virtually impossible to see.

102. The revised scheme plan has removed Lots 27 and 14. The revised RBPs and design controls for Lots 1 – 7 have further reduced the scale of built form and the impact on the surrounding landscape reducing further any potential effects. The refined building platforms have also resulted in Lots 8 and 9 being largely screened behind topography from this view.

103. Any potential effects on lake viewers / users arising from the proposed development on landscape and visual amenity values will be very low. The current level of coherence, naturalness and scenic value of the lower foothills and wider Dunstan Mountain Range will be retained.

Summary:
Distance to site: Varies – approximately 1.2 – 1.3km, elevated views.

Structures on former BPs potentially visible from this location: 1-9, 14, 20, 27

Structures on BPs potentially visible subsequent to amendments following application: 1 – 7 and 10

Scale of potential adverse effects: LOW

VIEWPOINT 9 – VIEW FROM BENDIGO LOOP ROAD – SH8 INTERSECTION (Attachment K9)

104. The viewpoint shows a view towards the lower part of the site looking west towards Lots 27-30. The distance at which the proposed development may be seen from this viewpoint is approximately 235 metres to Lot 27 and 400 meters to 30. From this viewpoint no other structures or other proposed lots on the site will be visible. All structures on these lots will be subject to design controls with structures on lots 27-29 subject to the dwelling controls and the building on Lot 30 subject to the communal controls. As described above, the landscape context of this area is one of a modified agricultural landscape.

105. The proposed structures on lot 30, will appear as 'farm' buildings, similar in form and character to those north across the road in the cluster of building around the Bendigo Station homestead. A dwelling on the proposed RBP on proposed Lot 27 will be approximately 250 metres east of an established dwelling located south of the intersection of Bendigo Loop Road and SH8. Another dwelling, with that separation and in that location will not be an unexpected component of this modified landscape.

106. The revised scheme plan has re-arranged the RBPs along Bendigo Loop Road with three RBPs for Lots 27, 28, and 29 and a Hospitality building on Lot 30. The residential lots 27 – 29 have reduced RBPS from those proposed in the initial scheme and have an average spacing of 30ms between platforms to retain appropriate spacing between lots in the modified landscape. Any built form on these lots is determined by design controls to retain the 'farm' building vernacular with gabled forms and a restricted material pallet.

107. The proposed hospitality lot, Lot 30, has been located further to the west away from both the existing intersection and existing residential lots. The design controls for this building ensures that the built form retains a similar form and materiality to those found both within the site and is in line with other commercial buildings within the broader Bendigo area. While an additional lot has been added, it is not seen to generate any additional effects from those initially proposed.

108. It is noted that the proposed access road has been shaped to follow the topography of the site and does not require the large cuts that are seen on the current landscape.

109. Whilst the future structures will be occupying locations where no structures currently exist the wider landscape values of this landscape differ from the rest of the site and does not display the natural characteristics of the wider site. Any potential effects on views arising from the proposed development on landscape and visual amenity values will be very low. The current level of coherence, naturalness and scenic value of this modified landscape will be retained.

Summary:
Distance to site: Varies – approximately 235 – 400m

Structures on former BPs potentially visible from this location: 31-33

Structures on BPs potentially visible subsequent to amendments following application: 27 – 30

Scale of potential adverse effects: LOW

VIEWPOINT 10 – VIEW FROM BENDIGO LOOP ROAD (Attachment N10)

110. The viewpoint shows a view west towards the lower part of the site towards Lots 27-30. The distance at which the proposed development may be seen from this viewpoint is approximately 250 metres to Lot 28. From this viewpoint a dwelling on proposed Lot 27 will not be visible as that sits below exiting landform. No other structures on other proposed lots on the site will be visible from this location. Structures on BP on lot 30 will appear as 'rural' structures given the specific design controls applied to the communal lots. These controls steer the architectural outcome to traditional gabled rural forms, similar to those visible further to the east on Bendigo Loop Road, in the cluster of forms within the Bendigo Station homestead cluster. As described earlier, the landscape context of this area is one of a modified agricultural landscape.

111. The revised scheme has rearranged the lots along Bendigo Loop Road, with the proposed Lot 30 being closer to the viewpoint that previously, and Lots 28 and 27 partially visible behind existing topography. As previously stated, it is believed the proposed building platforms and design controls both retain and scale and materiality that is consistent with the modified agricultural landscape.

112. Whilst the future structures will be occupying locations where no structures currently exist the wider landscape values of this landscape differ from the rest of the site and does not display the natural characteristics of the wider site. Any potential effects on views arising from the proposed development on landscape and visual amenity values will be very low. The current level of coherence, naturalness and scenic value of this modified landscape will be retained.

Summary:
Distance to site: Varies – approximately 250m

Structures on BPs potentially visible from this location: 31 & 32

Structures on BPs potentially visible subsequent to amendments following application: 27 – 30

Scale of potential adverse effects: LOW

RESPONSES TO MATTERS RAISED IN THE REPORT OF THE PLANNING OFFICER

113. Having read the report of the Planning Officer, I noted that there were many matters raised in that report in regards to further information required. To avoid any confusion in regards to the intended outcome and amenity of the proposed subdivision, those concerns have been addressed by way of a full review of the Design Controls, undertaken since receiving that report. This has been discussed in full in the descriptions of the proposed development contained in my addendum and summaries of the amendments undertaken by way of the Design Controls in Appendix A below.

114. I address other concerns raised in the planners report below:

115. Paragraph 6.14[2] of the report refers to views from State Highway 8 and Lake Dunstan. As noted earlier in my addendum, a limited number of lots will be viewed from SH8 and at distance (aside from lots 27-30 (former lots 31-33) which occupy a modified landscape which already contains established rural - residential development in that locale) and I am comfortable that the elevated lots potentially viewed from further afield on SH8 will be barely discernible, given the distance viewed and the form, scale and colour of those proposed dwellings.

116. Views from Lake Dunstan (my Attachment K7) will be largely experienced from the central and western portions of the Lake (topography screens the development from the eastern shores), towards the head of the lake. Viewing distances are considerable (1.2km to 1.6km) and I have covered the mitigating factors of distance and low dark buildings earlier in my addendum. From my experience, the context of any proposed development and the Design Controls are foremost when considering potential adverse effects. I consider that, from Lake Dunstan, taking the above into account, that the dwellings described on Attachment M2 will be barely distinguishable from lake views.

117. The planners report raises several concerns over height restrictions[3] and the measurement of height. I consider that these have now been addressed by way of the attached Design Controls. To that end, all floor levels from which heights are to be measured are set as fixed datums, based on level platforms, with the extent of earthworks shown on the Attachments. I consider that the option measuring from natural ground level, over a sloping site, leaves too much open to interpretation and that the rolling height measurement can result in dwellings of varying heights and unexpected height outcomes. A fixed datum on flat land enables certainty in regards to the scale of a proposed structure. I would be unable to undertake a considered landscape assessment relying on natural ground level.

[2] Central Otago District Council – report of Planning Officer Paras 6.14

[3] Central Otago District Council – report of Planning Officer Paras 6.20

118. My Attachment M describes site coverages for each Lot. I note that this has been amended since the application was lodged and I confirm that the site coverage has been lowered on all lots. I have determined those site coverages and heights in response to what I consider, from my experience, that is the appropriate size of a dwelling(s) in each landscape context that enables me to rate the scale of effects as Low (refer my Appendix B). In effect this is a design-lead approach to assessment, with the maintenance of the landscape values and amenity driving the recommended outcome.

119. The planners report raises concerns visual effects at night, from lighting in regards. Whilst I agree that lights may be visible at night, I consider that the overall potential adverse effects would be Low. The design controls have been amended to limit the extent of glazing over lake facing and northern facing visible elevations. Realistically, given the scope of the visible landscape panorama that these views are experienced at, the distances from which the proposed development is viewed from and the limits on lighting, any lights would be pinpricks in a vast panorama. It is important to keep the matter of scope of view, scale and distance in perspective when considering night lighting

VISIBILITY ASSESSMENT - CONCLUSION

120. The proposed development seeks to subdivide Lots 1 DP 561457 into 30 lots including residential dwelling sites and communal activities within the Rural Resource Area and the Rocky Point Recreation Zone. Portions of the site are within an ONL overlay as shown on Attachment B. The proposed development includes building platforms, with crafted design controls that are sympathetic to the existing landform and respecting the character of the receiving environment. It is considered that the application site can absorb the proposed scale of development.

121. The areas of proposed development included within the ONL have been located and designed to minimise visibility from Lake Dunstan in such a way as to retain and protect the existing values attributed to this landscape, as a backdrop to Lake Dunstan. Furthermore, the proposed design control ensures development are sympathetic to the underlying landscape values and will ensure an ongoing high-quality landscape outcome. I have discussed the fundamentals of distance and low, dark buildings in my addendum and will not repeat that suffice to say that I consider that the proposed structures will be very difficult to detect from the public viewpoints described in this addendum.

122. The proposed development will provide for future development that is appropriate to the area and will not result in significant adverse landscape effects on the application site or to the wider landscape and Dunstan Mountain Range. The proposed development is seen to be an extension of existing residential and small-scale communal operations along the foothills above Lake Dunstan and along the terrace above Bendigo respectively, albeit with a raft of controls tailored to the site. The proposed development result in a low level of change but will not result in adverse landscape or visual amenity effects that cannot be either avoided or mitigated.

123. As previously outlined, an ONL overlay covers a significant portion of the overall site, with an area located approximately in the centre of the site excluded from the ONL (refer to Attachment B) being that part of the site within the Rural Resource Area 2 and subject to the Rocky Point Recreation Zone (Concept Plan in Schedule 19.16). The ONL identifies the elevated areas as a distinctive landform providing a visual backdrop to Lake Dunstan with minimal visible human modification and is perceived as a coherent

landscape. It displays a high level of naturalness with large distinctive rocky outcrops and large swathes of Kanuka forest, and overall is of a high level of landscape quality.

124. The proposed development has been designed so the bulk of the proposed development is contained within the development area excluded from the ONL in the Schedule 19.16 Concept Plan (refer to Attachment A). Where built development has been proposed to occur within the ONL area, these building platforms have been located to reduce or eliminate adverse effects on views from Lake Dunstan to the site and to maintain and extent the existing cloak of Kanuka. The proposed development is set out to with appropriate design controls that been tailored to minimise the potential visual impact of development against the natural colours and form of the landscape. Prescribed building heights, limited building platforms, materiality and roof pitch and colour aid in blending the proposed development with the landscape. Building platforms are to be set down into the landscape and levelled, allowing for the built form to be set into the sloping topography recessed into the landscape. Those building platforms within the ONL will retain the large stone outcrops and have a requirement to replace Kanuka which has been removed for the requirement of construction (refer to Appendix A).

125. In summary, given the considered placement of the proposed building platforms within the ONL, the overall low-density scale of the development, and the design controls, the proposed development mitigates or avoids adverse landscape and visual amenity effects on the ONL and therefore protects the values of the ONL overall.

EFFECTS ON LANDSCAPE CHARACTER

126. Referring to the report of the Planning officer, I concur with his statement that '*the bar gets higher in terms of the reduction and mitigation of those buildings..'*[4], especially those proposed dwellings that are (a) within the development area and are potentially visible from Lake Dunstan and (b) those outside the development are and potentially visible from northern viewpoints looking in to the site.

127. The site sits within a wider landscape that contains both highly natural features and slightly modified landscape elements. The wider landscape character of Bendigo and the lower foothills can be described as a rural character with a viticulture presence. Along Lake Dunstan, the landscape character conveys a rural character, modified by existing and/or consented residential and agricultural development. As the topography rises above Lake Dunstan the character takes on a more natural landscape, with natural vegetation and natural landscape features dominating the landscape however, accessways and transmission lines are still present on the site.

128. In regards to those buildings potentially visible from Lake Dunstan that are located within the development area, under the revised scheme plan being proposed Lots 1-10, I consider that the design response, expressed by way of location, design and design controls has lifted the bar and responded accordingly to the landscape values. The proposed building platforms avoid any development near or on the character features of this natural landscape, such as the large rocky knolls and densely vegetated gullies. The required implementation of design controls also requires the restitution of removed Kanuka. Design controls over bulk and location of the proposed building platforms will maintain the scale, height, and materiality of buildings to an appropriate form consistent with the materiality anticipated within this landscape. When compared to the wider landscape, which contains modified elements including other

[4] [4] Central Otago District Council – report of Planning Officer Paras 6.27

residential developments, the scale and distribution of the proposed development will deliver a level of change that can be absorbed by this landscape. I also consider that, as I have expressed earlier in my addendum, that the proposed lots potentially visible from Lake Dunstan, will be reasonably difficult to see or detect by eye, given the unique design characteristics of those dwellings

129. The proposed development introduces a low level of change into the landscape character at the wider macro cale acknowledging that, at the micro scale there will be pockets of substantial change such as in the locale of proposed Lots 1-10. The bulk, location, and scale of the development in combination with the proposed design controls will avoid and mitigate any adverse effects on the overall macro landscape character, being that visible panorama. The proposal changes portions of the environment but will not degrade the quality of the surrounding environment, with the scale of the development appearing as a logical extension of existing residential development to the south, which is successfully visually absorbed into the landscape.

EFFECTS ON LANDSCAPE AMENITY

130. The application site has a significant level of amenity providing a natural landscape backdrop to Lake Dunstan and the landscapes of the Clutha Valley and environs. The unique scale, form and topography of the higher areas of the site enable the proposed development to be visually absorbed into this landscape, avoiding the lower more visible lower slopes of the Dunstan Range foothills. A large portion of the development is to be located within the centre of the site, where the level of change on the amenity and landscape character will not be evident from wider views.

131. The proposed design controls restrict the bulk, location, form, and materiality of development within the site and promote a contiguous character. The design controls ensure that development is highly sympathetic to the landscape and consistent with the local vernacular, enabling a high visual absorption capability. The proposed residential building platforms at the entrance to the site off Bendigo Loop Road are located adjacent to a landscape that is already modified and will be perceived as an extension to the cluster of existing development at the intersection of Bendigo Loop Road and SH8.

132. Although the site has a high level of amenity when viewed from Lake Dunstan and the flats of Bendigo, the proposed development will complement the character and quality of the application site and surroundings and will be difficult to perceive from wider views. Overall, the proposal will be perceived as a low level of change on landscape amenity with low adverse effects.

SUMMARY OF LANDSCAPE EFFECTS

133. The proposed development will generate a low level of change on the landscape character and amenity of the site. The proposed bulk and location of building platforms and prescriptive design controls will avoid and mitigate any potential adverse effects development would have on the natural character and amenity values. With regard to the ONL, the extent of loss to the outstanding natural landscape character is assessed to be very low. The overall level of change is seen to be very low and the proposed development will create less than minor effects on the values of the ONL, and those values will be protected.

134. In summary, the proposed development occupies a site that is still largely a ‘natural’ landscape, between a highly modified landscape to the east (Chinaman’s Terrace viticulture) and the modified landscape south of the site, parallel to Lake Dunstan. The proposed development acknowledges the inherent naturalness

of the site and has been crafted to retain this overriding natural character, preserving the existing pivotable location of the site.

135. The existing Rocky Point Recreation Zone boundary appears to loosely follow the valleys and terraces in the upper elevations of the site without specifically following topography. The bulk of the proposed development is located within the Rocky Point Recreation Zone and some components of the proposed development fall outside of that zone boundary. However, there are parts of the landscape within the zone that would be appropriate for development where development is not proposed. It is considered that, taking the overall landscape character into account, within and outside the Rocky Point Recreation Zone, the ONL values of the site will still be retained and protected.

Objectives and Policies – assessment

Objective 4.3.2 – Outstanding Natural Landscapes and Outstanding Natural Features, and Land in the Upper Manorburn/Lake Onslow Landscape Management Area
To protect the Districts outstanding natural landscapes and outstanding natural features, and land in the Upper Manorburn/Lake Onslow Landscape Management Area (including landforms) from the adverse effects of inappropriate subdivision, use and development.

136. Response: As discussed in my addendum and taking into account the location of the Rocky Point Recreation Zone, and the development proposed, any potential adverse effects will be low and less than minor, and the development is appropriate in the ONL. The values of the ONL overall will be protected, and the objective is achieved by the proposal. This is further addressed in the policies below.

Objective 4.3.3 – Landscape and Amenity Values
To maintain and where practicable enhance rural amenity values created by the open space, landscape, natural character and built environment values of the District's rural environment, and to maintain the open natural character of the hills and ranges.

137. Response: The rural amenity values will be maintained by the proposal. The open natural character of the hills and ranges will be maintained, taking into account the configuration of development anticipated within the Rocky Point Recreation Zone and the rigour of the proposed design controls.

138. *4.4.1 Policy - Outstanding Natural Landscapes and Outstanding Natural Features and Land in the Upper Manorburn/Lake Onslow Landscape Management Area. To recognise the District's outstanding natural landscapes and outstanding natural features and land in the Upper Manorburn / Lake Onslow Landscape Management Area which:*

- *(a) Are unique to the district, region or New Zealand; or*
- *(b) Are representative of a particular landform or land cover occurring in the Central Otago District or of the collective characteristics and features which give the District its particular character; or*
- *(c) Represent areas of cultural or historic significance in the district, region or New Zealand; or*
- *(d) Contain visually or scientifically outstanding geological features; or*
- *(e) Have characteristics of cultural, historical and spiritual value that are significant to Kai Tahu ki Otago;*

(f) Have high natural character values and high landscape quality that can be distinguished from the general landscapes of the Central Otago District and provide protection for them from inappropriate subdivision, use and development.

139. Response: Whilst the majority of the proposed development occurs within the Rocky Point Recreation Zone, which is the same area excluded from the ONL, proposed development to the north including Lots 24-30 are within the ONL while Lots 20 – 21 are partially contained within ONL exclusion. The area is recognised for its outstanding landscape values as a backdrop to Lake Dunstan and its unique rocky outcrops and Kanuka-covered slopes. The proposed development responds to the existing landscape character values and high-quality landscape by locating and distributing building platforms away from visually significant features reducing the overall visual impact of development. Building platforms avoid areas of high visual significance, such as rocky outcrops, and dense areas of existing Kanuka vegetation, especially when viewed from Lake Dunstan. Additionally, the provision of prescriptive design controls ensures that built form, and materiality will be sympathetic to the existing landscape topography ensuring that development sits as part of the landscape.

140. *4.4.2 Policy – Landscape and Amenity Values To manage the effects of land use activities and subdivision to ensure that adverse effects on the open space, landscape, natural character and amenity values of the rural environment are avoided, remedied or mitigated through:*

(a) The design and location of structures and works, particularly in respect of the open natural character of hills and ranges, skylines, prominent places and natural features,
(b) Development which is compatible with the surrounding environment including the amenity values of adjoining properties,
(c) The ability to adequately dispose of effluent on site,
(d) Controlling the generation of noise in backcountry areas,
(e) The location of tree planting, particularly in respect of landscape values, natural features and ecological values,
(f) Controlling the spread of wilding trees.
(g) Encouraging the location and design of buildings to maintain the open natural character of hills and ranges without compromising the landscape and amenity values of prominent hillsides and terraces

141. Response: The proposed development has carefully considered the location of building platforms and structures and has resolved the densities of the development to avoid locating near highly sensitive areas such as natural features or skylines. Development has been avoided in highly prominent areas including natural features and skylines while prescriptive design controls ensure that built form, bulk and location, and materiality of development are highly sympathetic to the existing character and amenity values of the site. Furthermore, the proposed design controls ensure the vernacular of architecture seen along the foothills above Lake Dunstan is continued into the proposed development, albeit with far more prescriptive and restrictive design controls that that along existing development to the south. The proposed design controls have strict requirements over vegetation planting to ensure the existing landscape, natural features, and ecological values are all respected. Additionally, the proposed development incorporates public access walking tracks connected to a publicly accessible carpark, which provides access to key viewpoints within the site, not previously accessible to the public. This access also provides the opportunity for interpretative signage to engage in both the cultural and ecological history of the site. The development incorporates areas of existing natural features into a wider open space network.

142. 4.4.8 Policy – Adverse Effects on the Amenity Values of Neighbouring Properties To ensure that the effects associated with some activities including (but not limited to):

(a) Noise (including noise associated with traffic generation, night time operations), and vibration,
(b) The generation of a high level of traffic, in particular heavy vehicles,
(c) Glare, particularly from building finish,
(d) A reduction in visual amenity due to excessive signage and the storage of goods or waste products on the application site,
(e) The generation of odour, dust, wastes and hazardous substances, and
(f) The use and/or storage of hazardous goods or substances do not significantly adversely affect the amenity values and privacy of neighbouring properties or the safe and efficient operation of the roading network.

143. Response: The proposal includes design controls that prescribe materials and reflectivity rates that reduce any adverse effects on neighbouring properties to an acceptable level.

144. *4.4.10 Policy – Rural Subdivision and Development To ensure that the subdivision and use of land in the Rural Resource Area avoids, remedies or mitigates adverse effects on:*

(a) The open space, landscape and natural character amenity values of the rural environment in particular the hills and ranges,
(b) The natural character and values of the District's wetlands, lakes, rivers and their margins,
(c) The production and amenity values of neighbouring properties,
(d) The safety and efficiency of the roading network,
(e) The loss of soils with special qualities,
(f) The ecological values of significant indigenous vegetation and significant habitats of indigenous fauna,
(g) The heritage and cultural values of the District,
(h) The water quality of the District's surface and groundwater resources, and
(i) Public access to or along the rivers and lakes of the District, particularly through the use of minimum (and average) allotment sizes.

145. Response: The proposal will avoid adverse effects on the existing amenity values of the rural environment by the careful location of all building platforms and access ways. Prescriptive design controls on development form, bulk, location, and materiality will avoid and mitigate any adverse effects of development on amenity values. The proposed design controls have strict requirements surrounding the reestablishment and protection of Kanuka planting surrounding the proposed development. This is particularly relevant to the areas of the proposed development that occur within the ONL.

CONCLUSION

146. The proposed subdivision avoids adverse effects on the existing amenity values of the rural environment by careful location of all building residential and communal platforms and access ways. The development is predominantly located within the Rocky Point Recreation Zone within which clustered housing and travellers' accommodation is anticipated by the District Plan. Prescriptive design controls on development form, bulk, location, and materiality avoid and mitigate any adverse effects of development on amenity values. Furthermore, the proposed design controls have strict requirements surrounding the reestablishment and protection of Kanuka planting surrounding the proposed development.

147. Following submitter feedback, a revised scheme plan and design controls document has further bought in greater controls over the location and sizes of building platforms, and receded heights further of built form in visually sensitive areas. Public access to the site has also been provided to key viewpoints over Lake Dunstan and the Pisa Range where there was not possible previously.

148. The revised scheme plan has reduced the number of visible lots across most key viewpoints looking towards the site from sensitive locations. The proposed scheme plan has also reduced the number of lots built within the ONL and in visually sensitive areas.

149. Where development is visible along Bendigo Loop Road, this development occurs within a tight cluster of existing development adjacent to the Bendigo Station Homestead and other existing established residential properties and does not occur on an area of the site which displays the natural characteristics of the wider site.

150. The areas of proposed development within the ONL have been located to minimise perceived visibility from Lake Dunstan in such a way as to retain the existing values attributed to this area as a backdrop to Lake Dunstan. Furthermore, the proposed design controls ensure development are sympathetic to the underlying landscape values and safeguards high-quality landscape outcomes. Overall the values of the ONL will be protected, and the development proposed within the ONL is appropriate.

151. Any potential adverse cumulative effects will be low to negligible due to the careful placement of building platforms and associated access ways in combination with the architectural and landscape design controls to apply to all lots.

152. Overall, I find that there is a Low level of adverse effects on landscape and visual amenity values.

Appendix A

ARCHITECTURE AND LANDSCAPE DESIGN CONTROLS

TKO Properties – Bendigo - Rocky Point
JULY 2024

A. ARCHITECTURAL DESIGN CONTROLS

A1. KEY OBJECTIVES

The objectives of the following architectural controls seek to achieve a high-quality architectural design complementary to the Rocky Point character of the site, ensuring that the dwellings are:

- At an appropriate scale to the surrounding landscape character of the wider Bendigo Mountain Range,
- At a scale that can be visually absorbed into the wider landscapes texture and pattern, with appropriate landscaping without compromising landscape character
- A balanced composition of solid, void and glazed openings,
- Clad in visually recessive wall and roof materials,
- Finished in selected colours that are complementary with the dark hues and saturation found naturally in the surrounding landscape.

A2. SITE COVERAGE

Objective: To ensure the Rocky Point landscape character and values are maintained by promoting an appropriate ratio of open space and dwelling scale.

Controls:

(a) All dwellings and garage are to be contained within the prescribed Residential Building Platforms (RBP) and together shall not exceed the site coverages set out below for each lot (refer schedule Baxter Design Plan 4371-SK129

Lot 1	RBP 400m^2	55% site coverage	(220m^2 maximum)
Lot 2	RBP 450m^2	49% site coverage	(220m^2 maximum)
Lot 3	RBP 450m^2	49% site coverage	(220m^2 maximum)
Lot 4	RBP 421m^2	52% site coverage	(220m^2 maximum)
Lot 5	RBP 393m^2	56% site coverage	(220m^2 maximum)

Lot 6	RBP 392m^2	56% site coverage	(220m^2 maximum)
Lot 7	RBP 400m^2	55% site coverage	(220m^2 maximum)
Lot 8	RBP 360m^2	55% site coverage	(200m^2 maximum)
Lot 9	RBP 373m^2	54% site coverage	(200m^2 maximum)
Lot 10	RBP 278m^2	54% site coverage	(150m^2 maximum)
Lots 11-18	RBP 84m^2	100% site coverage	(84m^2 maximum)
Lot 19	RBP 272m^2	91% site coverage	(250m^2 maximum)
Lot 20	RBP 395m^2	63% site coverage	(250m^2 maximum)
Lot 21	RBP 250m^2	49% site coverage	(250m^2 maximum)
Lot 22	RBP 400m^2	63% site coverage	(250m^2 maximum)
Lot 23	RBP 385m^2	65% site coverage	(250m^2 maximum)
Lot 24	RBP 499m^2	50% site coverage	(250m^2 maximum)
Lot 25	RBP 339m^2	65% site coverage	(220m^2 maximum)
Lot 26	RBP 465m^2	56% site coverage	(260m^2 maximum)
Lot 27	RBP 714m^2	49% site coverage	(350m^2 maximum)
Lot 28	RBP 575m^2	61% site coverage	(350m^2 maximum)
Lot 29	RBP 611m^2	57% site coverage	(350m^2 maximum)
Lot 30	RBP 1494m^2	23% site coverage	(350m^2 maximum)

Reason for the above controls: The residential building platform and site coverage have been tailored to respond to the landscape sensitivity issues of each lot. Providing smaller platforms with prescribed site coverages reflects those lots which have a higher potential for visibility.

A3. BUILDING FORM, ROOF AND HEIGHT CONTROLS

Objective: To reduce the visual scale of the dwelling in the surrounding environment.

Controls:

(a) Lots 1-10, 25 and 26:

All buildings on these lots shall be in monopitch ('flat') forms only to follow the natural grade of the Rocky Point landscape forms. The 'downhill' elevation (being that facing towards the primary view or drop in elevation) shall be a maximum of 3m high in height sloping back up continuous to a maximum height of 3.8 metres. Refer to plans Baxter Design Plan SK130, SK132, and SK133 for roof slope indication.

Reason for the above controls: Buildings on these lots are potential more visible from a wider field of distant viewpoints and these controls respond accordingly by reducing the potential visual acuity of any built form.

(b) Lots 11-18:

These are standalone small 'cabin' lots with footprints of 84m^2. Buildings on these lots are permitted to 5.5m in height with single gabled roof forms between 20 and 35 degrees only. No hip roofs are permitted. All structures on lots 11-18 shall be constructed on timber piles with the piles not to exceed 1200mm in height.

Reason for the above controls: Buildings on these lots are located within a small and visually discrete 'valley' and are screened from the wider field of distant viewpoints. The intention of these controls is to create a small cluster of 'cabins'.

(c) Lot 19-23:

All buildings on these lots shall not exceed 4.5m in height. All dwellings on these lots shall have a gable roof only. A break in the gable (flat roof) is permitted up to 3m in height.

Reason for the above controls: Buildings on these lots are located within more visually discrete areas and are generally screened from the wider field of distant viewpoints, as such, the design controls respond accordingly.

(d) Lot 24:

This communal / commercial building shall impart the amenity of a typical farm building. A building on this lot shall not exceed 4.5m in height. The roof shall be gabled in form between 20-25 degrees, with the gable running west to east along the building form. A break in the gable (flat roof) is permitted up to 3m in height.

Reason for the above controls: The scale and form of a building on this lot is intended to impart the amenity of a typical farm building.

(e) Lots 27-29:

All buildings on these lots shall not exceed 5.0m in height. All dwellings on these lots shall have a gable roof form. A break in the gable (flat roof) is permitted up to 3m in height.

Reason for the above controls: These lots are on a lower elevation and these controls ensure the scale and form of buildings on these lots respond to the context of the Bendigo area.

(f) Lot 30

A building on this lot shall not exceed 5.5m in height. The roof shall either be a gable form between 20-25 degrees or shall be in a monopitch ('flat') form. A break in the gable (flat roof) is permitted up to 3m in height.

Reason for the above controls: This lot is on a lower elevation and these controls ensure the scale and form of any building form on this lots respond to the context of the Bendigo area.

General Notes; Building form, roof and heights

(a) The datums are specified for each dwelling on a level RBP (excluding Lots 11-18). Building heights are determined from those specified datums. No buildings shall exceed the specified heights by way of excavation below the specified datums.

(b) Flat connections are permitted between gabled and monopitch building forms. Any flat connections are to be level with to or below gutter levels. Flat connections shall be at 3m high and not exceed 15% of the buildings footprint. All windows on the lower elevation (the 'view' elevation shall be either recessed 1m back from the building edge or the roofline shall extend 1.5m past the windows.

(c) All roof colours should have an LRV of less than 27%. Roof materials shall be restricted to one material from the listed materials only.

(d) Each building platform has a specified R.L. datum as set out on the schedule SK129 with maximum heights for dwellings on each RBP noted.

(e) Verandahs and eaves are permitted to extend up to 2.75m on elevations orientated towards Lake Dunstan and the north outside of the RBP and are encouraged on Lots 1-10, 25 and 26.

(f) Decks are permitted on the 'cabin' lots 11-18 and may extend up to 2.5m outside of the RBP's on those lots and shall not exceed 25m^2 in area.

(g) Decks can extend 2.5m past the RBP on all other lots.

A4. ROOF MATERIAL + EXTERNAL WALL CLADDING

Objective: To ensure an appropriate range of materials, which complement the natural characteristics of the environment and are recessive within the landscape.

Controls:

(a) Lots 1-10, 25 and 26

Roof Material: All roof material on these lots shall be Steel tray roof in Colorsteel 'Flaxpod' or similar or in corrugated iron, in Colorsteel 'Flaxpod' or similar

Wall claddings: Exterior wall materials shall be restricted to the following materials only:

- Natural timber cladding, left to weather or in a clear 'natural' stain,
- Stained timber cladding, in a 'Drydens' Stain Elm wood oil, or similar, or in a black stain,
- Corrugated Iron cladding, in colorsteel 'Flaxpod' or similar
- Steel tray cladding in Colorsteel 'Flaxpod' or similar, to match roof finish,
- Concrete, either in situ or precast. Low light reflection coefficient to be achieved through texture or oxide additive,
- Locally sourced schist stone, laid horizontally with dark tinted mortar/grout
- Steel sheet cladding, in mild steel, with steel oil ('Penetrol' or similar) to prevent rusting

Reason for the above controls: To promote a contiguous pattern of similarly dark coloured dwellings.

(b) Lots 11-18:

Roof material: All roof material on these lots shall be Steel tray roof in Colorsteel 'Flaxpod' or similar or in corrugated iron, in Colorsteel 'Flaxpod' or similar

Wall claddings: Exterior wall materials shall be restricted to the following materials only:

- Horizontal rusticated weatherboard left to weather or in a clear 'natural' stain or in a 'Drydens' Stain Elm wood oil, or similar, or in a black stain.

Reason for the above controls: To promote a contiguous pattern of similar 'Cabins' on these lots.

(c) Lots 19-23

Roof Material: All roof material on these lots shall be Steel tray roof in Colorsteel 'Flaxpod' or similar or in corrugated iron, in Colorsteel 'Flaxpod' or similar

Wall claddings: Exterior wall materials shall be restricted to the following materials only:

- Natural timber cladding, left to weather or in a clear 'natural' stain,
- Stained timber cladding, in a 'Drydens' Stain Elm wood oil, or similar, or in a black stain,
- Corrugated Iron cladding, in colorsteel 'Flaxpod' or similar
- Steel tray cladding in Colorsteel 'Flaxpod' or similar, to match roof finish.

- Concrete, either in situ or precast. Low light reflection coefficient to be achieved through texture or oxide additive,
- Locally sourced schist stone, laid horizontally with dark tinted mortar/grout
- Steel sheet cladding, in mild steel, with steel oil ('Penetrol' or similar) to prevent rusting

Reason for the above controls: To promote a contiguous pattern of similarly dark coloured dwellings.

(d) Lot 24

Roof and Wall claddings: A building on this lot is to be clad in locally sourced schist stone stacked horizontally' or aged uncoloured corrugated iron or a combination of both.

Reason for the above controls: The scale and form of a building on this lot is intended to be 'long and low' from northern views imparting the amenity of a typical farm woolshed building.

(e) Lots 27-29

Roof Material: All roof material on these lots shall be Steel tray roof in Colorsteel 'Flaxpod' or similar or in corrugated iron, in Colorsteel 'Flaxpod' or similar or in aged corrugated iron

Wall claddings: Exterior wall materials shall be restricted to the following materials only:

- Natural timber cladding, left to weather or in a clear 'natural' stain,
- Stained timber cladding, in a 'Drydens' Stain Elm wood oil, or similar, or in a black stain,
- Corrugated Iron cladding, in colorsteel 'Flaxpod' or similar
- Steel tray cladding in Colorsteel 'Flaxpod' or similar, to match roof finish.,
- Concrete, either in situ or precast. Low light reflection coefficient to be achieved through texture or oxide additive,
- Locally sourced schist stone, laid horizontally with dark tinted mortar/grout.
- Steel sheet cladding, in mild steel, with steel oil ('Penetrol' or similar) to prevent rusting

(f) Lot 30

Roof Material: All roof material on this lot shall be Steel tray roof in Colorsteel 'Flaxpod' or similar or in corrugated iron, in Colorsteel 'Flaxpod' or similar or in aged corrugated iron

Wall claddings: Exterior wall materials shall be restricted to the following materials only:

- Natural timber cladding, left to weather or in a clear 'natural' stain,
- Stained timber cladding, in a 'Drydens' Stain Elm wood oil, or similar, or in a black stain,
- Corrugated Iron cladding, in colorsteel 'Flaxpod' or similar
- Steel tray cladding in Colorsteel 'Flaxpod' or similar, to match roof finish.
- Concrete, either in situ or precast. Low light reflection coefficient to be achieved through texture or oxide additive,

- Locally sourced schist stone, laid horizontally with dark tinted mortar/grout.
- Steel sheet cladding, in mild steel, with steel oil ('Penetrol' or similar) to prevent rusting

General Notes; Joinery, Gutters and Downpipes

(a) For steel and aluminium joinery all window and door joinery, gutters and downpipes shall be coloured to match the roof and exterior wall cladding. Timber window and door joinery is permitted on all buildings. No galvanized finishes are permitted.

(b) 'The Woolshed' is to be clad in locally sourced schist stone stacked horizontally' or aged uncoloured corrugated iron. Timber barge boards are permitted

A.5 WINDOW AND GLAZING

Objective: To control glazing percentage of each elevation and mitigate potential reflectivity and cumulative light spill form all distant viewpoints.

Controls:

(a) Lots 1-10, 25 and 26:

Glazing on all 'view' elevations (being the elevations facing wider views, generally on elevations of 3 metres high), shall be restricted to 60% of that elevation, the rest of the elevation to be solid and clad as specified above

Reason for the above control: Dwellings on these lots are potentially more visible from a wider field of distant viewpoints and these controls are intended to limit visible light spill.

(b) Lots 11-18:

Glazing is permitted an all elevations and shall not exceed 50% of the total wall area (all elevations combined)

Reason for the above control: These 'cabins' are visually discrete and light spill is visually contained within landform.

(b) Lots 19-23:

Glazing on all northern elevations (being the elevations facing wider views) shall be restricted to 75% of that elevation. Overall, glazing shall not exceed a maximum of 50% of all elevations combined.

Reason for the above control: Dwellings on these lots are less visible from a wider field of distant viewpoints and these controls aim to limit the potential of visible light spill.

(c) Lot 24:

Glazing on the northern elevation of this building shall not exceed 50% of that elevation

Reason for the above control: A building on this lot is potentially visible from a wide field of distant viewpoints and these controls are intended to limit visible light spill and reflectivity from those viewpoints.

(d) Lots 27-29

Glazing shall not exceed a maximum of 50% of all elevations combined.

Reason for the above control: The 3 dwellings on Lots 27-29 are at a low elevation with very limited visibility from wider views.

(d) Lots 30

Glazing shall not exceed a maximum of 60% of all elevations combined.

Reason for the above control: The built form on Lot 30 is at a low elevation with very limited visibility from wider views.

General Notes; Windows and Glazing

(a) All glazing shall be non-reflective.
(b) Glazing is to be recessed into any elevation by a minimum of 250mm

B. LANDSCAPE DESIGN CONTROLS

B1. KEY OBJECTIVES

The objectives of the following landscape controls are to ensure that the designed landscape will:

- Maintain the existing scale of vegetative cover visible from all from wider viewpoints,
- Prescribe landscape treatments that will ensure the designed 'domestic' landscape is in character with the existing Rocky Point landscape character.
- Preserve the Kanuka landscape present along the slopes of Rocky Point

B2. CURTILAGE AREAS

Objective: To ensure that minimal structures are visible from outside of the site and to avoid any spread of visible domestic clutter.

Controls:

(a) All buildings, structures, fixed clothes lines, play equipment, sculptures or any other items associated with domesticated landscaping and structures are to be located within the curtilage areas and out of locations where they may be visible from wider views,
(b) Small structures that are permitted in the curtilage areas may not exceed 5m^2 in footprint size or 2.5m in height (garden sheds by way of example). These structures shall be clad in a recessive colour with LRV less than 25%.
(c) No garden art or sculptures beyond the curtilage areas are permitted.

B3. PLANTING

Objective: To ensure that any planting integrates into the existing context and landscape patterns.

Controls:

(a) Where not prohibited by fire management requirements, only Kanuka shall be utilised for the purposes of tree or shrub planting
(b) Where not prohibited by fire management requirements, all tree planting (kanuka) shall be planted and maintained by the lot owner. Any deceased kanuka shall be replaced and planted by the lot owner during the planting season immediately following their loss.
(c) Any existing Kanuka that is removed (not including those removed for fire management) is to be replaced within the lot boundary where permitted by fire management.
(d) Herb and garden planting is permitted is permitted with 5m of the dwelling and shall not exceed 1m in height or 30m^2 in area.
(e) All areas outside the curtilage areas shall be maintained in its existing state, retaining existing Kanuka planting where permitted by fire management.
(f) Outside of Kanuka, a mixture of dryland species can also be planted to aid in preventing ecological fragmentation. These species are limited to those below:
    i. *Corokia cotoneaster* Korokia
    ii. *Olearia lineata*
    iii. *Olearia odorata*
    iv. *Coprosma propinqua*
    v. *Coprosma crassifolia*
    vi. *Coprosma virescens*
    vii. *Ozothamnus vauvilliersii* Mountain cottonwood
    viii. *Meuhlenbeckia axillaris*
(g) All noxious weeds within lots shall be controlled by lot owner.

B4. FENCING AND GATES

Objectives:

- Reduce the level of manmade shapes and structures in the natural environment of Rocky Point.

Controls:

(a) No fencing materials outside the curtilage area are permitted

(b) Fencing within the curtilage area is restricted to 1m high post and wire fencing only for the purpose of containing pets and for rabbit proofing.

(c) Any gate or feature wall shall be 1.0m high only, unless required for retaining. Materials will be limited to the following:

- Timber left to weather naturally
- Locally sourced schist stone, laid horizontally,
- Mild steel left to weather.
- A combination of the above

B5. EARTHWORKS, DRIVEWAY AND PARKING

Objectives:

- To ensure surface materials are complimentary with the surrounding landscape.

Controls:

(a) Vehicle courtyards are restricted to gravel or exposed aggregate only.

(b) Driveways shall be in gravels only

B6. EXTERNAL LIGHTING

Objectives:

- Lighting will be used for the purpose of illuminating the dwelling entries, driveways and outdoor living areas only and reduce potential for night time light pollution

Controls:

(a) Any external lighting shall be restricted to down lighting only and no higher than 1.2m.

(b) Lighting should not create any light spill and shall be low lux level. Light sources are to be LED, incandescent, halogen or other 'white light'. Sodium vapour or other coloured lighting is not allowed.

(c) Lighting shall align to the 5 Five Principles for Responsible Outdoor Lighting from the International Dark-Sky Association.

B7. UTILITIES AND EXTERIOR SERVICE AREAS

Objectives:

- To appropriately screen exterior services.

Controls:

(a) Air conditioning units, meters or any other electronic units relating to the house shall be painted to match house cladding or screened with planting.

(b) No air conditioning units, heat pumps etc or other units of any kind are permitted to be mounted on the roof.

(c) All site utilities such as gas supply, electrical supply, storm water piping, foul sewer, and telecommunications, shall be underground or contained within the building structure.

(d) All water tanks shall be located within the curtilage areas, be buried underground a minimum of 60%, fully screened by planting and shall be in dark colours.

APPENDIX B – NZILA SCALE OF EFFECTS

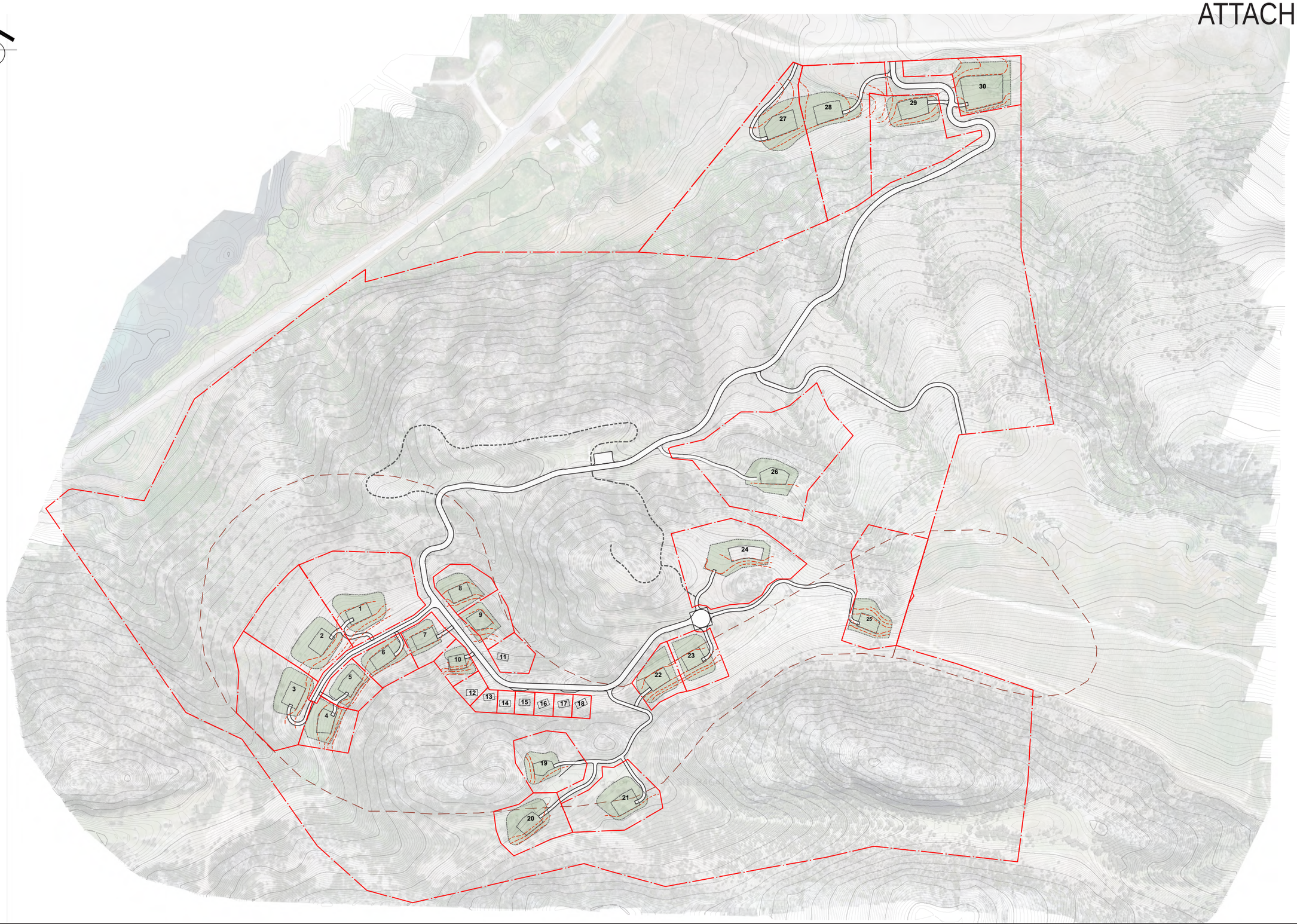
Adverse Visual Effects Rating Scale	
Effect Rating	Use and Definition
Very High	Total loss of key elements / features / characteristics, i.e. amounts to a very significant negative change in visual amenity.
High	Major modification or loss of most key elements / features / characteristics, i.e. little of the pre-development visual amenity remains and amounts to a significant negative change in visual amenity values. Concise Oxford English Dictionary Definition High: adjective - Great in amount, value, size, or intensity.
Moderate - High	Modifications of several key elements / features / characteristics, i.e. the pre-development visual amenity remains evident but materially changed.
Moderate	Partial loss of or modification to key elements / features / characteristics, i.e. the pre-development visual amenity remains evident but is changed. Concise Oxford English Dictionary Definition Moderate: adjective - average in amount, intensity, quality or degree
Moderate - Low	Small loss of or modification to one or more key elements / features / characteristics, i.e. new elements are not uncharacteristic within the visual environment and do not disturb the pre development visual amenity.
Low	Very little material loss of or modification to key elements / features / characteristics. i.e. new elements integrate seamlessly into the pre-development visual environment. Concise Oxford English Dictionary Definition Low: adjective- 1. Below average in amount, extent, or intensity.
Very Low	Negligible loss of or modification to key elements/ features/ characteristics of the baseline, i.e. visual influence of new elements is barely discernible.

For the purposes of notification determination, an adverse effects rating of Moderate- Low corresponds to a 'minor' adverse effects rating. An adverse effects rating of 'Low' or 'Very Low' corresponds to a 'less than minor' adverse effects rating.

NB. These rating scales apply to adverse effects, not to positive effects.

ATTACHMENT A

North



baxter design

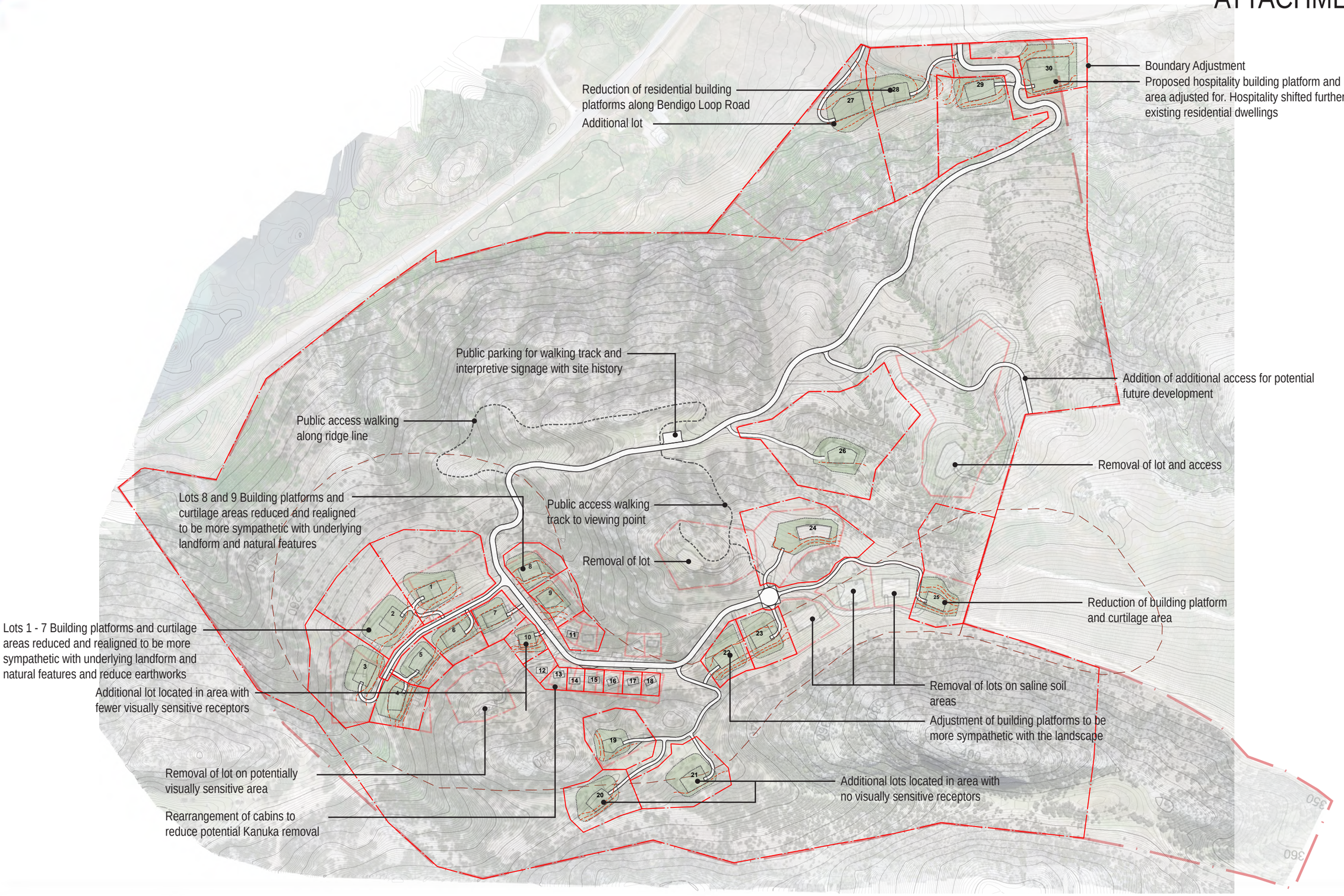
0 20 40 70 100m
SCALE = 1:2000 AT A1

REFERENCE **4371 -SK125** - SCALE = 1:2000 AT A1 - 1:4000 AT A3 - **08 Jul 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION
j:\4371 - infracon bendigo\cad\xref - 4371 - masterplan 10.dwg - Scheme Plan

DRAFT

REVISED SCHEME PLAN
INFRACON - BENDIGO

ATTACHMENT A1



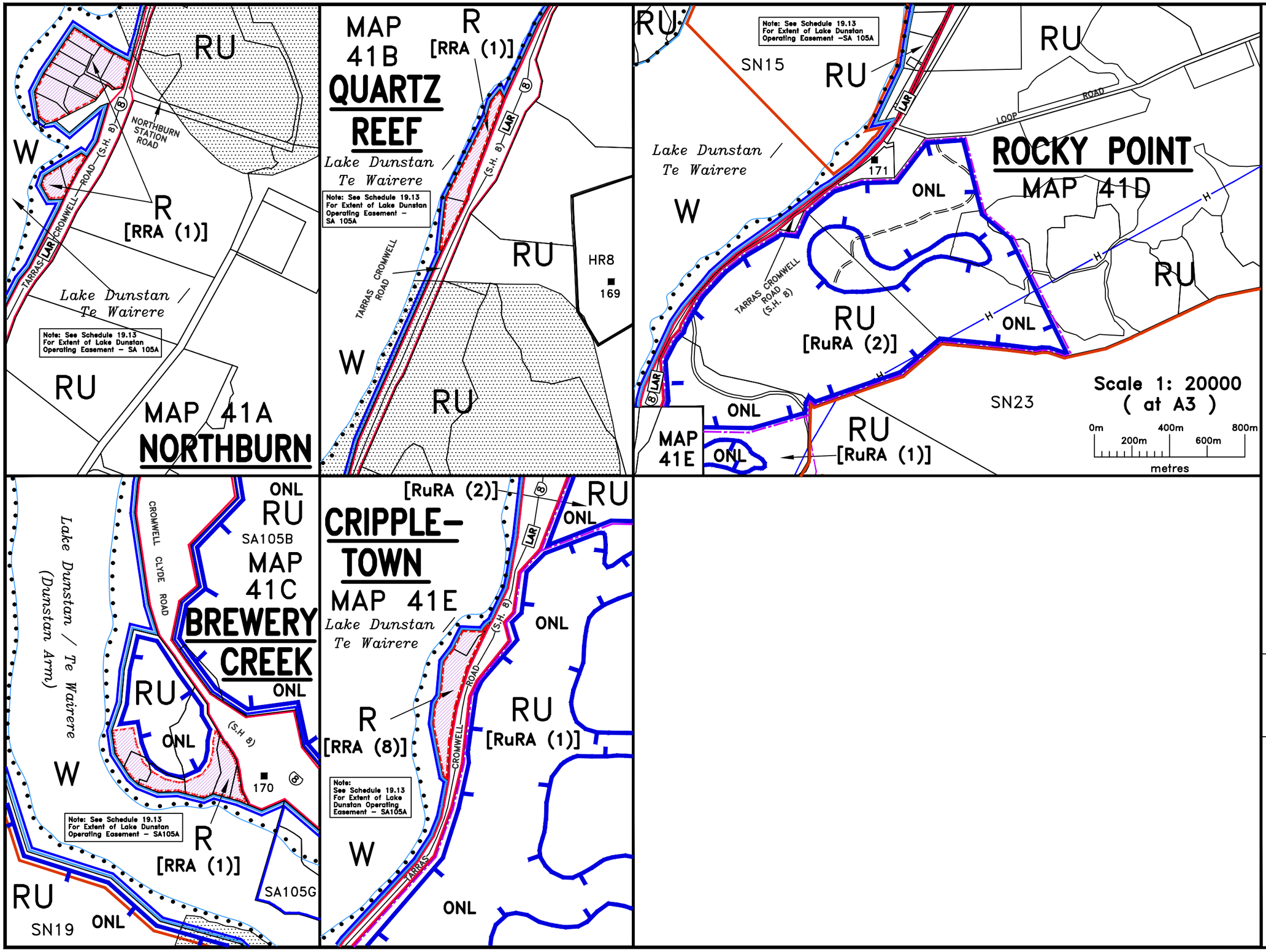
baxter design

REFERENCE **4371-SK135** - SCALE = 1:4000 @ A3 - **10 JUL 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION

DRAFT

ROCKY POINT - SUMMARY OF CHANGES

INFRACON - BENDIGO

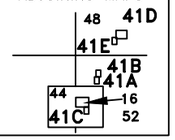


CENTRAL OTAGO DISTRICT COUNCIL

LOCATION

CENTRAL OTAGO DISTRICT

ADJOINING MAPS



Scale 1: 10000
(at A3)

0m 100m 200m 300m 400m
metres

Northpoint Vertical

See LEGEND for key to map notations

Amended: 15 July 2013

Publicly Notified : 18 July 1998
Amended by Decisions : 1 July 2000
Operative Date : 1 April 2008

CENTRAL OTAGO DISTRICT PLAN

MAPS 41 A–E

NORTHBURN, QUARTZ REEF, BREWERY CREEK, CRIPPLETOWN & ROCKY POINT

EXCERPT FROM CODC DISTRICT PLAN

CENTRAL OTAGO DISTRICT COUNCIL

SCHEDULE 19.16 : CONCEPT PLAN – RURAL RESOURCE AREA (2) (See Rule 4.7.2(ii)(a)(iii), p 4:38)

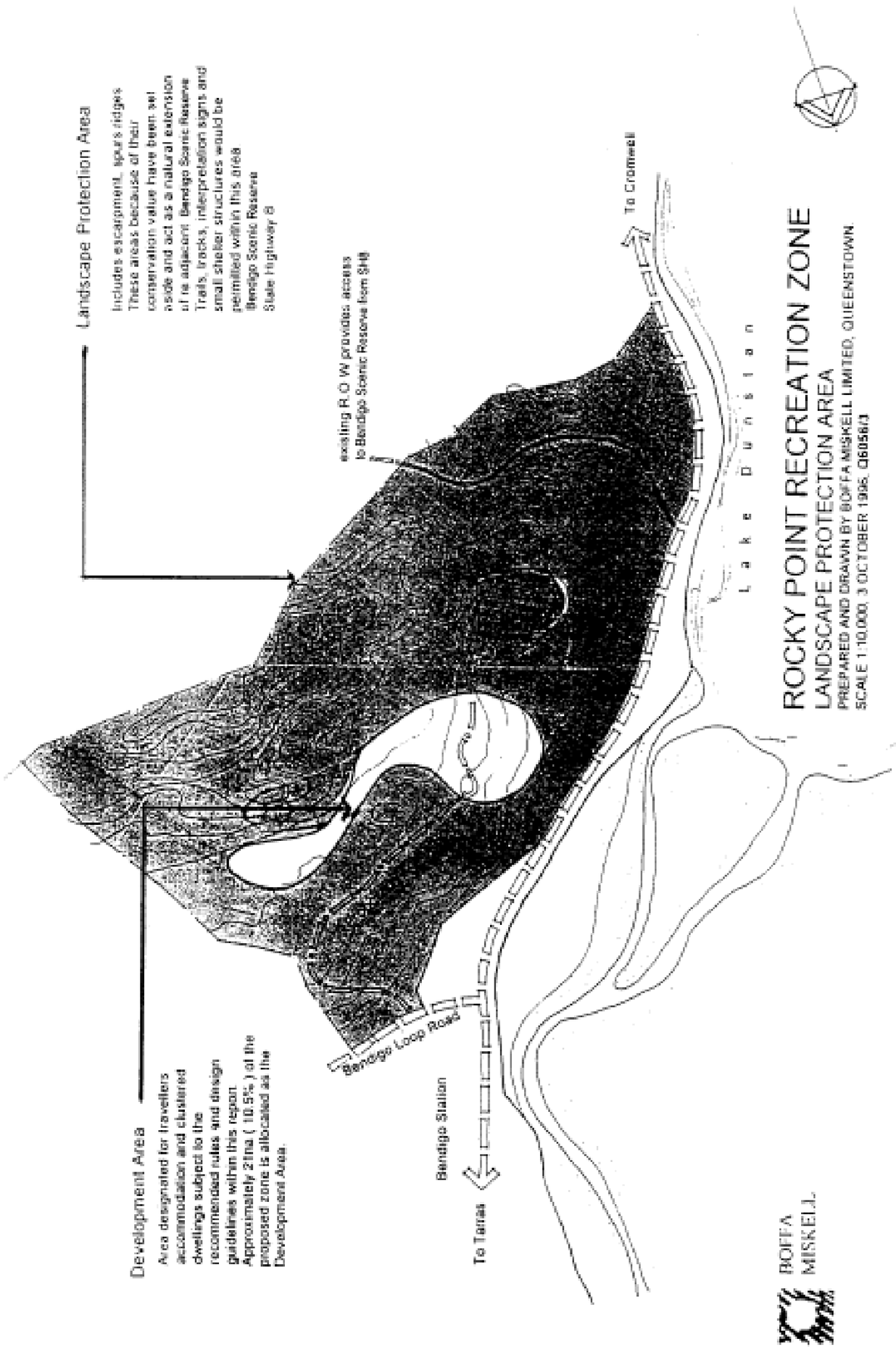
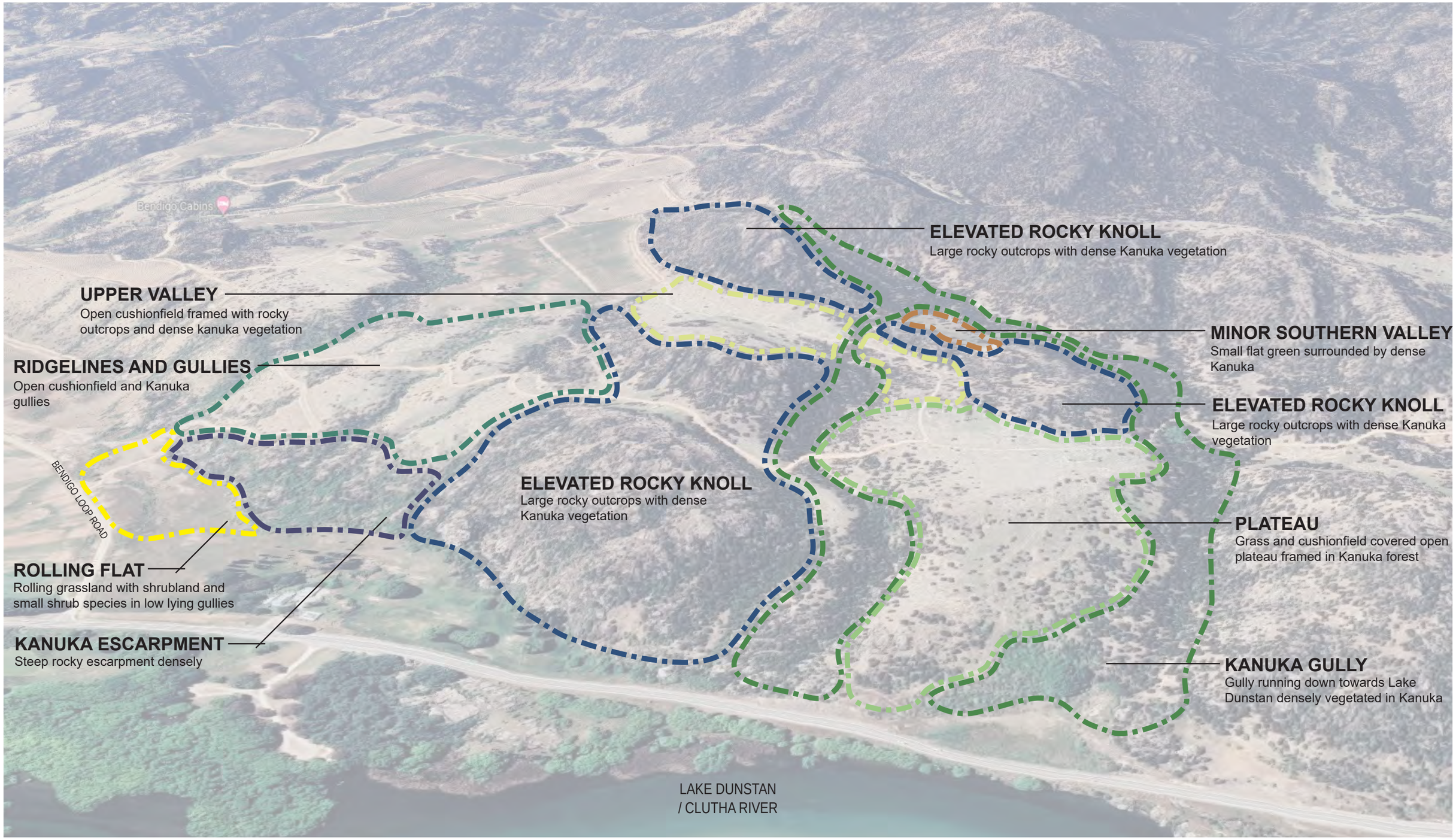


Figure 4.10



baxter design

REFERENCE **4371-SK58** - SCALE = NTS - **18 JAN 2023**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION

EXISTING LANDSCAPE COMPONENTS - ANALYSIS
INFRACON - BENDIGO

ATTACHMENT E

baxter design

0 20 40 70 100m
SCALE = 1:2000 AT A1

REFERENCE **4371-SK130** - SCALE = 1:500 AT A1 - 1:1000 AT A3 - **12 Jul 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION
j:\4371 - infracon bendigo\cad\xref - 4371 - masterplan 10.dwg - Lots 1 - 18

DRAFT

LOTS 1 - 18
INFRACON - BENDIGO

ATTACHMENT F

baxter design

0 20 40 70 100m
SCALE = 1:2000 AT A1

REFERENCE **4371-SK131** - SCALE = 1:500 AT A1 - 1:1000 AT A3 - **08 Jul 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION
j:\4371 - infracon bendigo\cad\xref - 4371 - masterplan 10.dwg - Lots 19 - 21

DRAFT

LOTS 19 - 21
INFRACON - BENDIGO

ATTACHMENT G

baxter design

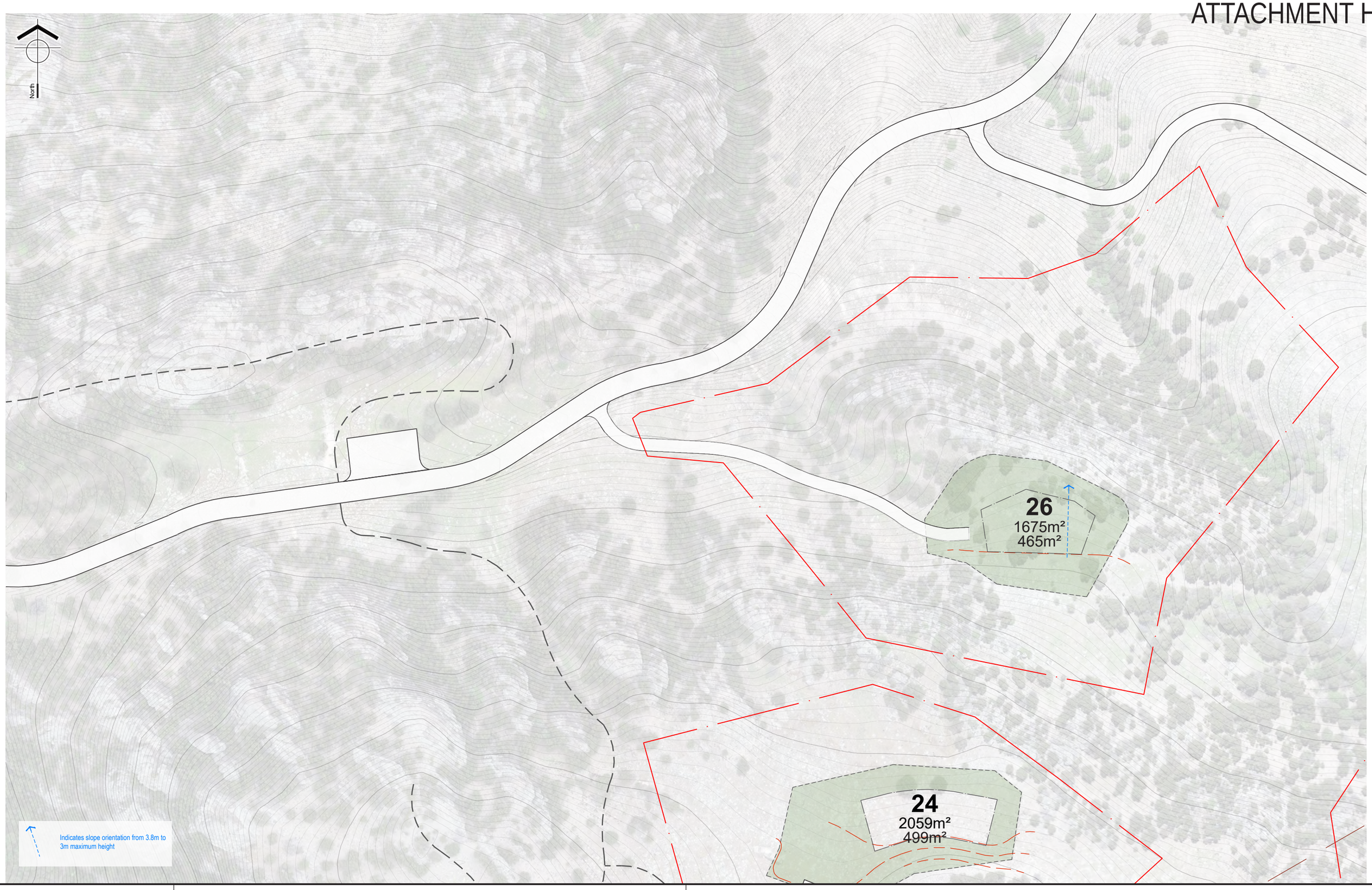
0 20 40 70 100m
SCALE = 1:2000 AT A1

REFERENCE **4371-SK132** - SCALE = 1:500 AT A1 - 1:1000 AT A3 - **12 Jul 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION
j:\4371 - infracon bendigo\cad\xref - 4371 - masterplan 10.dwg - Lots 22 - 25

DRAFT

LOTS 22 - 25
INFRACON - BENDIGO

ATTACHMENT H



baxter design

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SCALE = 1:2000 AT A1

REFERENCE **4371-SK133** - SCALE = 1:500 AT A1 - 1:1000 AT A3 - **12 Jul 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION
j:\4371 - infracon bendigo\cad\xref - 4371 - masterplan 10.dwg - Lot 26

DRAFT

LOT 26
INFRACON - BENDIGO

ATTACHMENT I

baxter design

0 20 40 70 100m
SCALE = 1:2000 AT A1

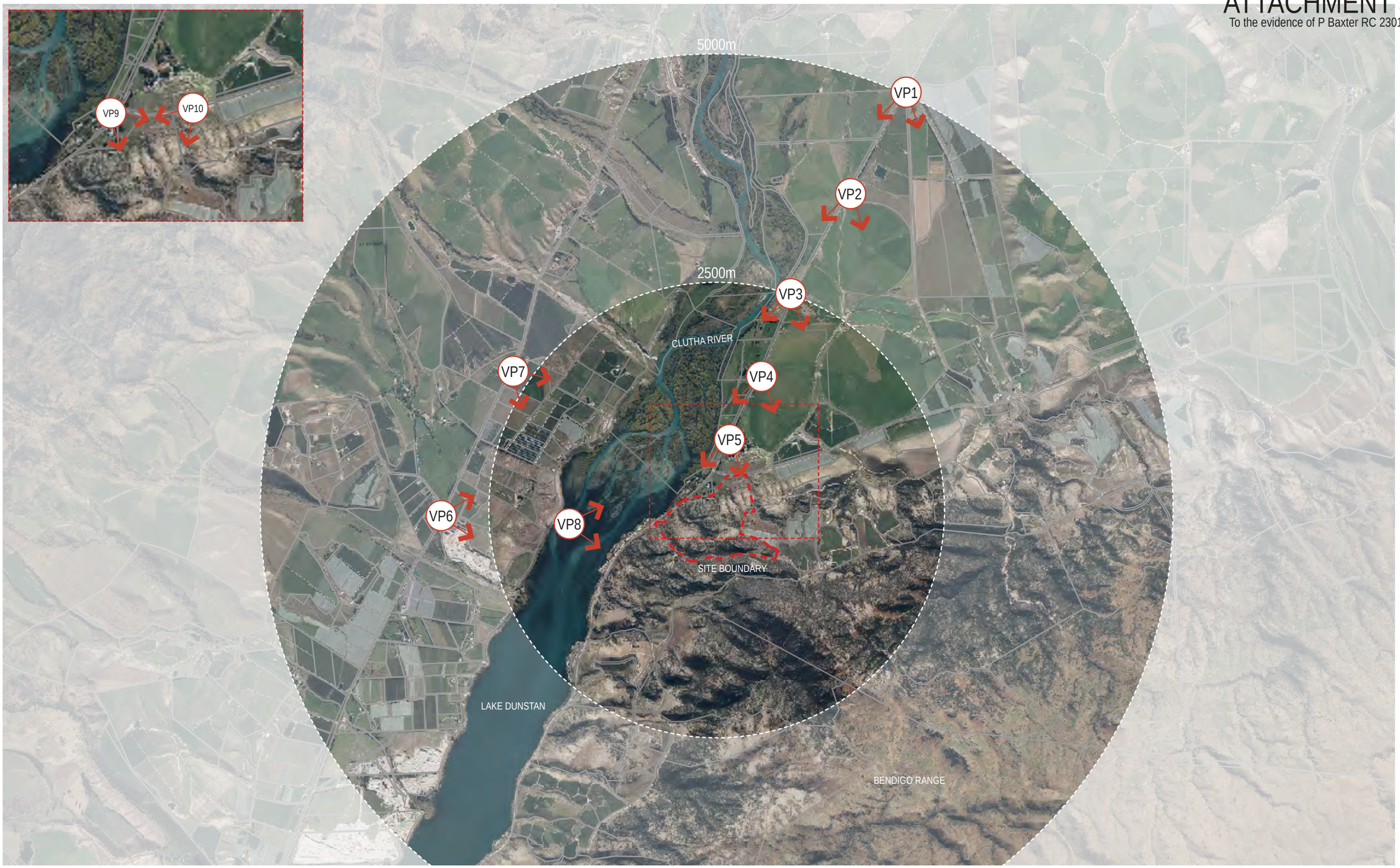
REFERENCE **4371-SK134** - SCALE = 1:500 AT A1 - 1:1000 AT A3 - **08 Jul 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION
j:\4371 - infracon bendigo\cad\xref - 4371 - masterplan 10.dwg - Lots 27 - 30

DRAFT

LOTS 27 - 30
INFRACON - BENDIGO

ATTACHMENT J

To the evidence of P Baxter RC 230179



baxter design

REFERENCE **4371-SK41** - SCALE = 1:40000 @ A3 - **20 NOV 2023**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION

ROCKY POINT - PHOTO LOCATION MAP

INFRACON - BENDIGO

FIG A. Viewpoint Location

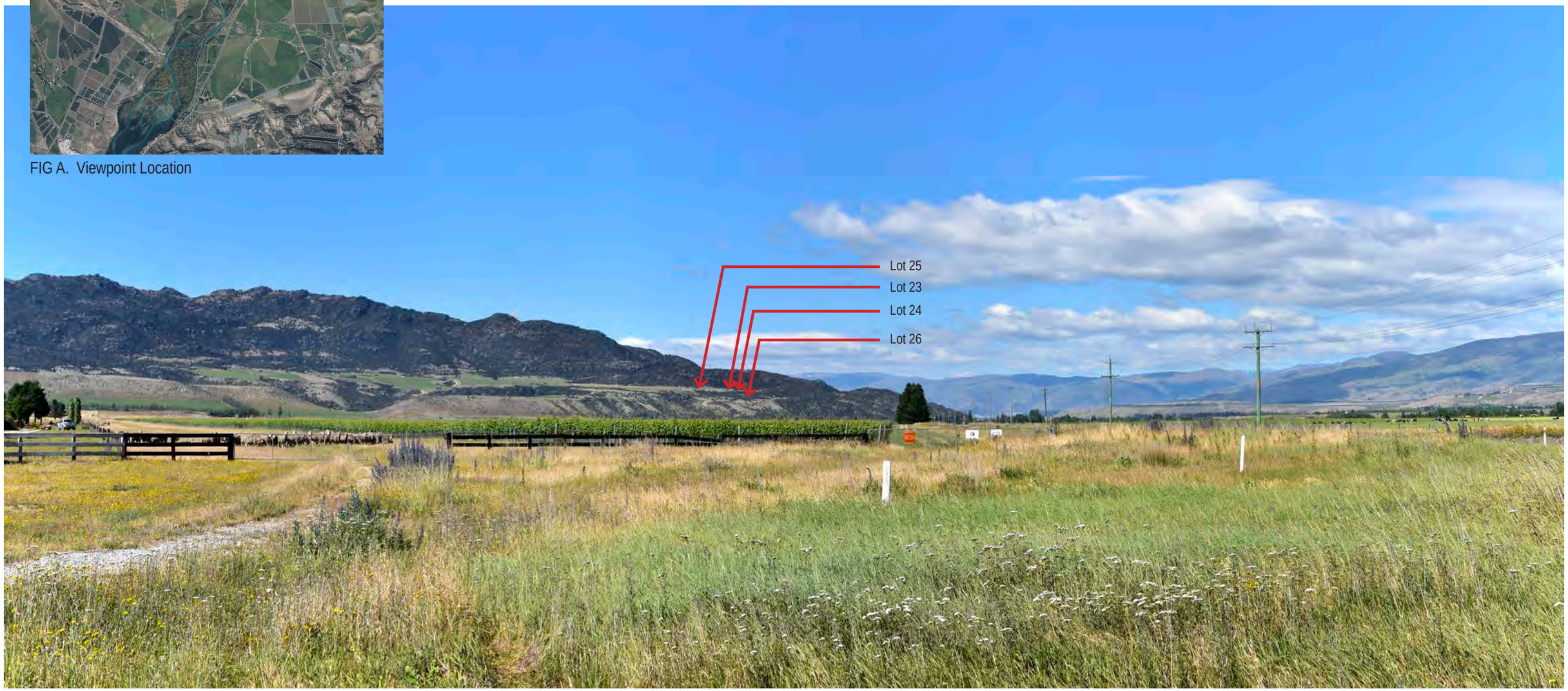


FIG B. Panoramic Image

Approximately 4700m from Lot 32

NOTE:

Arrows indicate approximate location of structures potentially visible from this viewpoint

Panoramic image created from four portrait images captured at 50mm Full Frame Equivalent with minimum 25% overlap then stitched together using Image Composite Editor.

FIG A. Viewpoint Location

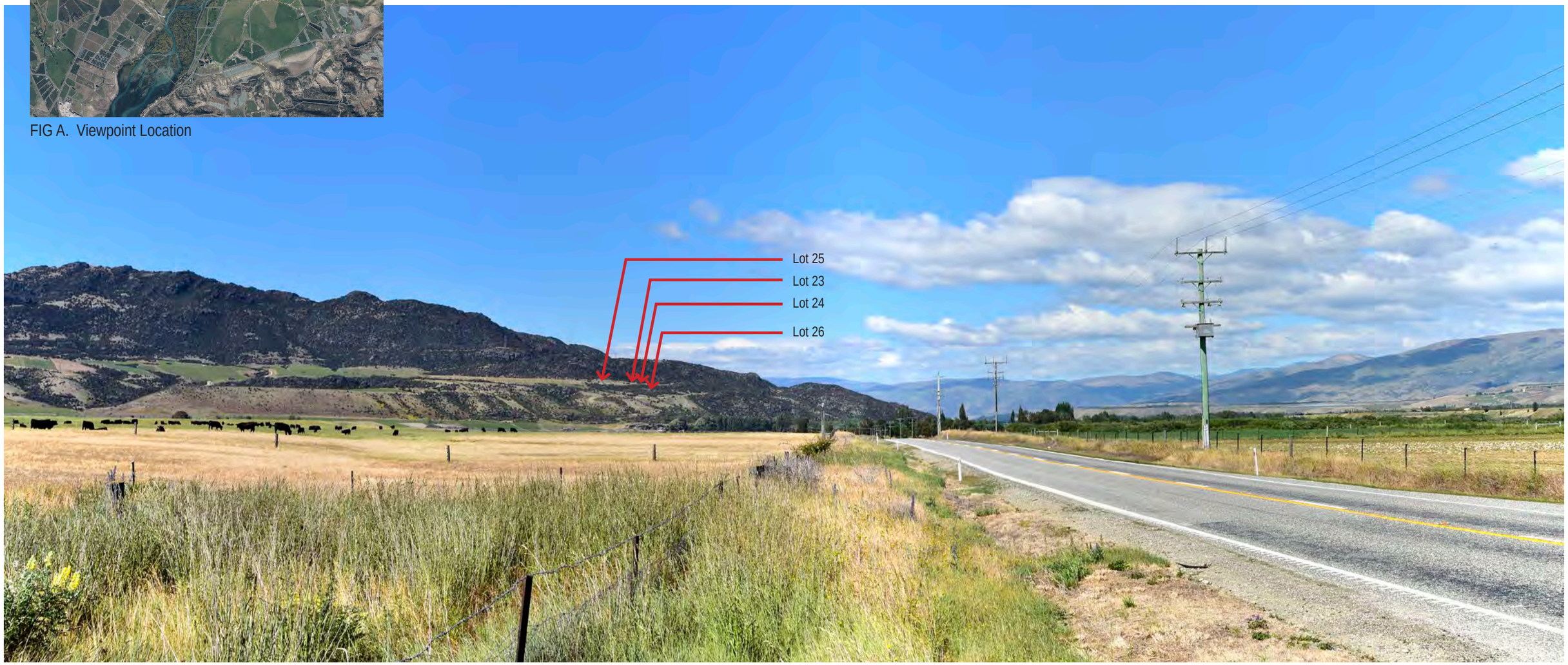


FIG B. Panoramic Image

Approximately 3400m from Lot 32

NOTE:
Arrows indicate approximate location of structures potentially visible from this viewpoint

Panoramic image created from four portrait images captured at 50mm Full Frame Equivalent with minimum 25% overlap then stitched together using Image Composite Editor.

FIG A. Viewpoint Location

FIG B. Panoramic Image

Approximately 2000m from Lot 32

NOTE:

Arrows indicate approximate location of structures potentially visible from this viewpoint

Panoramic image created from four portrait images captured at 50mm Full Frame Equivalent with minimum 25% overlap then stitched together using Image Composite Editor.

FIG A. Viewpoint Location

FIG B. Panoramic Image
Approximately 900m from Lot 32

NOTE:
Arrows indicate approximate location of structures potentially visible from this viewpoint

Panoramic image created from four portrait images captured at 50mm Full Frame Equivalent with minimum 25% overlap then stitched together using Image Composite Editor.

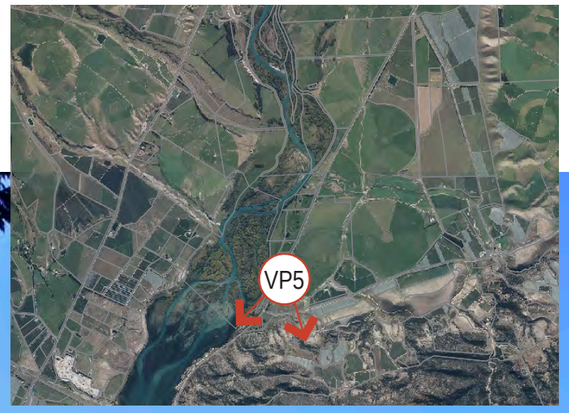


FIG A. Viewpoint Location

FIG B. Panoramic Image
Approximately 400m from Lot 32

NOTE:
Arrows indicate approximate location of structures potentially visible from this viewpoint

Panoramic image created from four portrait images captured at 50mm Full Frame Equivalent with minimum 25% overlap then stitched together using Image Composite Editor.

FIG A. Viewpoint Location

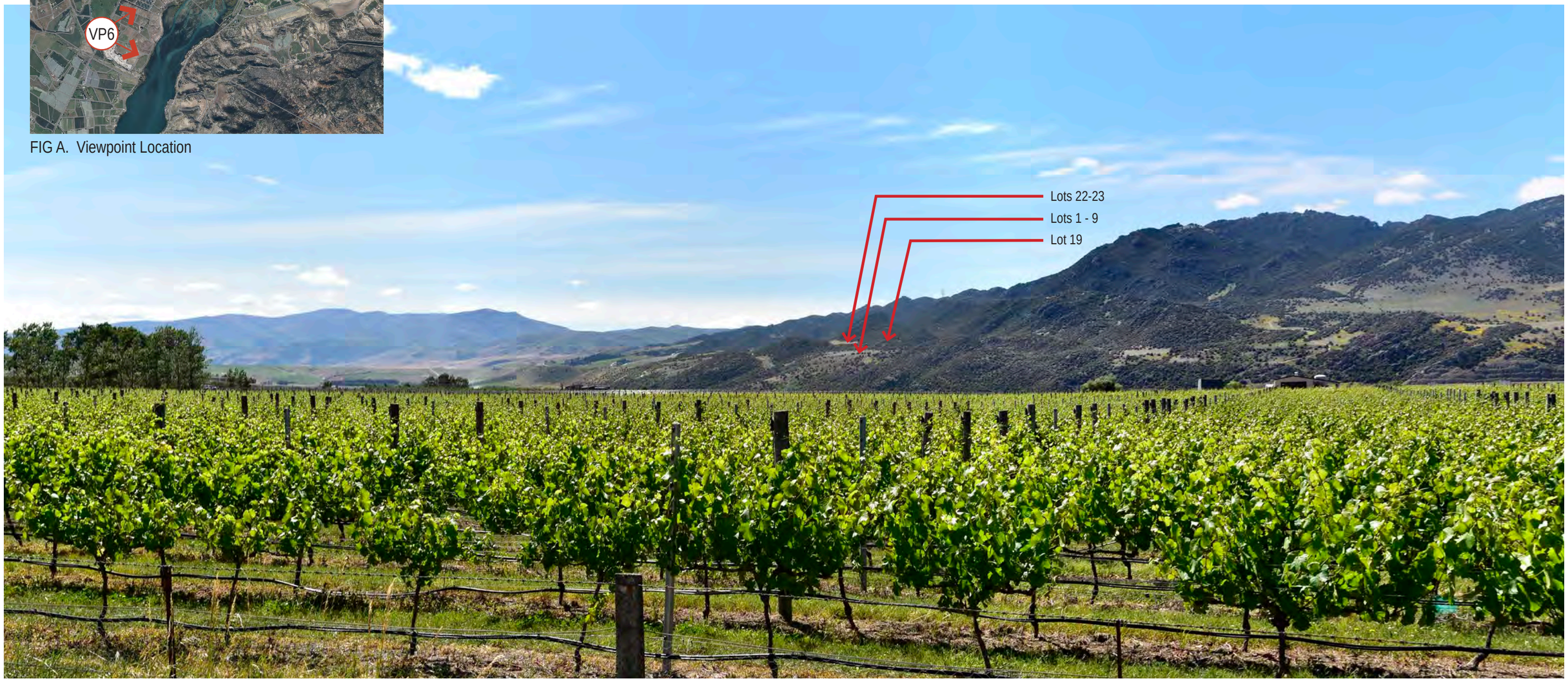


FIG B. Panoramic Image
Approximately 2650m from Lot 2

NOTE:
Arrows indicate approximate location of structures potentially visible from this viewpoint

Panoramic image created from four portrait images captured at 50mm Full Frame Equivalent with minimum 25% overlap then stitched together using Image Composite Editor.

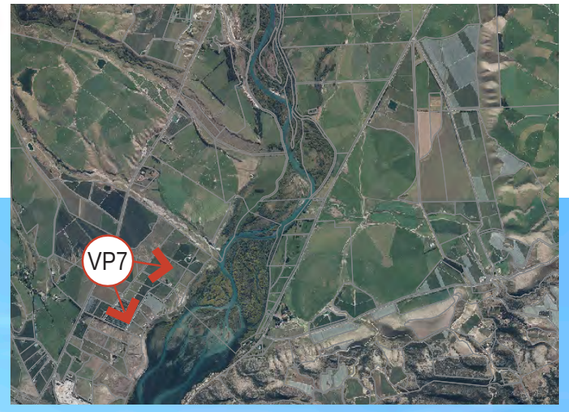


FIG A. Viewpoint Location

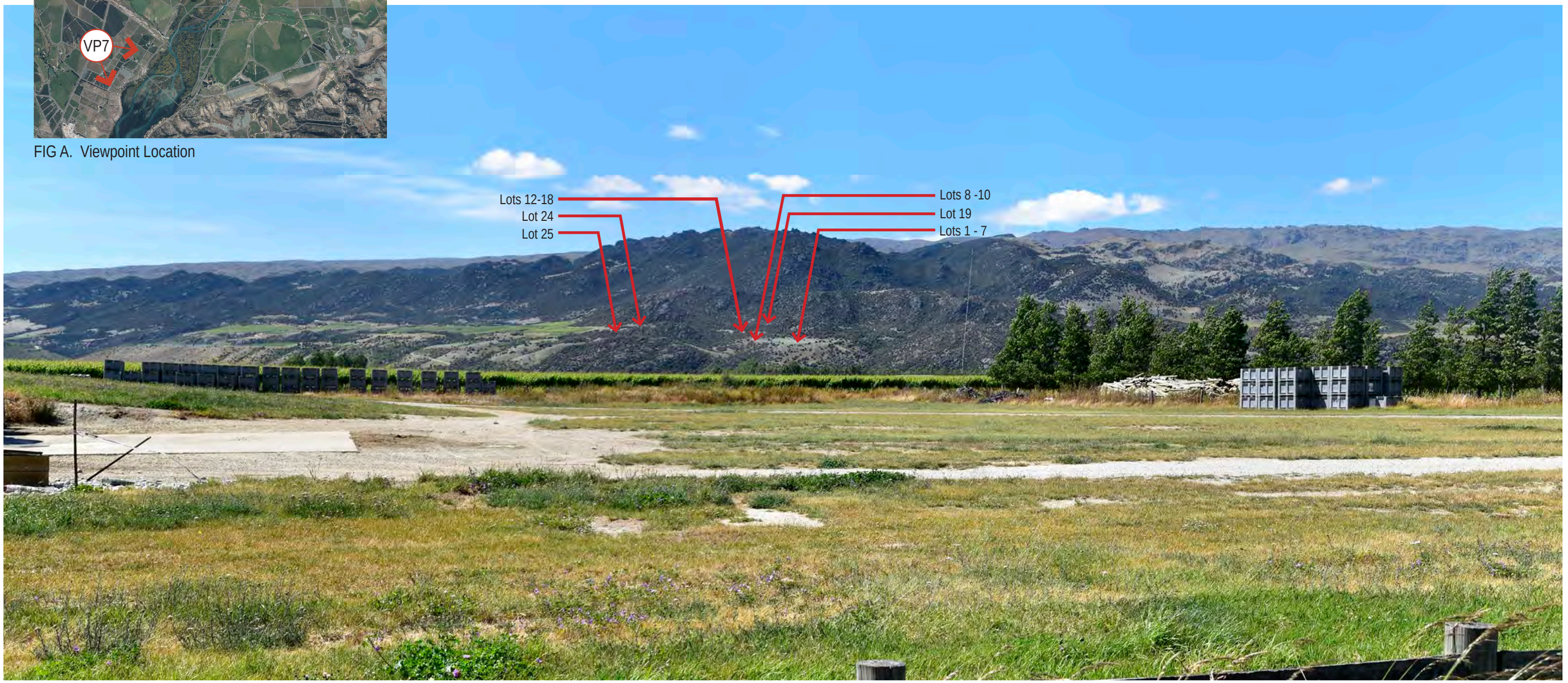


FIG B. Panoramic Image
Approximately 2650m from Lot 2

NOTE:
Arrows indicate approximate location of structures potentially visible from this viewpoint

Panoramic image created from four portrait images captured at 50mm Full Frame Equivalent with minimum 25% overlap then stitched together using Image Composite Editor.

baxter design

REFERENCE **4371-SK42G** - SCALE = NTS - **08 JULY 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION

VIEWPOINT 7 - LUGGATE CROMWELL ROAD (VP7)
INFRACON - BENDIGO

FIG A. Viewpoint Location

FIG B. Panoramic Image

Approximately 1350m from Lot 32

NOTE:

Arrows indicate approximate location of structures potentially visible from this viewpoint

Panoramic image created from four portrait images captured at 50mm Full Frame Equivalent with minimum 25% overlap then stitched together using Image Composite Editor.

FIG A. Viewpoint Location

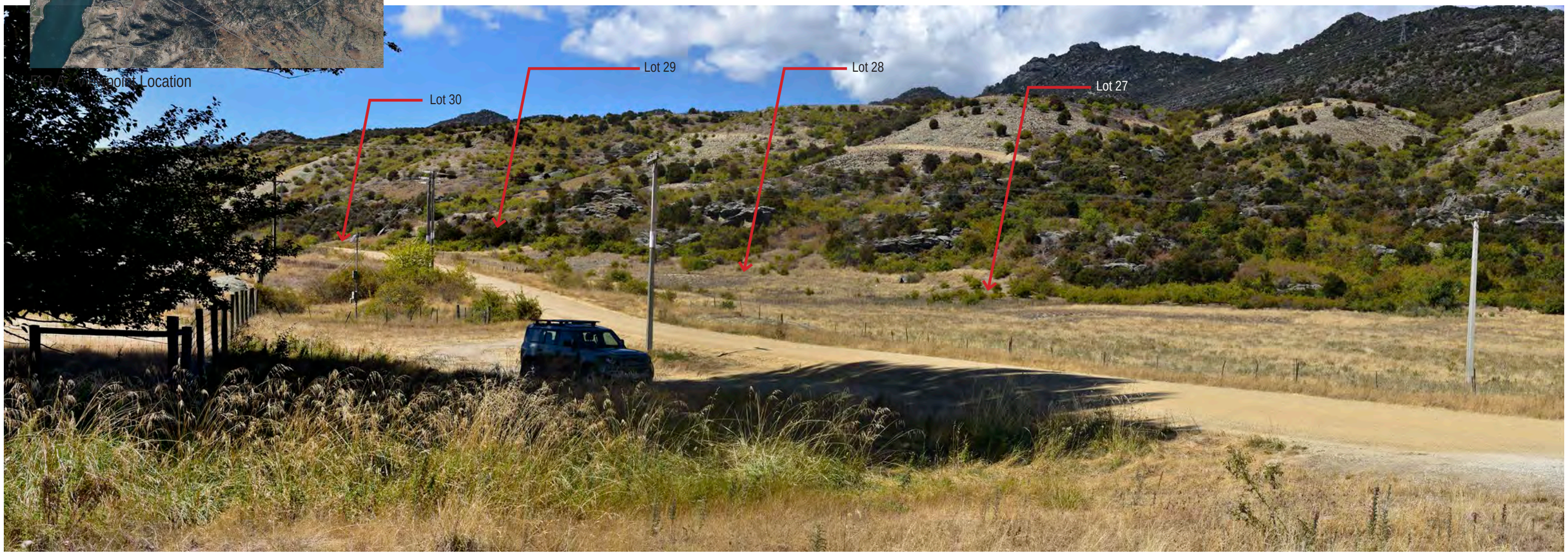


FIG B. Panoramic Image
Approximately 220m from Lot 32

NOTE:
Arrows indicate approximate location of structures potentially visible from this viewpoint

Panoramic image created from four portrait images captured at 50mm Full Frame Equivalent with minimum 25% overlap then stitched together using Image Composite Editor.

Viewpoint Location

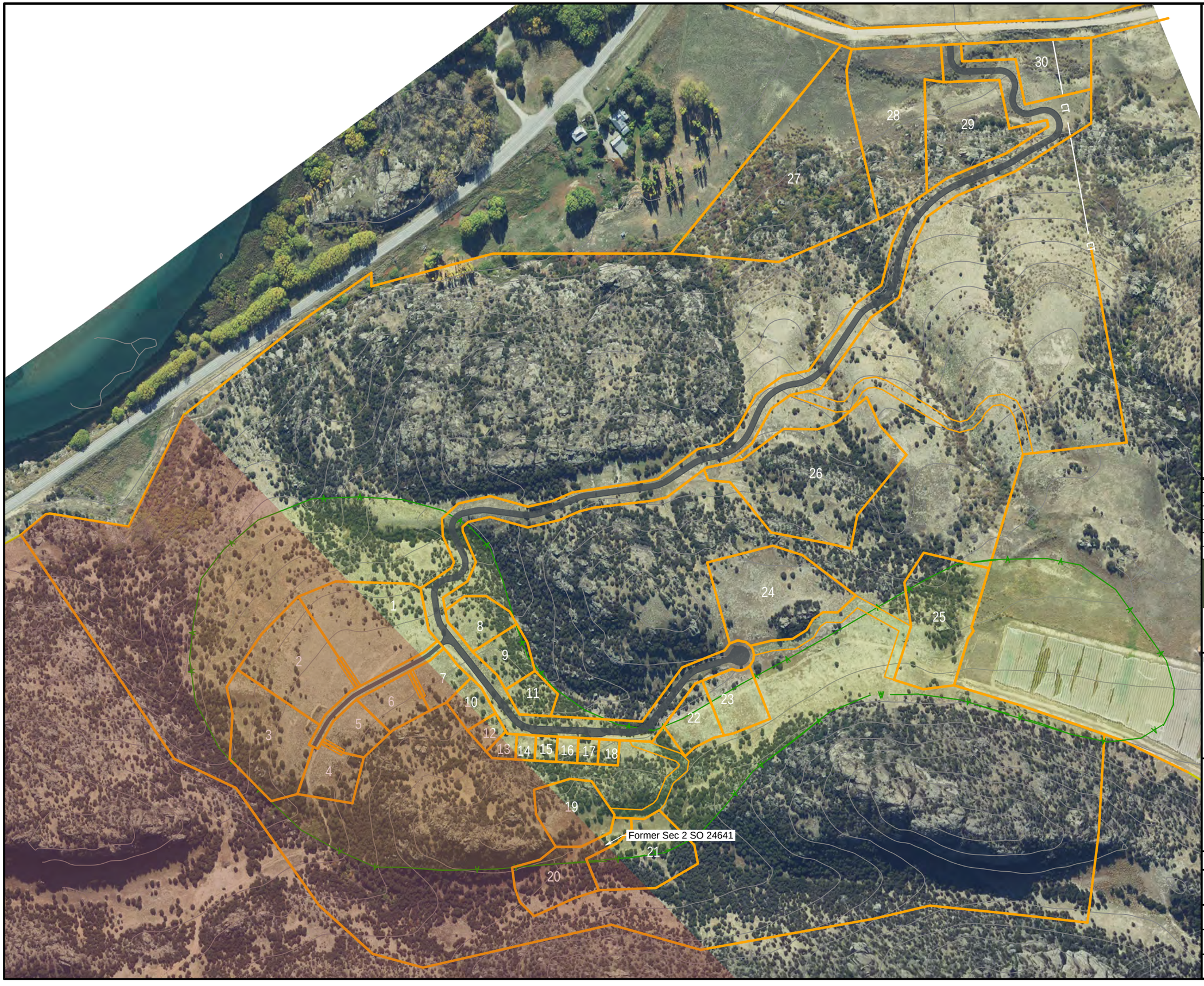
FIG B. Panoramic Image

Approximately 350m from Lot 32

NOTE:

Arrows indicate approximate location of structures potentially visible from this viewpoint

Panoramic image created from four portrait images captured at 50mm Full Frame Equivalent with minimum 25% overlap then stitched together using Image Composite Editor.



ATTACHMENT L

To the evidence of P Baxter RC 230179

1) Not used.

2) Area marked --A-- is approximate extent of area designated as "Development Area" on CODC District Plan Schedule 19:16.

3) Areas and dimensions are subject to survey.

4) Aerial image on Sheet 1 has been sourced from Landpro Ltd. Detailed aerial on Sheets 2-4 C Hughes and Assoc Ltd UAV.

5) Residential building platforms have varying sizes.

6) Refer Landscape Architect design guidelines for site coverage and other building restrictions for specific sites.

7) Lots 24, 29-30 are intended for commercial use.

8) Proposal includes minor boundary adjustment with Lot 2 DP 523873.

REVISION	DETAIL	DATE
B	Subdivision layout	29 Nov 2022
C	Layout	30 Jan 2023
D	Lots 29,30 & tracks	3 Feb 2023
E	Entrance and Lots 30-32	11 May 2023
F	Road alignments and Platforms	9 June 2023

COTERRA.

WANAKA
LEVEL 3, 80 ARDMORE ST
P.O. BOX 599
03 443 5052

CROMWELL
17A MURRAY TERRACE
P.O. BOX 51
03 445 0376

coterra.co.nz

Project

ROCKY POINT
TKO Properties Ltd
Overall layout

Title

Proposed Subdivision
of Lot 1 DP 596985.

FOR CONSENT

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The Contractor shall verify all dimesions on site.

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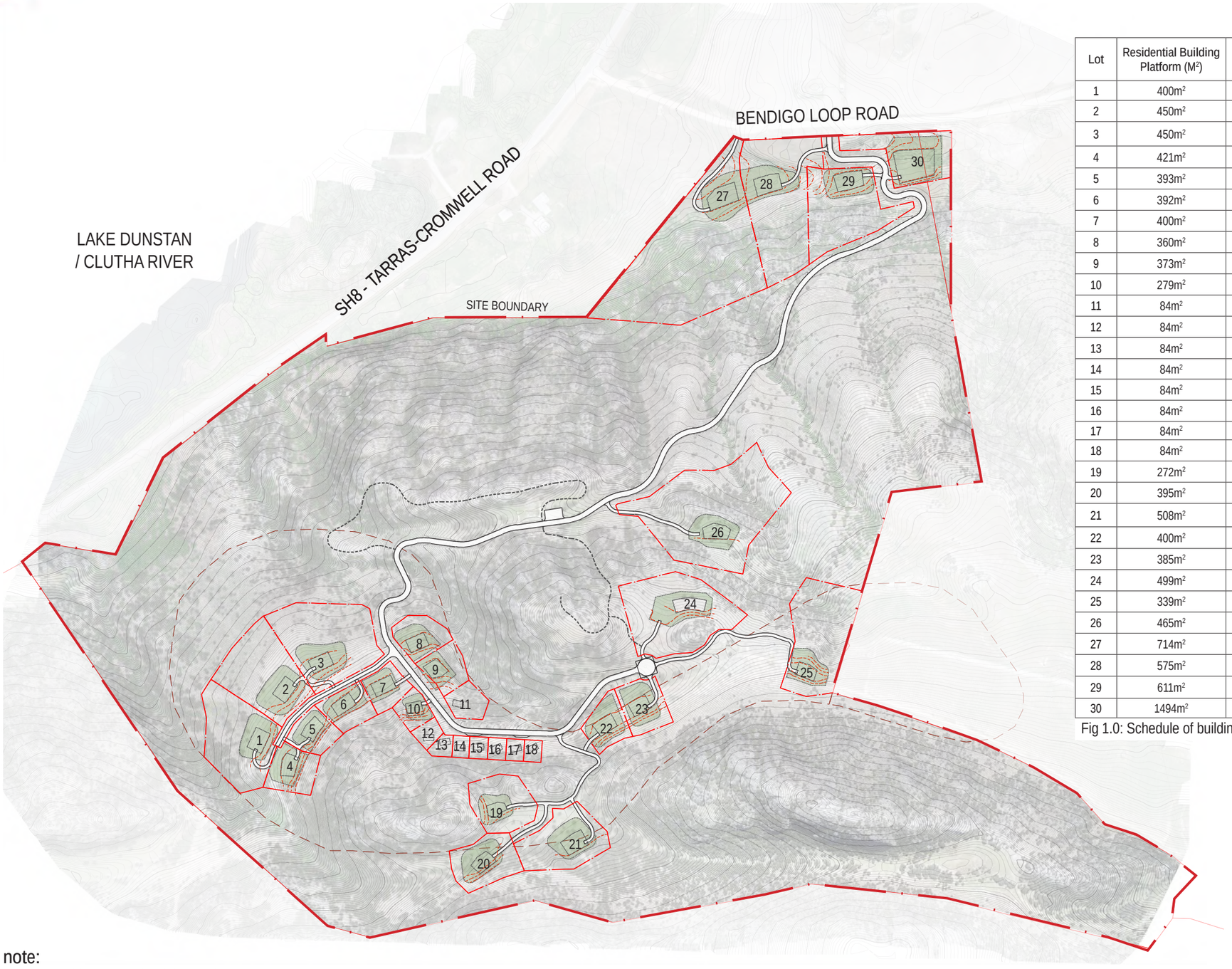
Scale: 1:3500

Job No:	Drawn By:	Datum:		
5925	MJS	LP2000		
Drawing No:	Sheet No:	Revision:	Date Created:	
W1665	1	G	June 2024	

ATTACHMENT M

To the evidence of P Baxter RC 230179



Lot	Residential Building Platform (M^2)	Maximum Site Coverage (M^2)	Site Coverage of RBP	Curtilage Area (M^2)	Platform RL	Maximum Height RL	Maximum Building Height
1	400m²	220m²	55%	1823m²	+292.00	+295.80	3.8m
2	450m²	220m²	49%	2019m²	+291.50	+295.30	3.8m
3	450m²	220m²	49%	1603m²	+292.00	+295.80	3.8m
4	421m²	220m²	52%	1411m²	+297.00	+280.80	3.8m
5	393m²	220m²	56%	1104m²	+297.00	+280.80	3.8m
6	392m²	220m²	56%	1191m²	+298.00	+301.80	3.8m
7	400m²	220m²	55%	985m²	+299.00	+302.80	3.8m
8	360m²	200m²	55%	1313m²	+296.00	+300.80	3.8m
9	373m²	200m²	54%	1084m²	+300.00	+303.80	3.8m
10	279m²	150m²	54%	718m²	+304.00	+307.80	3.8m
11	84m²	84m²	100%	-	-	-	5.0m
12	84m²	84m²	100%	-	-	-	5.0m
13	84m²	84m²	100%	-	-	-	5.0m
14	84m²	84m²	100%	-	-	-	5.0m
15	84m²	84m²	100%	-	-	-	5.0m
16	84m²	84m²	100%	-	-	-	5.0m
17	84m²	84m²	100%	-	-	-	5.0m
18	84m²	84m²	100%	-	-	-	5.0m
19	272m²	250m²	91%	1080m²	+332.50	+337.00	4.5m
20	395m²	250m²	63%	1564m²	+329.00	+333.50	4.5m
21	508m²	250m²	49%	1666m²	+333.00	+337.50	4.5m
22	400m²	250m²	63%	1703m²	+322.00	+326.50	4.5m
23	385m²	250m²	65%	1545m²	+322.00	+326.50	4.5m
24	499m²	250m²	50%	2059m²	+323.00	+327.50	4.5m
25	339m²	220m²	65%	1440m²	+328.00	+331.80	3.8m
26	465m²	260m²	56%	1675m²	+302.00	+305.80	3.8m
27	714m²	350m²	49%	2207m²	+203.00	+208.00	5.0m
28	575m²	350m²	61%	2035m²	+204.00	+209.00	5.0m
29	611m²	350m²	57%	1671m²	+210.00	+215.00	5.0m
30	1494m²	350m²	23%	3123m²	+210.00	+215.50	5.5m

Fig 1.0: Schedule of building platforms

note:
Roads and driveways to be deisgned by engineer or surveyor

baxter design

REFERENCE **4371-SK129** - SCALE = 1:5000 @ A3 - **12 JUL 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION

ROCKY POINT - SCHEDULE OF LOTS
INFRACON - BENDIGO

ATTACHMENT N

To the evidence of P Baxter RC 230179

North

LEGEND		
	Areas of existing Kanuka	343,942 m^2
	Proposed areas of Kanuka removal	13,539 m^2
	Areas of existing Cushionplant	139,649 m^2
	Proposed areas of Cushionplant removal	39,880 m^2
	Areas of Saline Soils	10,700 m^2
LOCATIONS OF		
	Myosurus minimus subsp. novae-zelandiae	
	Myosotis brevis	
	Colobanthus brevisepalus	

NOTE: for each of the points identifying a threatened species, these points generally represent more than one specimen, sometimes groups of plants.

baxter design

0 20 40 70 100m

SCALE = 1:2000 AT A1

REFERENCE **4371-SK127** - SCALE = 1:2000 AT A1 - 1:4000 AT A3 - **08 Jul 2024**

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j:\4371 - infracon bendigo\cad\xref - 4371 - masterplan 10.dwg - Ecology Map

DRAFT

ECOLOGY MAPPING

INFRACON - BENDIGO

CKL

Planning | Surveying | Engineering | Environmental

Water and Wastewater Assessment

Rocky Point - Bendigo Loop Road

TKO Properties Ltd

Document Information

Client	**Infracon Limited for TKO Properties Ltd**
Site Location	Bendigo Loop Road, Central Otago
Legal Description	Lot 1 DP 561457
CKL Reference	A23205
Office of Origin	Auckland

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1 Executive Summary

TKO Properties Ltd are proposing to subdivide Lot 1 Deposited Plan 561457, Lakefront Terrace, Bendigo. The proposed subdivision is colloquially known as the Rocky Point Development. The development includes 30 lots, with a mix of residential, large residential and communal use. CKL has been commissioned to conduct a conceptual level assessment for the treatment and disposal of wastewater, as well as the provision of water supply options for the proposed development, to support a resource consent application.

The findings of the investigation are summarised below. The enclosed assessment considered factors such as site characteristics, site geology, cost, regulatory requirements, resilience, sustainability, and environmental effects. This revision is based on extensive discussions with the client (between the 22nd of March 2024 and the 11th of July 2024) and includes further considerations for water supply options, storage and wildfire.

A service agency agreement will be created to ensure the ongoing maintenance of all water supply and wastewater devices and infrastructure, in accordance with the operation and monitoring recommendations within Section 4.7 and 5.4.

Drawings depicting the scheme and discussed options can be found in Appendix 1.

Water Supply

Multiple options have been considered for the supply and treatment of water. Each option focused on providing a safe water supply and level of service to meet obligations as a water service provider, as per requirements of Taumata Arowai (water services regulator for Aotearoa). It is intended that water shall be supplied to the proposed development from the Chinamans Terrace water scheme (existing bore to the north of the subject lot, with a permit to extract 2,735 m^3/day from the aquifer). Water quality is generally good, with no staining or pretreatment requirements envisaged at this stage. The Langelier saturation index was slightly high, but acceptable.

Wildfire Management NZ have been engaged to devise a strategy for combating wildfire. Two types of sprinklers have been recommended to mitigate this risk: vegetation sprinklers (to reduce and slow fire spread in key risk areas, particularly focussed on up-slopes and gullies) and ember sprinklers (to mitigate against the risk of ember attack (drifting embers)). The development infrastructure will provide for vegetation sprinkler supply. It will also provide for ember sprinkler water supply up to 150,000L (2 sprinklers per lot 1 – 26). Ember sprinklers can be pulsed on and off (1 min on, 1 min off) to reduce water storage requirements, and/or water storage volume can be increased over time if the need is increased.

Treatment will be required to provide safe, treated water in accordance with the NZ Drinking Water Standards requirements in light of responsibilities laid out in the Drinking Water Quality Assurance Rules. It is proposed to comply with Taumata Arowai's Acceptable Solution for Mixed-Use Rural Water Supplies (Appendix 3).

After a concept level assessment of various options, a preferred option (Option A) was chosen:

- Water supplied to all lots from the Chinamans Terrace Scheme to the southeast of the development.
- Expansion of the existing bank of raw water at Chinamans terrace, located at a suitable location to provide sufficient head for sprinklers, without the need for boosting. It is recommended to split the storage, with two supplies:
    - Storage system 1: storing 48 hours of domestic use and 30 minutes of hydrant demand with appropriate pretreatment and protection from stagnation/ contamination (e.g. a steel tank with an effective capacity of 90,000L (Pioneer GT110, or similar) or 3 – 4 large plastic tanks). This can be increased to include buffer storage.

    - Storage system 2: storing vegetation sprinkler and ember suppression sprinkler demand. This equates to approximately 340,000L. This can be stored in tanks or in a lined pond (more economical). In the event of the latter being adopted, it is recommended to install a floating plastic cover if a pond is implemented and/or appropriate auto-flushing filtration units (e.g. Arkal, Amiad, Filtersafe) to prevent sprinklers from blocking during a fire.
- Trunk mains and reticulation networks from each storage system installed to reticulate water to the Rocky Point development via gravity.
    - Reticulation System 1: will convey domestic use and hydrant demand.
    - Reticulation System 2: will convey vegetation sprinkler and ember suppression sprinkler demand.
    - Pressure reducing valves installed at lot connections, as necessary to regulate the pressure and flow of water for domestic consumption.
    - It is proposed that both mains be laid within common trench, where possible.
    - Large differential pressure between the top and bottom terrace requires a break-pressure tank to be situated at an appropriate location (access, aesthetics) and will serve to balance pressure and provide buffer storage for domestic and fire hydrants on the bottom terrace i.e. the bottom terrace will operate as a separate water supply and pressure zone.
- Installation (at time of building) and maintenance of independent treatment and disinfection units at each lot (30 of), sized accordingly (assumes that water quality will be of an acceptable standard to enable appropriate treatment at each lot (e.g. filtration and UV)).
- A bulk water meter at the outlet of domestic water storage system is proposed to measure water supplied. In addition, individual water meters at each lot are proposed to measure water consumed to allow for water consumption trends/monitoring as well as water loss management.
- Fire hydrants to be provided in accordance with SNZ PAS 4509:2008 and a FW-2 rating, to combat structure fires within the development.
- Wildfire sprinklers to be provided as outlined in Sections 4.2.4 and 4.3.

Other options which were considered included combining the domestic and wildfire storage and reticulation systems, installation of a new groundwater bore or a bifurcation of the existing bore's rising main to serve lots 27 – 30, bulk storage within development (same elevation) with booster pumps, or the installation of a centralised water treatment plant. Ultimately, these are all viable solutions for water supply. However, as discussed in the detailed option assessment in Section 4.5, Option A provided:

- The least risk of contamination using point of entry treatment systems. This is due to the potential for stagnation within the reticulation network when not fully utilised (occupancy/use dependant).
- The most economic option, due to the utilisation of gravity for reticulation.
- Smaller infrastructure footprint due to less pumps: reducing excavation area and reducing effect on ecology and high value landscape, reduced risk.
- Single point of supply for domestic use, simplifying water consumption monitoring and water loss management and enabling equitable payment for what is used, if required.
- Treatment at point of entry. The current water quality testing results show that minimal treatment will be required to get water to an acceptable solution, which suits point-of-entry treatment systems.

It is recommended to:

- Adopt Option A as the basis for detailed design and further community engagement, as per Section 4.4.1.
- Complete a definitive assessment of costs (Capex and Opex) and optimise storage size/location.
- Investigate the use of water conservation strategies by rainwater harvesting and storage for localised irrigation and emergency use (e.g. 2,000L 'slimline' tanks).
- A suitably qualified fire engineer should be engaged to confirm the firefighting strategy for the development as per Section 4.4. FENZ shall also be consulted for approval.
- Develop an operation and maintenance agreement as per Section 4.6.

Wastewater

In accordance with NZS4404:2010, the theoretical annual average dry weather flow was estimated to be approximately 18,000 L/day (lots 1 – 30). The expected peak wet weather flow was estimated to be approximately 1.1 L/s.

Multiple options have been considered for the treatment and disposal of wastewater. The analysis focused on identifying cost-effective and sustainable solutions to ensure compliance with relevant standards and regulations whilst minimising detrimental environmental effects. The options assessment within this report identified that this can be achieved through the implementation of Option A:

- Lots 1 – 3 and 19 – 30 are recommended for implementation of on-site treatment and disposal. Secondary level treatment is highly recommended for these lots due to the high ecological value of the area. The onsite systems are expected to consist of an Aerated Wastewater Treatment System (AWTS) with bed disposal, however this shall be determined at building consent stage pending site-specific analysis on each lot.
- The remaining lots (4 – 18) are considered unsuitable for on-site treatment and disposal. It is recommended to install a low-pressure sewer reticulation system, with on-site grinder pumps (e.g. Aquatec Enduraplex or similar) and small bore (50mm) rising mains to convey effluent off-lot to the area west of lot 20 for treatment and disposal. Treatment can be achieved via a commercial (communal) WWTP and land disposal (e.g. Eloy Oxyfix, or similar) or a large septic tank and aeration chamber, capable of treating approximately 9,000 L/day (average flow from lots 4 – 18). This equates to approximately 900m² primary disposal area. It is recommended that the WWTP has flow and quality monitoring. The system must be capable of treating wastewater to secondary level prior to land disposal, in accordance with ASNZ 1547:2012.

Other options that were investigated included, using a communal pump station instead of a low-pressure grinder sewer system, splitting the communal treatment system into two to three treatment and disposal areas, reticulating all effluent from lots 1 – 30 to a centralised WWTP and polishing within a subsurface engineered wetland near lot 28 with a discharge to the Clutha River, or reticulating all effluent from lots 1 – 30 to a centralised WWTP and disposing to land. Ultimately, these are all viable solutions. However, as discussed in the detailed option assessment in Section 5.2, Option A provided:

- The most efficient laying of reticulation, as small-bore rising mains can be installed at approximately 600mm below ground, and a small of amount of reticulation is required. The pipes are sealed and hence minimise inflow and infiltration, reducing the volume to be treated and disposed.
- Reduced visual impact of treatment and disposal system by pumping all reticulated effluent to the area west of lot 20 for disposal.
- Least risk (not discharging to river)
- Where possible, disposal fields can be placed to avoid existing vegetation and habitat.
- Smallest possible area needed for centralised disposal (for lots that cannot be serviced on-lot), reducing effect on high value ecology.
- Most economical option due to limited reticulation and on-site treatment systems being installed at building consent stage.

It is recommended to:

- Use Option A as the basis for detailed design and further community engagement.
- Complete a definitive assessment of costs (Capex and Opex) at detail design stage to optimise conveyance, treatment and disposal.
- Develop an operation and maintenance agreement as per Section 4.6, clearly outlining monitoring, sampling and reporting obligations and requirements for the Rocky Point services company.

2 Introduction

CKL have been engaged to provide an assessment of options of three waters infrastructure for a multi-lot subdivision in the Bendigo Hills, Central Otago area. This report has been prepared in support of future resource consent applications to Council and for the benefit of interested parties.

The scope of this report includes a concept-level assessment of:

- Water supply, storage, treatment, and reticulation for potable and firefighting purposes
- Wastewater management, primary and secondary treatment, and disposal

Stormwater management recommendations are provided in a separate CKL report titled "Stormwater Management Plan and Flood Risk Assessment".

2.1 Related documents

Reference has been made to the following site-specific documents:

- "Application for Resource Consent for a Comprehensive Residential Development at Rocky Point" prepared by Brown & Company Planning Group, dated the 15th of June 2023. A revision of this document is currently being prepared.
- "Suitability for Onsite Domestic Wastewater Disposal Report" prepared by Mt Iron Geodrill on the 6th of June 2023, reference G23068.
- "Professional Opinion for Possible On-site Wastewater Disposal" prepared by Mt Iron Geodrill on the 5th of March 2024.
- "Terrestrial Ecology Impact Assessment" prepared by Beale Consultants in June 2023, reference INN01.
- "Archaeological Assessment of Proposed Rocky Point Subdivision, Central Otago" prepared by University of Otago, Southern Pacific Archaeological Research, dated January 2023.
- A "Water Permit to take Groundwater" has been granted for a water supply bore in the 'Chinamans Terrace' area, reference 2001.928. This supply bore is discussed further in Section 2.3.
- An initial assessment for the supply of water to the development has been carried out by Irritech Otago LTD, dated the 15th of March 2023.
- "Stormwater Management Plan" by CKL, prepared concurrently with this report.

The assessments within this report are also in accordance with the following standards and guidelines:

- "Waterways, Wetlands and Drainage Guide" by Christchurch City Council, dated February 2003.
- AS/NZS 1547:2012: Onsite Domestic-Wastewater Management
- "On-site Wastewater Management in the Auckland Region", by Auckland Council, referred to as GD06/2021
- Central Otago District Council – Addendum to NZS 4404:2004 – July 2008
- NZS 4404:2010 Land Development and Subdivision Infrastructure
- SNZ PAS 4509:2008 New Zealand Fire Service Firefighting Water Supplies Code of Practice
- Water Services Act 2021
- Water Services (Drinking Water Standards for New Zealand) Regulations 2022
- Taumata Arowai - Water Supply Provider Quality Assurance Rules 2022
- Taumata Arowai – Drinking Water Acceptable Solutions 2022

2.2 Site Location

The project area is situated in the lower reaches of the Dunstan Ranges and is colloquially known as Rocky Point. The proposed development is located at Lakefront Terrace, Bendigo, Lot 1 DP 561457. To the east of

the development is 'Chinamans Terrace', which consists of approximately 65Ha of viticulture area. The site is bordered to the northwest by State Highway 8/Tarras-Cromwell Road and is accessed from the north on Bendigo Loop Road. The project location and extent of the development is shown in Figure 1.

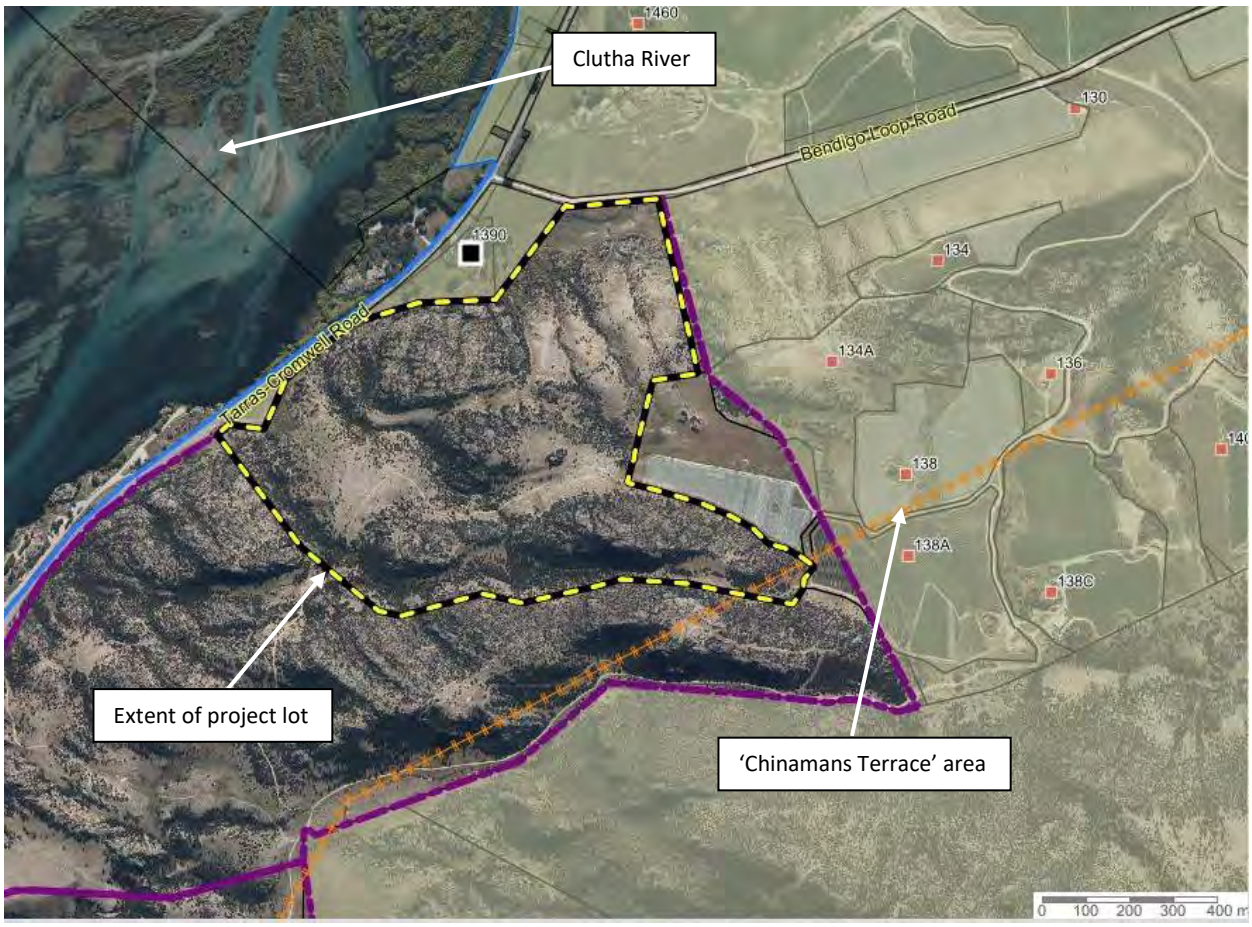


Figure 1: Site Location and project extent

2.3 Existing Site Conditions

Terrain grades across the site vary between gently sloping to very steep, and generally slope towards the northwest/west. The hills are incised by minor ridgelines, gullies and ephemeral overland flow paths that largely direct surface water to the northwest and towards two culverts installed beneath State Highway 8. From here, water is conveyed towards the Clutha River and Lake Dunstan. The site and surrounding area are populated by kanuka scrub and shrubland (shown in Figure 2), cushion field and exotic grassland with very high ecological value (Beale Consultants, reference INN01). Refer to Appendix 5 for photos of the site. A landscape assessment has been carried out for the site by Baxter Design. The assessment is summarised in the resource consent application by Brown & Company.

As per the soil evaluation by Mt Iron Geodrill (reference G23068), the soil profile across much of the site consists of schist rock with variable cover of alluvial material. Shallow rock and rocky outcrops were observed in multiple locations. The alluvial material is described as glacier deposits consisting of moderately weathered, poorly sorted, sandy gravel with silt lenses. Permeability testing within the project area confirmed the soils as category 4 (in accordance with AS/NZS1547:2012) with permeabilities of 0.11 m/d – 0.62 m/d observed.

Figure 2: Typical landscape throughout development.

3 Proposed Development

The proposed development comprises 30 lots with a mix of residential, large residential and communal uses as shown in Figure 3.

The proposal includes the construction of a new accessway, beginning at Bendigo Loop Road and ending near the top of the development at a cul-de-sac. The proposed accessway will have grades ranging from 8% - 15%, a carriageway width of 5.5m, and a total length of approximately 1.5 km.

Figure 3: Proposed development scheme plan[1]

4 Water Supply

4.1 Background

A water supply bore has been drilled approximately 370 metres northeast from the intersection of Loop Road and State Highway 8, Tarras. The bore takes water from an unconfined aquifer adjacent to the Clutha River to serve Rocky Point, Chinamans Terrace and future development in the Bendigo Hills. Soil profiles within the aquifer consists of unconsolidated Clutha Outwash gravels. Recharge is primarily from Lake Dunstan. A permit has been given to extract 2,735 m^3/day from the aquifer at a maximum rate of 32 L/s. This extraction is referred to as the Chinamans Terrace water scheme.

It is intended that water shall be supplied to the proposed development from the Chinamans Terrace water scheme. The proposed development will draw water from that scheme and necessary treatment, storage and boosting will be provided to satisfy water quality, domestic and fire demand requirements. Options for supply using new groundwater bores have also been explored.

[1] Sourced from Coterra, Overall Layout, reference 5925 – W1665, dated June 2024.

As per the resource consent application (Brown & Company, 2023), 500,000 L/day of the bore water supply has been allocated to Chinamans Terrace, the proposed Rocky Point development, and future developments in the Bendigo Hills. It is assumed that sufficient supply can be drawn from the 500,000 L/day allowance to meet the demands of the Rocky Point development.

Water from the bore is currently reticulated to and stored in four 25,000L plastic header tanks approximately 800m southeast of the proposed development. The ground level at the four existing water tanks is estimated to be approximately RL 410m. The ground level at the highest point of the subdivision (to the east of Lot 25) is estimated to have a level of approximately 340m.

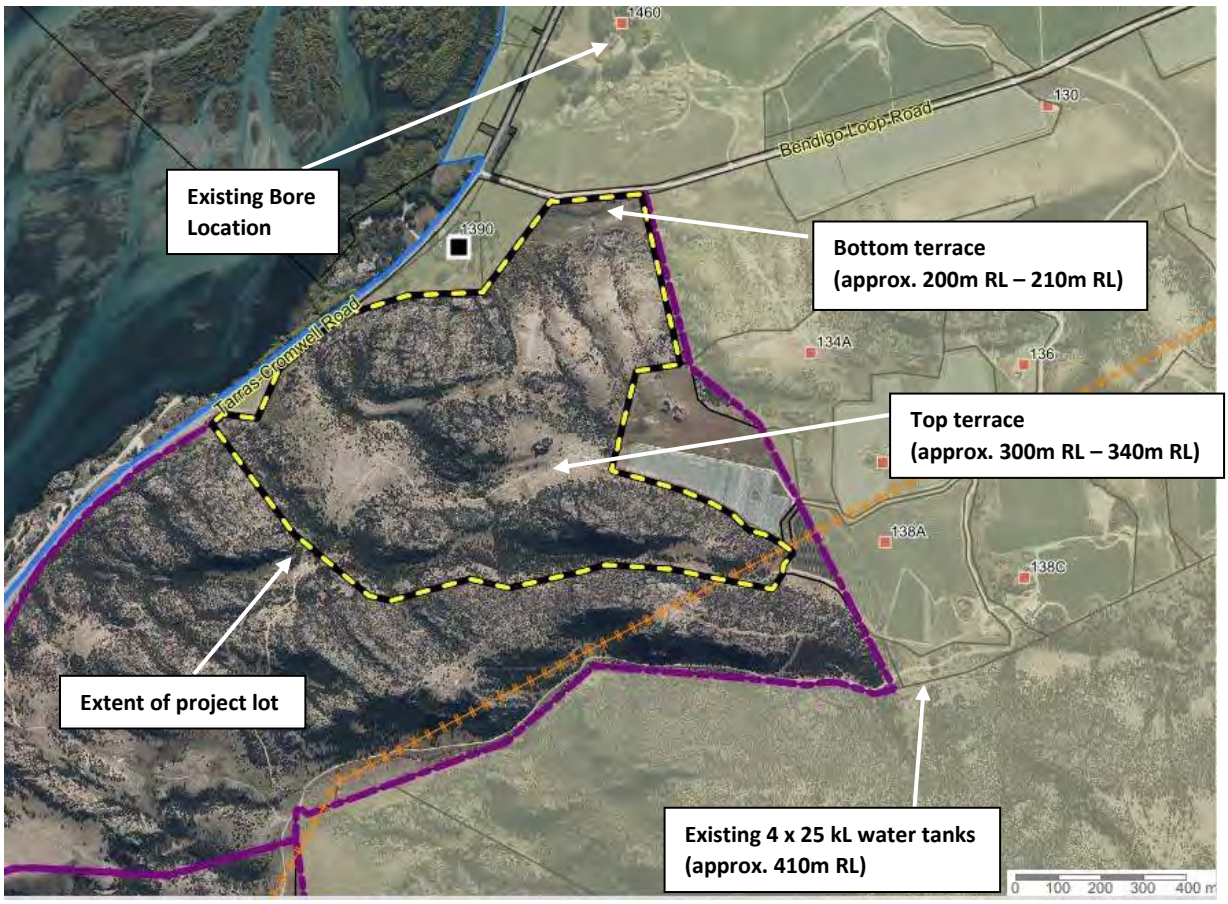


Figure 4: Chinamans water scheme[2]. Levels estimated from GIS, TBC by survey.

Water quality testing has been carried out to understand the required treatment process required to meet Drinking Water Standards. Water quality is generally good, with no staining or pretreatment requirements envisaged at this stage. The Langelier saturation index was slightly high, but acceptable. The results of the testing are attached in Appendix 2. Additional testing will be required at detailed design stage as per Taumata Arowai requirements.

The area has been identified to have a risk of wildfire. Storage of water must include provision for wildfire fighting.

4.2 Regulatory Obligations and Compliance Considerations

Taumata Arowai have the responsibility as a national water supply regulator to ensure that safe drinking water is provided as per the Water Services Act 2021 and NZS 4404:2010. Water supply to the development

[2] Reference: Annotated snip from GIS maps.

will require various considerations as per requirements by Taumata Arowai. Broadly, this includes the following:

- Water quality – safe drinking water, meeting maximum acceptable values as per Drinking Water Standards 2022, Drinking Water Quality Assurance Rules 2022, and Drinking Water Acceptable Solution. Regarding the latter, it is considered that either of the acceptable solutions below apply;
    - Acceptable solution for Spring and Bore Water Supplies – as water is supplied from the Chinamans Terrace scheme which has bore water as its source.
    - Acceptable solution for mixed use and rural water supplies – as the Chinamans scheme supplies predominantly rural irrigation water.
- Both have very similar implications in terms of responsibilities for provision of safe water supply for this development. For ease of reference, the latter has been adopted.
    - This development is classified as a Small (26 – 100 people) network supply. This classification has been made based on the limited average size of the designated building platforms and an assumed occupancy rate of approximately 2.7 p/dwelling.
    - It is intended that the supply of water will come from the existing Chinamans Terrace bore supply, operated by others, and stored and treated and supplied to the development in accordance with Taumata Arowai's Drinking Water Acceptable Solution (noted above). This document outlines the requirements for the water supply, including initial source quality testing, treatment, operation, maintenance, monitoring, incident and emergency management, training, and auditing. Refer Appendix 3.
- Water pressure – to be adequate for domestic use and to satisfy firefighting requirements (wildfire requirements and SNZ PAS 4509:2008).
- Storage – appropriately situated, accessible and sufficient capacity and resilience to cater for emergencies (fire).
- Fire protection – in accordance with SNZ PAS 4509:2008 as well as FENZ requirements for wildfire in this vicinity (refer Wildfire NZ recommendations).
- Adequate treatment and disinfection for potable use.
- Operation and maintenance arrangements for the water scheme as well as the water treatment and storage facilities.

4.3 Firewater

The provision for firefighting supply is detailed below, in accordance with SNZ PAS 4509 and recommendations by Wildfire Management NZ.

4.3.1 Structure fires

The recommended general philosophy for structure fires within the development is that they are contained using fire hydrants.

- Adequate bulk storage for FW-2 rating will be reserved for fighting structure fires, in accordance with SNZ PAS 4509. Bulk storage shall be dedicated, or level controlled (reserved).

- Fire hydrants will be installed to serve all lots with acceptable access for a fire truck. Spacing of hydrants will be in accordance with NZS 4404 and SNZ PAS 4509 to provide FW-2 coverage.
    - Fire hydrants must be capable of providing FW-2 required flow rate as per Section 4.4.2.
    - Fire truck access to the hydrants will be provided via the access road for the development. The proposed grade (8-15%) is within the allowable maximum (1V:5H as per SNZ PAS 4509:2008).

- Where access to hydrants is not practical, independent storage (min. 45m³) will be provided at those specific dwellings (e.g. 2 x 25,000L tanks with a firehose coupling).
- If these are connected to treated potable water line backflow devices will be fitted to prevent contamination of potable water by raw water.

- Firewater to the top terrace will be provided as described above, via the combined domestic/fire storage and water main.

- Supply of FW-2 firefighting to the bottom terrace (lots 27 – 30):
  - Due to elevation difference between the top and bottom terrace, a break pressure tank will be required to reduce pressure. This tank will also be utilised for buffer storage for both domestic and fire water. This will be assessed at detailed design stage but may comprise a separate storage bank (e.g. 3 x 30,000L tanks) automatically topped up from the top terrace water main

4.3.2 Wildfire provision

Wildfire Management NZ have been engaged to devise a strategy for combating wildfire. Two types of sprinklers have been recommended with demands and required pressures as per Section 4.4.3.

Vegetation sprinklers are recommended to reduce and slow fire spread in key risk areas, particularly focussed on up-slopes and gullies. The effect of this overhead water onto vegetation will be to reduce radiant heat, slow fire spread, and provide a buffer between fire and buildings. A secondary benefit of this sprinkler is that it can in the future assist in the greening of this vegetation buffer via irrigation, reducing fire risk.

Private ember suppression sprinklers are recommended (pending site-specific assessments of residual fire risk at design and consenting stage of each dwelling on Lots 1-26) to mitigate against the risk of ember attack from wildfire. It will be the responsibility of the lot owner to ensure adequate water supply to meet ember suppression needs. The development infrastructure will provision for this water supply up to 150,000L (2 sprinklers per lot 1 – 26). Should this not be adequate, lot owners will need to supplement this supply with their own domestic supply and/or private storage.

Refer to assessment by Wildfire Management NZ for more details.

4.4 Estimated Water Demand

The total water requirement for the development has been calculated using three different demands as discussed below: domestic water, structure firefighting and wildfire fighting.

4.4.1 Domestic water demand

The following assumptions have been made to calculate the domestic water supply demand, in accordance with NZS 4404:2010:

- Average 2.7 occupants per lot (based on average lot size and developers' knowledge of similar developments in the region.
- Each occupant uses 250 L/day (NZS 4404 recommendation)
- Peak factor = 5 (NZS 4404 recommendation)

Therefore, estimated water demand is as follows:

- Average daily demand per lot = 2.7 p * 250 L/day/p = 675 L/day
- Average daily demand = 30 lots * 675 L/day ≈ 20,500 L/day

- Peak demand = 20,500 L/day * 5 = 101,500 L/day
- Peak demand ≈ 1.2 L/s

4.4.2 Structure-fire water demand

Fire hydrants are recommended to combat structure fires within the development (refer to Section 4.3.1 for more details). With reference to SNZ PAS 4509:2008, we have assumed that a FW-2 rating would apply to the development. This rating requires an available water supply of 25 L/s from 2 hydrants, within 135 and 270 m distance respectively, with sufficient volume for 30 minutes of firefighting. This yields an additional volume requirement for fire hydrants of approximately 45,000 L.

Some of the larger lots may be designated for use as communal residential activity, leisure activities, or accommodation facilities. It is expected that such facilities may require sprinkler protection, but these lots have also been assumed to have an FW-2 rating for the purpose of this high-level assessment. It is recommended that a suitably qualified fire engineer is consulted during detailed design to confirm fire ratings and, if/where required, design sprinkler protection for buildings, also considering Fire and Emergency New Zealand (FENZ) requirements.

4.4.3 Wildfire sprinkler water demand

Wildfire Management NZ have been engaged to devise a strategy for combating wildfire. Two types of sprinklers have been recommended.

- Ember suppression sprinklers: sprinklers installed strategically on the corner of roofs. The following assumptions have been made:
    - The sprinklers have an allowable pressure range of 3.0 bar to 4.0 bar and a discharge rate of approximately 25 L/min. This is based on a Rolland 22 sprinkler with a 4.5mm nozzle (to be confirmed at detailed design stage.
    - The smaller lots (e.g. lots 11 – 18) will be able to share coverage.
    - Lots have been assumed to have two ember sprinklers each. Recommendation from Wildfire Management NZ is to have four per Lot. This shall be confirmed at detailed design stage
    - Number of lots requiring sprinklers = 25 (confined to higher risk, top lots only)
    - Total number of sprinklers = 50 (considering coverage of sprinklers and proposed house sizes)
    - Demand = 1250 L/min = 20.8 L/s
    - Required firefighting time = 120 minutes
    - Storage volume required ≈ 150,000 L.
    - Wildfire Management NZ recommended 300,000L however will accept 150,000L if ember sprinklers can be pulsed on and off (1 min on, 1 min off) to reduce water storage requirements, and/or water storage volume can be increased over time if the need is increased.
    - Detailed assessment shall be carried out at building consent stage to determine how many sprinklers are required per lot (based on structure size, material used and location). If more than 150,000L is required, storage can be increased to accommodate the additional requirements. It can be noted that the 150,000 l is conservative as the replenishment rate (dynamic) of the tanks (from Chinamans) has been ignored – this will be reviewed at detail design.

- Vegetation sprinklers (external sprinkler system): sprinklers installed strategically based on vegetation within predicted wildfire spread zones. The following assumptions have been made:
    - The sprinklers have an allowable pressure range of 4.0 bar to 6.5 bar and a discharge rate of approximately 79 L/min. This is based on a Hunter I-40 sprinkler with a #44 nozzle (to be confirmed at detailed design stage.
    - It is estimated that there shall be approximately 26 sprinklers.
    - Demand = 2054 L/min = 34.2 L/s
    - Required firefighting time = 90 minutes
    - Storage volume required ≈ 185,000 L
    - These sprinklers could be pulsed after an initial 20 minute wet down phase to increase run time.

Refer to Section 4.3.2 for more details.

4.4.4 Total water demand during wildfire

The total water demand has been calculated for the following assumed wildfire situation, deemed to be the worst-case scenario:

- It is assumed that domestic consumption will cease, and no domestic demand is required – it would be marginal anyway in context of overall demand in this scenario even if local hoses were used to suppress localised fire.
- As discussed in Section 4.3, the preferred firefighting supply option for the bottom terrace (lots 27 – 30) is fire hydrants. For the worst-case scenario, we have assumed that two hydrants are operating at 12.5 L/s (each) for 30 minutes at the bottom terrace. These can be supplied from separate storage (break-pressure) tanks.
- All ember sprinklers are operating at full capacity i.e. 20.8 L/s
- All vegetation sprinklers are operating at full capacity i.e. 34.2 L/s.

Therefore, the total water demand is 80.1 L/s, and the total required storage is approximately 390,000 L. These assumptions shall be confirmed by a fire engineer before detailed design stage. Refer to Section 4.5 for details of how this water will be stored and reticulated.

4.5 Options for Bulk Water Supply and Reticulation

A concept-level options assessment has been carried out, identifying a preferred option (Option A) for bulk water treatment and supply for the proposed development. Indicative plans are shown in Appendix 1, and Figure 5 below. An assessment of the chosen option is shown in Table 1. High level modelling has been carried out to determine the indicative pipe sizes given on the attached indicative plan.

Other potential options have been identified and are discussed in Section 4.5.2. All options have been assessed in accordance with Central Otago District Council and NZS 4404:2010 requirements.

4.5.1 Water supply and storage – Option A

This option would comprise;

- **Water supplied to all lots from the Chinaman's Terrace Scheme** to the southeast of the development (top of the development).

- **Expansion of the existing bank** of 4 x 25,000 L raw water storage tanks at Chinaman's terrace, or at an intermediate location. Approval will be required from the neighbours for the placement of tanks at this location. It is recommended to split storage into **two supplies:**
    - **Storage system 1: storing 48 hours of domestic use and 30 minutes of hydrant demand** as per Section 4.4. This equates to approximately 90,000 L.
        - As part of this water will be used for domestic supply, the storage vessel(s) must be contained, without the potential for stagnation or contamination from waterfowl.
        - E.g. steel tank with an effective capacity of 90,000L (Pioneer GT110, or similar). Alternatively, 3 – 4 large plastic tanks could be installed, as indicated on drawing 6002.
        - If pretreatment is necessary, this shall be installed in the same location.
        - The tank(s) could be located at a suitable location to provide sufficient pressure head for domestic use and hydrants, without the need for boosting.
        - This storage volume is based on the minimum requirements for the development, but this can easily be increased to include buffer storage.
    - **Storage system 2: storing vegetation sprinkler and ember suppression sprinkler demand as per 4.3.2.** This equates to approximately 340,000L.
        - This can be stored in tanks or in a lined pond (proposed).
        - It is recommended to install a floating plastic cover if a pond is implemented and/or appropriate auto-flushing filtration units (e.g. Arkal, Amiad, Filtersafe Trident etc.) to prevent sprinklers from blocking during a fire.
        - The pond/tanks could be located at a suitable location to provide sufficient head for sprinklers, without the need for boosting.
    - It can be noted that storage is dynamic i.e. storage will be replenished during use providing additional supply, over and above the static volume provided.

- **Trunk mains and reticulation networks from each storage system** are recommended to reticulate water to the Rocky Point development **via gravity**. Indicative pipe sizes are shown on drawing 6002
    - **Reticulation System 1: will convey domestic use and hydrant demand** as per Section 4.4.
    - **Reticulation System 2: will convey vegetation sprinkler and ember suppression sprinkler demand** as per Section 4.4.
    - Pressure reducing valves installed at lot connections, as necessary to regulate the pressure and flow of water for domestic consumption.
    - It is proposed that both mains be laid within common trench, where possible.
    - Large differential pressure between the top and bottom terrace requires a break-pressure tank to be situated at an appropriate location (access, aesthetics) and will serve to balance pressure and provide buffer storage for domestic and fire hydrants on the bottom terrace i.e. the bottom terrace will operate as a separate water supply and pressure zone.

- Installation (at time of building) and maintenance of **independent treatment and disinfection units at each lot (30)**, sized accordingly. This assumes that water quality will be of an acceptable standard to enable appropriate treatment at each lot (e.g. filtration and UV). It is recommended that a condition of consent be that a treatment device be installed at building consent stage and that an appropriate maintenance agreement be set in place for sustained operation (further discussed in Section 4.7).

- A bulk water meter at the outlet of domestic water storage system is proposed to measure water supplied. In addition, individual water meters at each lot are recommended to measure water consumed. This will allow for water consumption trends/monitoring as well as water balancing and **water loss management** measures to be implemented.

- **Fire hydrants** to be provided in accordance with SNZ PAS 4509:2008, as outlined below in Section 4.3.1.

- **Wildfire sprinklers** to be provided as outlined in Sections 4.4.3 and 4.3.2.

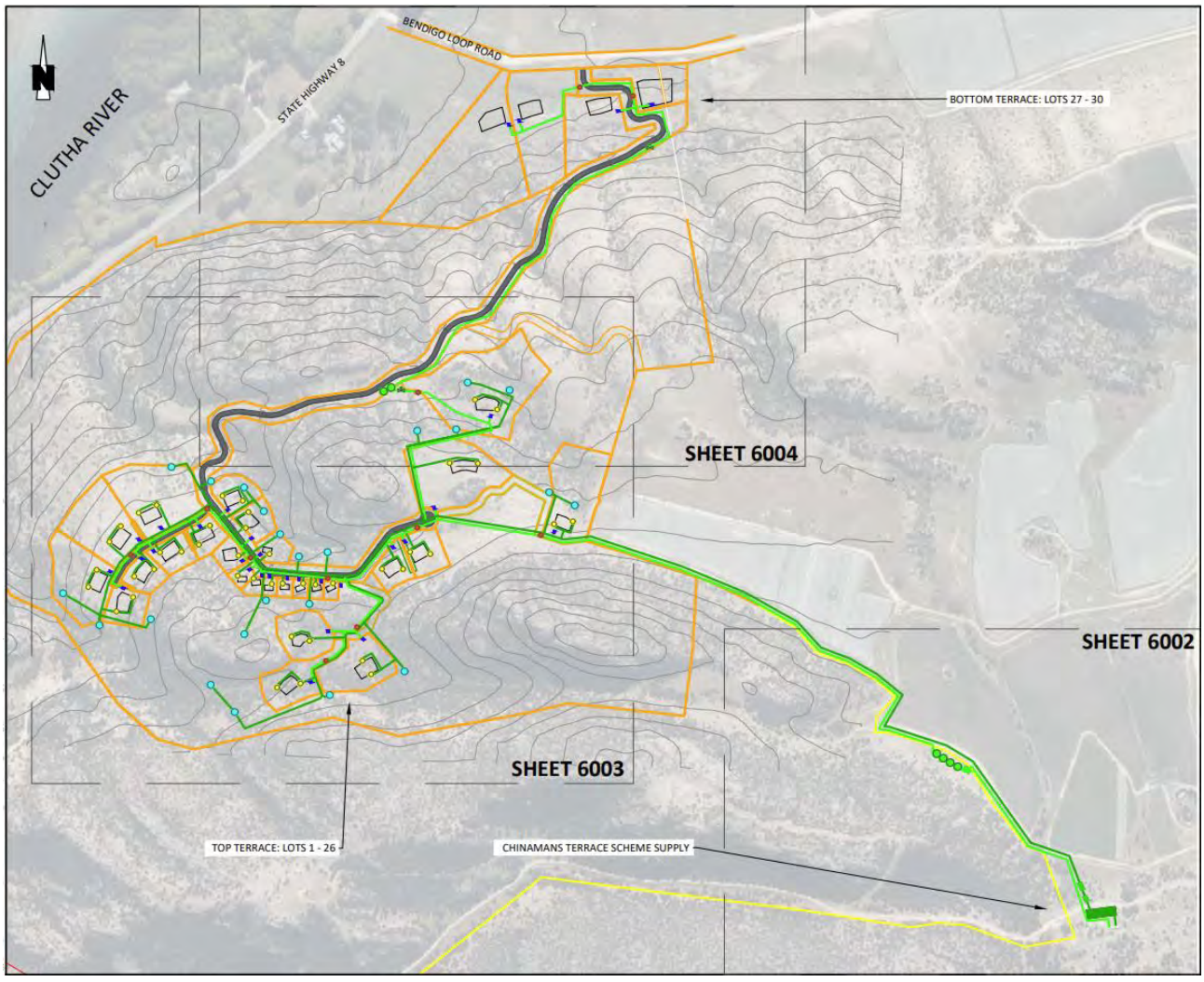


Figure 5: Water supply, option A (refer Appendix 1, drawings 6001 - 6004).

The benefits and challenges associated with Option A are described in Table 1 below.

Table 1: Concept level assessment of Option A for water supply and storage

Benefits/Pros	Challenges/Cons
Option A	
- The large flow rates required for wildfire fighting mean that high pressure is required. By utilising the steep terrain to produce adequate pressure head,	- Regulation of high pressures. This can be mitigated by installing break pressure tanks and pressure reducing valves where necessary.

Benefits/Pros	Challenges/Cons
the need for large, expensive booster pumps is negated: economical, no pumping costs, lower carbon footprint, no need for backup generators, reduced risk. - Aesthetics: no pump station within development. - This storage bank could also be expanded further in the future to serve further development in the area. For example, the proposed house site on lot 10 within the Bendigo Hills development. Water main pipe sizing could include some contingency for situations such as this. - Smaller infrastructure footprint due to less pumps: reducing excavation area and reducing effect on ecology and high value landscape. - Single point of supply for domestic use, simplifying water consumption monitoring and loss management and enabling equitable payment for what is used, if required. - Treatment at point of entry - treatment and reducing risk of contaminated water i.e. treat when used. The current water quality testing results show that minimal treatment will be required to get water to an acceptable solution, which suits point-of-entry treatment systems.	- Risk of point-of-entry treatment systems being disabled in power outage, posing risk to customers. However, water quality is generally good and water quality monitoring and reporting will highlight any risks (E.coli) from the supply source and temporary boil notices would be imposed. - Many point of entry treatment systems to maintain. This will be mitigated by creating Rocky Point Services LTD to manage all maintenance agreements with owners. This is discussed further in Section 4.7.

4.5.2 Water supply – other options considered

Several other options have been considered during this assessment. Notable options comprise of:

- **Option B:** Equivalent to Option A, except all water is stored within a combined storage system.
    - Benefits: less complicated reticulation installation, and single trunk main supplying whole development.
    - Challenges: More complex pressure management, large volume of water requiring high quality storage vessel (e.g. steel tanks as opposed to a pond system). This cost is considerable.
    - Conclusion: Less economical than Option A due to cost of a combined storage system.

- **Option C:** Equivalent to Option A, except water supply for top terrace provided by existing header tanks in Chinaman's Terrace Scheme as per Option A, and water supply for bottom terrace provided by **EITHER** a bifurcation of the Chinaman's Terrace Scheme near lot 30 **OR** a new groundwater bore in the bottom terrace.
    - Benefits: less complicated pressure regulation required and reticulation installation, as no water main is required between lot 26 and the bottom terrace.
    - Challenges: installation of bifurcation or groundwater bore, independent storage facility, booster pumps required if using a bore, separate reticulation systems, separate metering systems, separate water quality monitoring, backup diesel generator required.
    - Conclusion: challenges outweigh benefits, in comparison to Option A.

- **Option D:** Equivalent to Option A, except bulk storage is placed near lot 25, and booster pumps are installed to provide adequate pressure.
    - Benefits: smaller trunk main between and existing header tanks and development than Option A, bulk storage would be located within the development lot.
    - Challenges: very large pumps required for boosting, ongoing pump energy costs, backup diesel generator required, pressure reduction requirements but would still be required to regulate pressure between the top and bottom terrace.
    - Conclusion: this cost of the booster pumps makes this option uneconomical in comparison to Option A.

- **Option E:** Equivalent to Option A, except bulk storage is placed near lot 25, a centralised water treatment plant is installed near lot 25, and booster pumps are installed to provide adequate pressure.
    - Benefits: smaller trunk main between existing header tanks and development than Option A, bulk storage would be located within the development lot, one treatment system with single maintenance agreement for treatment.
    - Challenges: very large pumps required for boosting, ongoing pump energy costs, backup diesel generator required, pressure reduction requirements would still be required to regulate pressure between the top and bottom terrace, raw water would be split from potable water after treatment so the reticulation system would be larger with more excavation and vegetation damage, and risk of stagnation and potential re-contamination in reticulation in times of low use.
    - Conclusion: this cost of the booster pumps makes this option uneconomical in comparison to Option A.

4.5.3 Summary – water supply options

Option A is recommended. This option provides a robust solution for the provision of domestic water, firewater and wildfire management. In line with the proposed scheme, Rocky Point Services LTD and operating and maintenance guidelines will provide a sustainable source of water for the development whilst accounting for the management of wildfire potential in this area (discussed in Section 4.7).

4.6 Water Sensitive Design

Water conservation techniques can be investigated further at design stage. Such techniques could include rainwater harvesting (for irrigation or emergency storage), grey-water recycling (flushing toilets, irrigation) and water-reduction fixtures. Installation of individual water meters as well as a bulk water meter will enable water consumption monitoring, water balancing and a water loss management protocol to be established.

4.7 Operating and Maintenance and Reporting

A Service Agency (Rocky Point Services LTD) will be established to ensure appropriate level of service is maintained through regular maintenance of infrastructure and required level of sampling, testing, and reporting sustained – in line with Taumata Arowai requirements for Acceptable Solutions.

A water management plan will be prepared for the agency incorporating for example;

- An operations and maintenance (O&M) guideline for the pretreatment systems (if required), water storage, reticulation, pumps (if required), individual filtration and UV systems, hydrants, sprinklers, pressure reduction valves, and control valves. Appropriate servicing/replacement protocols will be stablished to ensure safe and sustainable water treatment and supply.

- A consent condition will be required for each property to install an appropriate treatment facility and engage a maintenance contractor approved by the service agency, to ensure sustained acceptable and safe water quality.
- Monitoring of water supplied and consumed and water demand/loss management.
- Reporting on water quality with an appropriate water quality sampling and testing regime in accordance with the Drinking Water Quality Assurance Rules 2022 and Acceptable Solutions requirements (refer Appendix 3).
- A regular fire hydrant inspection and testing regime, in terms of SNZ PAS 4509, Appendix G. Similarly, wildfire protection sprinklers and any control valves will need regular inspections and testing. Emergency/contingency plan to address quality/security of supply issues.
- Easy access to key infrastructure for O&M (considering the site location and terrain).

5 Wastewater Management and Disposal

The treatment and disposal of wastewater has been assessed in accordance with AS/NZS 1547:2012 and NZS4404:2010 in compliance with Central Otago District Council requirements.

5.1 Total Wastewater Flow Estimate

The following assumptions have been made in order to estimate the theoretical total peak wastewater flows from the development (Lots 1- 30), in accordance with NZS 4404:2010:

- Average 2.7 occupants per lot
- Each occupant produces 220 L/day
- Dry weather diurnal peak factor = 2.5
- Peak factor for wet weather = 2 (note this will reduce if/where low pressure pumping/small bore systems are used)

Estimated wastewater water demand is as follows.

- Annual average dry weather flow (AADW) = 30 lots x 2.7 p x 220 L/p ≈ 18,000 L/day
- Expected peak wet weather flow (PWWF) = 18,000 L/day x 2.5 x 2/(3600x24) ≈ 1.1 L/s

This calculation applies a peak factor to model the effect of infiltration of groundwater and inflow of stormwater into the wastewater network. With modern construction techniques and materials such polyethylene piping, the amount of infiltration and inflow is likely to be reduced. In addition, should any of the development utilise low pressure grinder pumps and small-bore sewers, these are not prone to infiltration. As such, the above peak wastewater flow is considered to be conservative.

5.2 Options for Wastewater Treatment and Disposal

A concept-level options assessment has been carried out, identifying a preferred option (Option A) for the reticulation, treatment and disposal of wastewater from the proposed development. An indicative wastewater plan for the chosen option is shown in Appendix 1.

The design loading rate for on-site disposal to ground has been assumed to be 10 mm/day, as per AS/NZS 1547:2012. Potential areas for land disposal are limited due to shallow/exposed rock and steep topography across much of the site (refer Mt Iron Geodrill (reference G23068)).

5.2.1 Wastewater treatment and disposal – Option A

This option proposes a combination of on-site treatment and reticulation, as per the recommendations from Mt Iron Geodrill (reference G23068). An indicative site plan is shown in Figure 6.

The soil evaluation by Mt Iron Geodrill (reference G23068) identified that some lots are suitable for onsite treatment and disposal. Secondary level treatment is highly recommended for these lots due to the high ecological value of the area. The onsite systems are expected to consist of an Aerated Wastewater Treatment System (AWTS) with bed disposal, however this shall be determined at building consent stage pending site-specific analysis by a suitably qualified engineer. Due to lot size, ecological effect, soil type and topographical location, lots 1 – 3 and 19 – 30 are recommended for implementation of on-site treatment and disposal.

The remaining lots (4 – 18) are considered unsuitable for on-site treatment and disposal due to shallow depth to rock or limited lot sizes. A reticulation system is required to convey effluent off-lot to the area west of lot 20 for treatment and disposal. Pumping is required. Option A consists of using a low-pressure sewer reticulation system, with on-site grinder pumps (e.g. Aquatec Enduraplex or similar) and small bore (50mm) rising mains. Treatment can be achieved via a commercial (communal) WWTP and land disposal.

The chosen communal wastewater treatment plant (WWTP) will comprise of a commercial WWTP (e.g. Eloy Oxyfix, or similar) or a large septic tank and aeration chamber, capable of treating approximately 9,000 L/day, equating to approximately 900m² primary disposal area[3].

- Average Daily Flow (lots 4 – 18) = 15 lots * 2.7 p/lot * 220 L/p = 8,910 L/day.
- Disposal Area = 8,910 L/day / 10 L/m²/day = 891 m²

It is recommended that the WWTP has flow and quality monitoring. The system must be capable of treating wastewater to secondary level prior to land disposal, in accordance with ASNZ 1547:2012:

- BOD_5 less than or equal to 20 g/m³ with no sample greater than 30 g/m³
- TSS less than or equal to 30 g/m³ with no sample greater than 45 g/m³

The WWTP can be configured to provide a higher quality of effluent if required, however at a cost. The exact layout of the reticulated system shall be determined at detailed design stage. The disposal method and size of the disposal areas is also subject to detailed design. The wastewater allowance for each treatment system will vary significantly depending on the number of lots directed to the systems.

Geotechnical investigations of the proposed communal disposal area have been carried out, confirming that this area is suitable for treated wastewater disposal (refer Appendix 4).

Flood modelling, for large rainfall events (100yr ARI), has been carried out by CKL (refer separate CKL stormwater management report). The results show that the majority of stormwater flows from the adjacent gully are directed north, travelling in between lot 18 and 22, away from the proposed disposal field. The maximum depth of water directly to the south of the proposed disposal field during a 100-year return interval storm event has been modelled as 0.03m (30mm). Although this depth is minimal, to prevent any chance of flooding the effluent disposal area it is recommended to install a swale to direct surface flows away from the disposal field.

[3] Based on NZS4404 and a soil permeability of 10 mm/day:

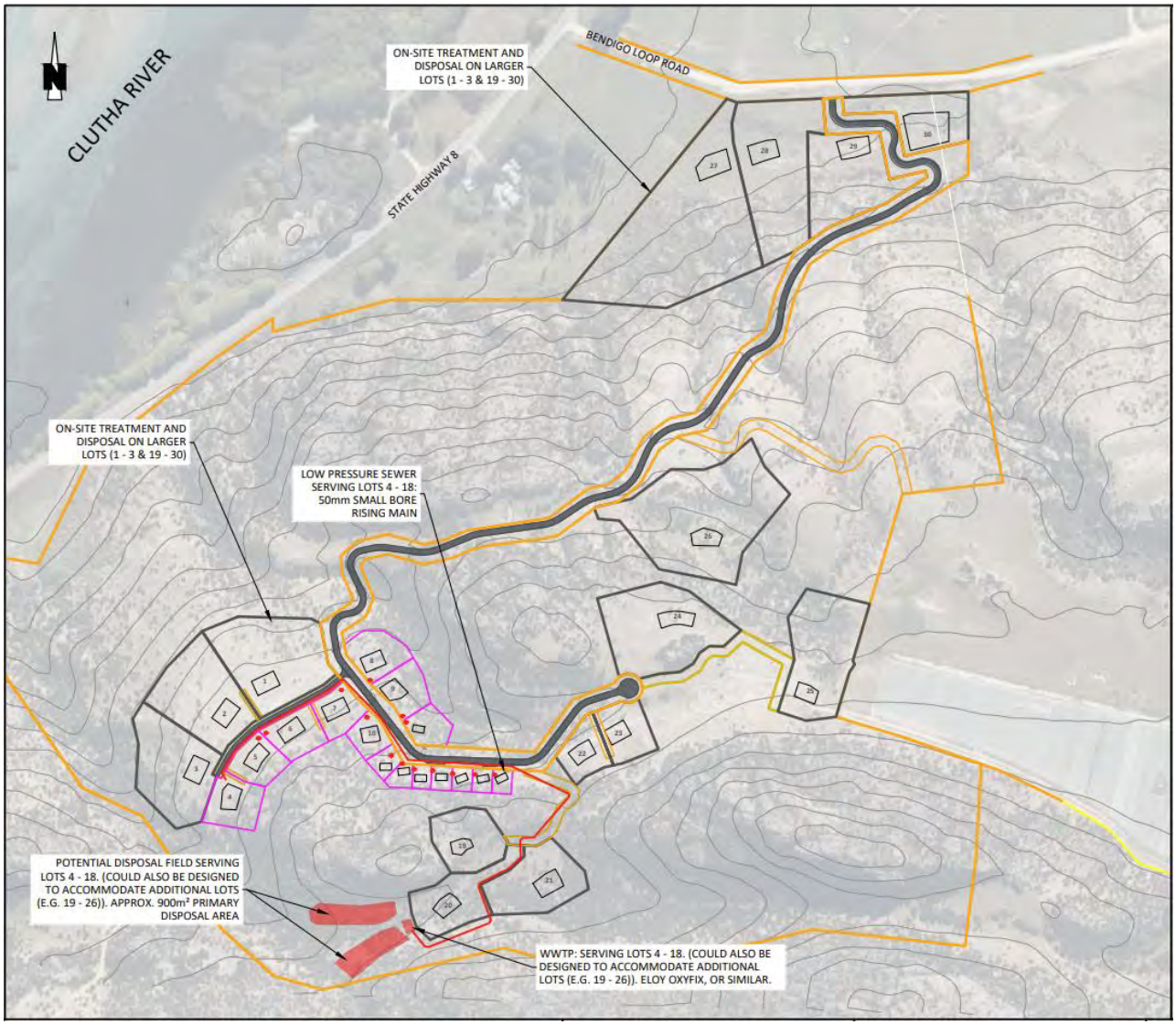


Figure 6: Wastewater management Option A. [4]

The benefits and challenges associated with Option A are described in Table 2 below.

Table 2: Concept level assessment of Option A for wastewater management

Benefits/Pros	Challenges/Cons
Option A	
- Utilises space on larger lots. - More economical for developer (pushes cost of on-site systems onto owners). - Increases resilience by separating systems. - Simple reticulation system.	- Large disposal area: high ecological impact, large excavation - Need to engage consultants to carry out site-specific disposal assessments for each Lot using on-site disposal. - Pumping required - however, low pressure grinders and small-bore system will minimise ground water infiltration.

[4] Ref: Appendix A, drawing 5001.

Benefits/Pros	Challenges/Cons
- Where possible, disposal fields can be placed to avoid existing vegetation and habitat. - Service agency can be setup to maintain system. Use of grinder pumps and low-pressure distribution system reduces infiltration and inflow and hence flows/disposal area, also provides versatility in timing and situation of grinder pumps and reticulation to suit staging of the development.	

5.2.2 Wastewater – other options considered

Several other options have been considered during this assessment. Notable options comprise of:

- **Option B:** Equivalent to Option A, except the reticulation system serving lots 4 – 18 gravitates towards a communal pump station instead of individual grinder pumps on each lot.
    - Benefits: fewer pumps required, single pump station for maintenance, increased resilience by splitting systems
    - Challenges: deep excavation into rocky subsoil for gravity main and pump station wetwell, relatively large pump station and emergency storage, space/location.
    - Conclusion: a low-pressure sewer system reduces the excavation required, as a small bore rising main can be installed at approximately 600mm below ground.

- **Option C:** Equivalent to Option A, except the reticulation system serving lots 4 – 18 is split into two (or three) separate reticulation, treatment and disposal systems.
    - Benefits: smaller communal disposal fields, potentially fewer pumps required (due to some lots gravitating towards smaller centralised disposal fields.
    - Challenges: multiple communal treatment plants and disposal fields that are visible to public.
    - Conclusion: Pumping all reticulated effluent to the area west of lot 20 reduces the visual impact of the treatment and disposal system.

- **Option D:** reticulating all effluent from lots 1 – 30 to a centralised WWTP, polishing within a subsurface engineered wetland near lot 28, discharge to Clutha River.
    - Benefits: highest level of treatment, additional ecology amenity due to biodiversity within wetland, and less excavation (due to no on-site disposal fields)
    - Challenges: extremely long reticulation system (requiring pumping in some areas) with steep grades and rocky subsoil, high risk due to single treatment and disposal method, large WWTP (high cost), space requirement in bottom terrace for wetland
    - Conclusion: laying a single reticulation system from the top terrace down to the Clutha River makes this option less economical and impractical. Also high risk due to discharge to Clutha River.

- **Option E:** reticulating all effluent from lots 1 – 30 to a centralised WWTP, treating and disposing to land.
    - Benefits: high level of treatment, centralised treatment plant and one facility to operate and maintain.
    - Challenges: extremely long reticulation system (requiring pumping in some areas) with steep grades and rocky subsoil, higher risk of potential breakout in disposal bed (pending location), large WWTP capital cost, space requirement for disposal.

- Conclusion: Not a practical or cost-effective option considering logistics and environmental (large land disposal area) considerations.

5.2.3 Summary – wastewater management options

In conclusion, Option A was selected as the most versatile and practical solution, considering environmental and cost impacts.

5.3 Staging the Development

The proposed development may be delivered in stages, which brings design considerations into the delivery of the wastewater services. These considerations are presented in the following sections.

5.3.1 Reticulation

A combination of gravity sewerage and low-pressure grinder pump and rising main installations is proposed. This provides flexibility to lots that can't be gravitated to the proposed WWTP and/or where house situation (on lot) may change significantly. Grinder pumps and small-bore reticulation also minimise the possibility of rainwater (or groundwater) infiltration and inflow, thus protecting the design capacity of the WWTP and disposal fields. Rising main pipe sizing should include some contingency to allow for intensification or for some lots previously designated for on-site treatment joining the reticulation system.

5.3.2 Treatment and disposal

It should be noted that the proposed WWTP and disposal fields are modular by nature of design and can be adapted to suit flows and requirements, assuming space (footprint) requirements are provided for. This is beneficial in terms on adapting to any uncertainties in development as well as staged growth/development.

The lots that have been marked for communal use (e.g. lot 28) may experience large peak wastewater flows. It is recommended that the need for buffer storage is investigated/allowed for these lots at design stage.

5.4 Operating and Maintenance

As outlined in section 4.7, a Service Agency (Rocky Point Services LTD) will be established to ensure appropriate level of service is maintained through regular maintenance of infrastructure and required level of sampling, testing, and reporting sustained.

A wastewater management plan is to be developed for Rocky Point Services LTD to ensure that;

- An operations and maintenance (O&M) guideline for the wastewater scheme, treatment plant(s) and pumps (if required) are established.
- An O&M agreement with a party qualified to provide this service is established. Where individual WWTP's are installed on-lot, property owners will be required to install the systems at time of build and to have a maintenance agreement with the supplier to ensure proper operation is sustained. This should be facilitated by Rocky Point Services LTD.
- An appropriate treated wastewater quality monitoring regime is established.
- Emergency/contingency plans should be established to address quality issues.
- Easy access to key infrastructure for O&M (considering the site location and terrain) is provided.

6 Conclusions and Recommendations

6.1 Water Supply

The developer has a responsibility to provide an adequate supply of safe drinking water and firefighting water, as discussed in Section 4.2. The main objective of the water supply system should be to achieve these obligations, whilst minimising environmental effects and increasing sustainability. The options assessment within this report identified that this can be achieved through the implementation of the preferred Option A (Section 4.5.1).

The establishment of a service agency (Rocky Point Services LTD) will be key to ensuring an adequate maintenance regime is established to sustain safe drinking water and an acceptable level of service for domestic water consumption and firefighting (including the provision and maintenance of wildfire sprinklers).

A centralised water treatment plant offers versatility of treatment to cope with any raw water quality. However, in the event that reticulated treated water is not turned over readily (initial stages of development, holiday homes etc.) there is a risk of water stagnation and re-contamination of the reticulation.

Conversely, point of entry (POE) units offer a number of benefits, financially and in terms of reducing risk of recontamination (other than power failure). This is the preferred option over a centralised treatment system. Should further water quality testing indicate any contaminants which are unable to be removed by point of entry units, then a pre-treatment system may be required in conjunction with individual POE units.

A conceptual storage and reticulation design for domestic and firewater has been provided. The location of the storage devices can be strategically located to provide adequate pressure via gravity. This is more economical, ecologically friendly, and resilient than providing a boosted system.

It is recommended to:

- Use Option A as the basis for detailed design and further community engagement, as per Section 4.5.1.
- Complete a definitive assessment of costs (Capex and Opex) and optimise storage size/location.
- Investigate the use of water conservation strategies by rainwater harvesting and storage for localised irrigation and emergency use (e.g. 2,000L ‘slimline’ tanks).
- A suitably qualified fire engineer should be engaged to confirm the firefighting strategy for the development as per Section 4.5. FENZ shall also be consulted for approval.
- Develop an operation and maintenance agreement as per Section 4.7.

6.2 Wastewater

The chosen wastewater treatment and disposal system must safely treat and dispose of effluent whilst minimising detrimental environmental effects. The options assessment within this report identified that this can be achieved through the implementation of Option A (Section 5.2.1).

The site presents difficult terrain for effluent disposal and reticulation, with steep grades, high ecological value and shallow rock. The implementation of on-site treatment and disposal (where possible) utilises space on larger lots and decreases the size of the required reticulation system (maximising the protection of high ecological areas). The use of secondary treatment systems reduces the risk of groundwater or surface water contamination.

Where pumped reticulation if required, it is recommended that this is achieved through a low-pressure sewer system. These systems utilise shallow, small bore rising mains which reduce the width/depth of required

excavation and allow effluent to be conveyed over the difficult topography, whilst minimising inflow and infiltration and hence effluent flows.

The establishment of a service agency (Rocky Point Services LTD) will be key to ensuring an adequate maintenance and monitoring regime is established for sustaining good performance of the treatment and reticulation systems with high quality effluent being discharged from all treatment systems for ground disposal.

It is recommended to:

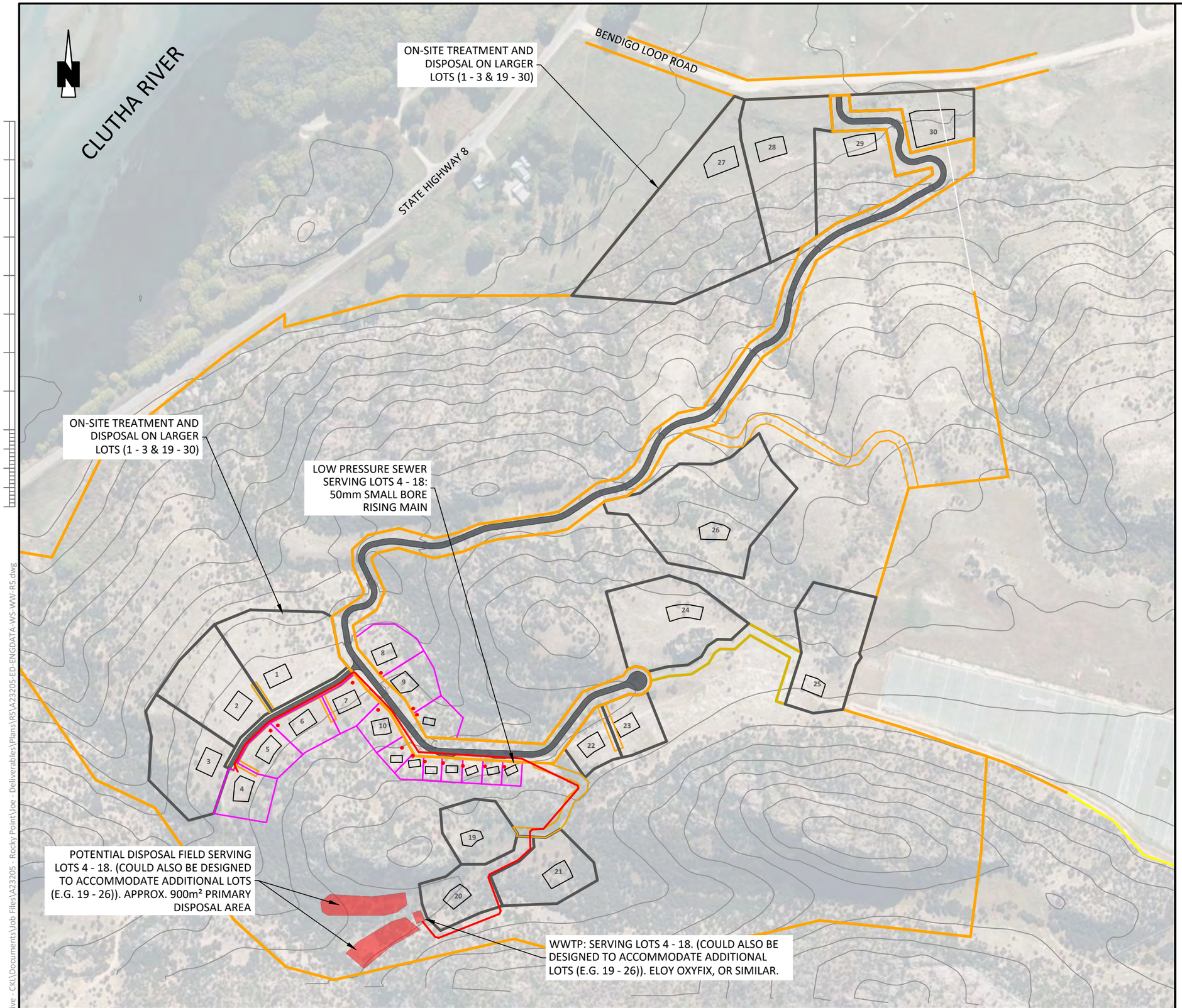
- Use Option A as the basis for detailed design and further community engagement, as per Section 5.2.1.
    - Lots 1 – 3 and 19 – 30 utilising individual on-site treatment and disposal systems.
    - Lots 4 – 18 reticulated to communal treatment plant using low-pressure grinder pumps and small bore rising mains.
    - Communal treatment plant (with flow and quality monitoring) designed to accommodate an average daily flow of approximately 9,000 L/day, with a primary disposal area of approximately 900m².
- Complete a definitive assessment of costs (Capex and Opex) at detail design stage to optimise conveyance, treatment and disposal
- Develop an operation and maintenance agreement as per Section 5.4, clearly outlining monitoring, sampling and reporting obligations and requirements for the Rocky Point Services LTD.

7 Limitations

This report has been prepared solely for the benefit of our client with respect to the particular brief and it may not be relied upon in other contexts for any other purpose without the express approval by CKL. Neither CKL nor any employee or sub-consultant accepts any responsibility with respect to its use, either in full or in part, by any other person or entity. This disclaimer shall apply notwithstanding that the memo/report may be made available to other persons including Council for an application for consent, approval or to fulfil a legal requirement.

Appendix 1 Drawings

- Sheet 5001: Indicative Wastewater Plan (Option A)
- Sheet 6001: Indicative Water Supply Plan (Option A)
- Sheet 6002: Indicative Water Supply Plan (Option A)
- Sheet 6003: Indicative Water Supply Plan (Option A)
- Sheet 6004: Indicative Water Supply Plan (Option A)



LEGEND

- LOW PRESSURE GRINDER PUMP STATION
- LOTS SUITABLE FOR ON-SITE TREATMENT AND DISPOSAL
- LOTS DEEMED UNSUITABLE FOR ON-SITE TREATMENT AND DISPOSAL

NOTES

1) RETICULATION INSTALLATION METHOD SHALL BE DETERMINED BY LOCATION SPECIFIC GEOLOGICAL CONDITIONS. THE NEXT DESIGN STAGE WILL PROVIDE MORE CLARITY ON INFRASTRUCTURE DESIGN, CONSTRUCTION METHODOLOGY AND MATERIAL USE.
2) PUMPING IS REQUIRED TO REACH THE DISPOSAL AREA TO THE WEST OF LOT 20. THIS CAN BE ACHIEVED BY A SINGLE CENTRALIZED GRINDER PUMP STATION OR INDIVIDUAL GRINDER PUMPS ON EACH LOT. TBC AT DETAILED DESIGN.
3) REFER TO WS/WW REPORT FOR MORE DETAILS.
4) LOCATION AND SCALE OF DEVICES INDICATIVE ONLY (SUBJECT TO DETAILED DESIGN)
5) SITE SPECIFIC INVESTIGATION WILL BE CARRIED OUT TO DETERMINE ON-SITE TREATMENT AND DISPOSAL METHODS
6) INDICATIVE STRUCTURES SHOWN WITHIN LOTS. TBC AT DETAILED DESIGN STAGE

FOR RESOURCE CONSENT

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ROCKY POINT
TKO Properties LTD
Lakefront Terrace, Bendigo

Indicative WW Plan
1 OF 5
OPTION A

Issue	Description	Checked	Date
01	INDICATIVE WW PLAN	JS	8/3/2024
03	INDICATIVE WW PLAN (OPTION 2)	JS	21/03/24
03	INDICATIVE WW PLAN (OPTION A)	JS	9/7/2024
04	UPDATED SCHEME PLAN	JS	12/07/24
05	UPDATED REV NUMBER	JS	22/07/24

		Date
Designed:	JA	5/07/24
Drawn:	JA	5/07/24
Checked:	JS	6/07/24

Scale: **1:4000** (A3 Original)

Job No: **A23205** Dwg No: **5001** Rev: **05**

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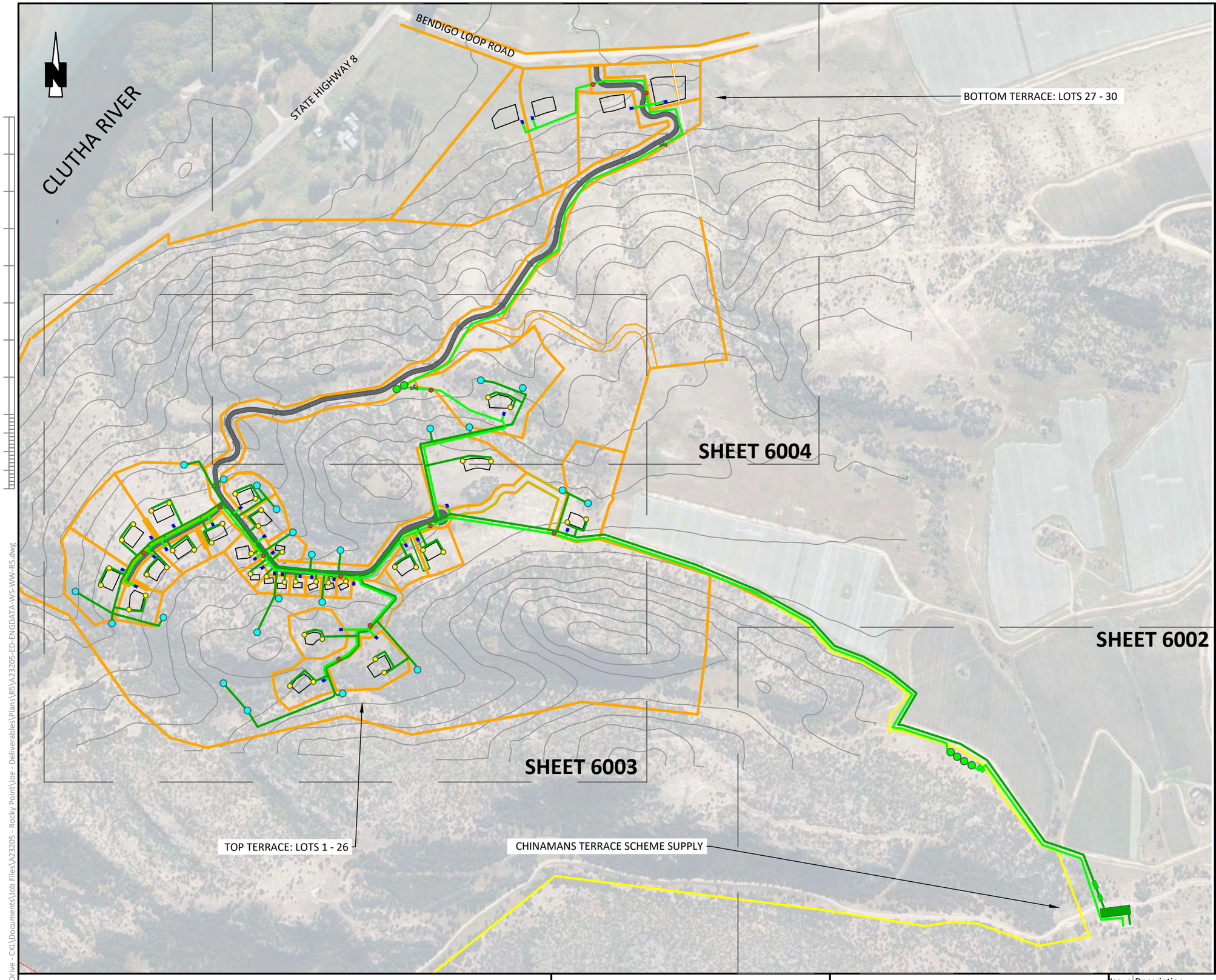

LEGEND

- RETICULATION SYSTEM 1 (DOMESTIC + HYDRANTS)
- RETICULATION SYSTEM 2 (WILDFIRE SPRINKLERS)
- FIRE HYDRANT
- ON-SITE TREATMENT (FILTER/UV, METERING OPTIONAL)
- WATER TANKS
- VEGETATION SPRINKLER
- EMBER SUPPRESSION SPRINKLER
- CONTROL VALVES (PRV = PRESSURE RELIEF, CV = CONTROL)
- PF PARTICULATE FILTER
- WM BULK WATER METER

NOTES

1) RETICULATION INSTALLATION METHOD SHALL BE DETERMINED BY LOCATION SPECIFIC GEOLOGICAL CONDITIONS.
2) REFER TO WS/WW REPORT FOR MORE DETAILS.
3) LOCATION OF DEVICES INDICATIVE ONLY (SUBJECT TO DETAILED DESIGN AND REVIEW FROM FENZ/WILDFIRE ENGINEER)
4) HYDRANTS TO BE INSTALLED AS PER SNZ PAS 4509:2008
5) PRESSURE REDUCTION SHALL BE INSTALLED WHERE NECESSARY, TBC AT DETAILED DESIGN STAGE.
6) INDICATIVE STRUCTURES SHOWN WITHIN LOTS. TBC AT DETAILED DESIGN STAGE

FOR RESOURCE CONSENT

CKL
Planning | Surveying | Engineering | Environmental
OFFICE
Tauranga
A: 53 Spring Street, Tauranga
P: 07 262 2282
E: tauranga@ckl.co.nz

ROCKY POINT
TKO Properties LTD
Lakefront Terrace, Bendigo

INDICATIVE WS PLAN
2 OF 5
(OPTION A: WHOLE SITE)

Issue	Description	Checked	Date
01	INDICATIVE WS PLAN (OPTION A)	JS	8/03/24
02	INDICATIVE WS PLAN (OPTION A)	JS	21/03/24
03	INDICATIVE WS PLAN (WHOLE SITE)	JS	9/07/2024
04	UPDATED SCHEME PLAN	JS	12/07/2024
05	UPDATED REV NUMBER	JS	22/07/24

		Date
Designed:	JA	22/2/24
Drawn:	JA	28/2/24
Checked:	KG	29/02/24

Scale: 1:5000 (A3 Original)

Job No: A23205 | Dwg No: 6001 | Rev: 05

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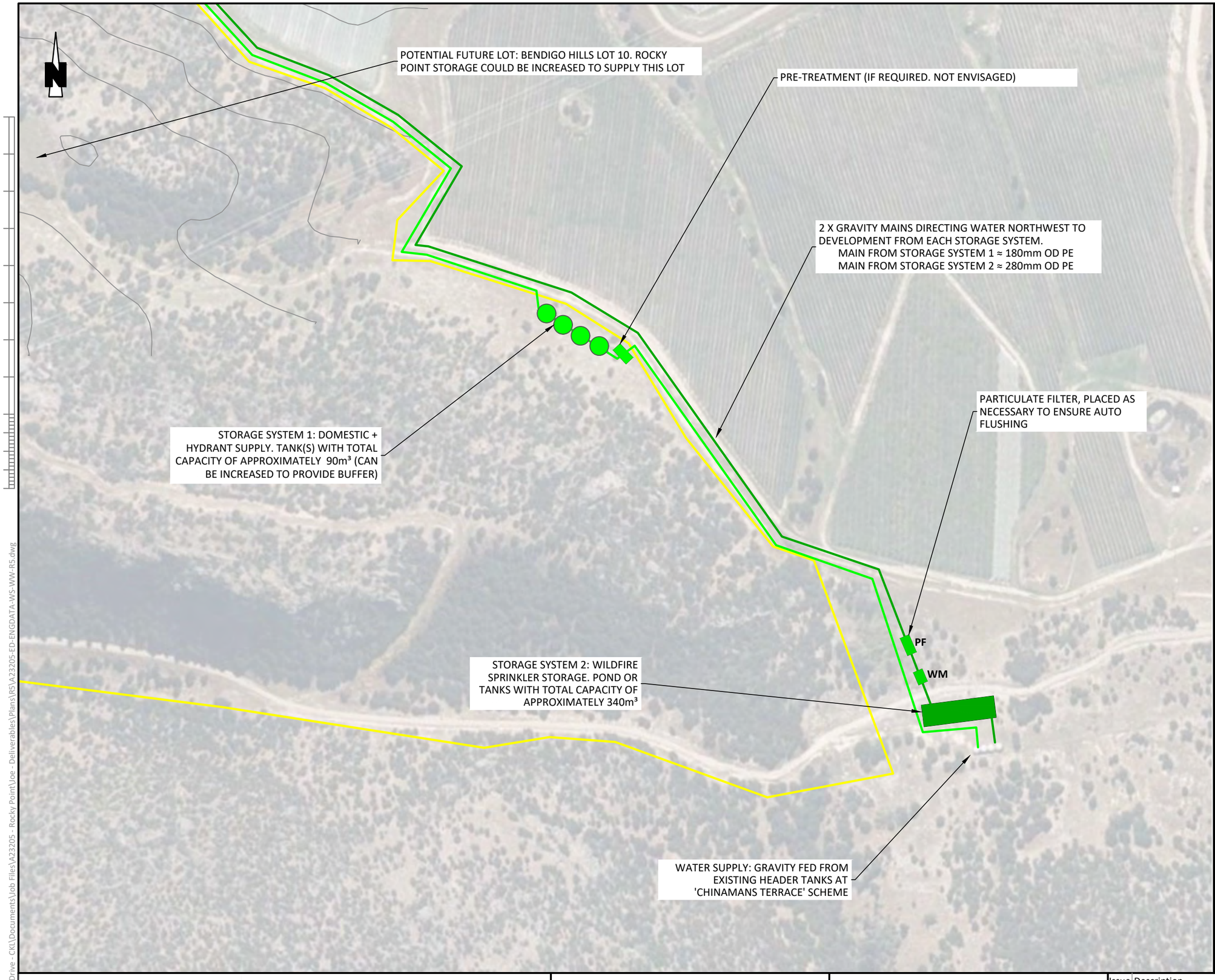

LEGEND

- RETICULATION SYSTEM 1 (DOMESTIC + HYDRANTS)
- RETICULATION SYSTEM 2 (WILDFIRE SPRINKLERS)
- FIRE HYDRANT
- ON-SITE TREATMENT (FILTER/UV, METERING OPTIONAL)
- WATER TANKS
- VEGETATION SPRINKLER
- EMBER SUPPRESSION SPRINKLER
- CONTROL VALVES (PRV = PRESSURE RELIEF, CV = CONTROL)
- PF PARTICULATE FILTER
- WM BULK WATER METER

NOTES

1) RETICULATION INSTALLATION METHOD SHALL BE DETERMINED BY LOCATION SPECIFIC GEOLOGICAL CONDITIONS.
2) REFER TO WS/WW REPORT FOR MORE DETAILS.
3) LOCATION OF DEVICES INDICATIVE ONLY (SUBJECT TO DETAILED DESIGN AND REVIEW FROM FENZ/WILDFIRE ENGINEER)
4) HYDRANTS TO BE INSTALLED AS PER SNZ PAS 4509:2008
5) PRESSURE REDUCTION SHALL BE INSTALLED WHERE NECESSARY, TBC AT DETAILED DESIGN STAGE.
6) INDICATIVE STRUCTURES SHOWN WITHIN LOTS. TBC AT DETAILED DESIGN STAGE

FOR RESOURCE CONSENT

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Planning | Surveying | Engineering | Environmental
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ROCKY POINT
TKO Properties LTD
Lakefront Terrace, Bendigo

INDICATIVE WS PLAN
3 OF 5
(OPTION A: STORAGE)

Issue	Description	Checked	Date
01	INDICATIVE WS PLAN (OPTION A)	JS	8/03/24
02	INDICATIVE WS PLAN (OPTION A)	JS	21/03/24
03	INDICATIVE WS PLAN (STORAGE)	JS	9/07/2024
04	UPDATED SCHEME PLAN	JS	12/07/2024
05	UPDATED REV NUMBER	JS	22/07/24

		Date
Designed:	JA	22/2/24
Drawn:	JA	28/2/24
Checked:	KG	29/02/24

Scale: 1:2000 (A3 Original)

Job No: A23205 | Dwg No: 6002 | Rev: 05

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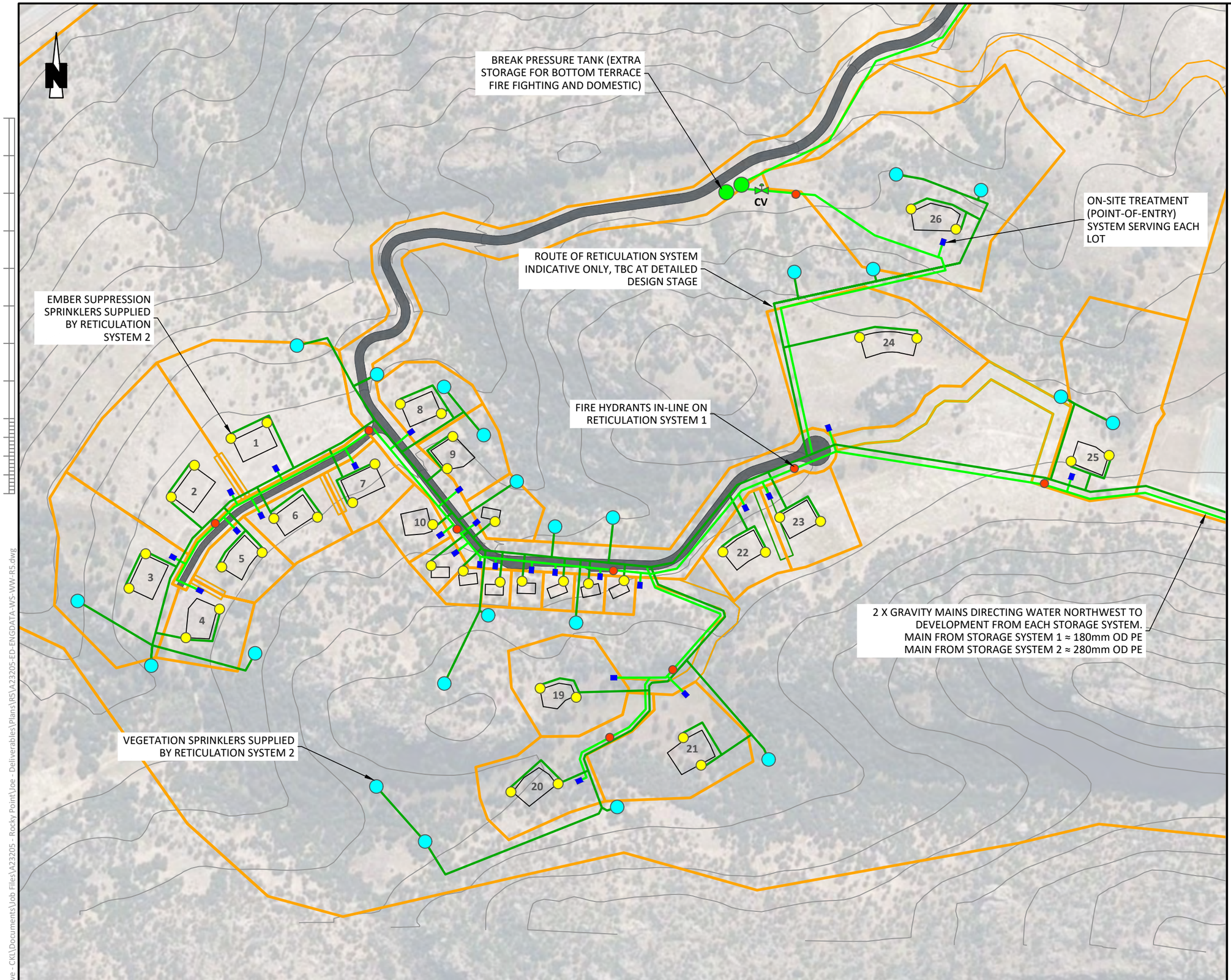

LEGEND

- RETICULATION SYSTEM 1 (DOMESTIC + HYDRANTS)
- RETICULATION SYSTEM 2 (WILDFIRE SPRINKLERS)
- FIRE HYDRANT
- ON-SITE TREATMENT (FILTER/UV, METERING OPTIONAL)
- WATER TANKS
- VEGETATION SPRINKLER
- EMBER SUPPRESSION SPRINKLER
- CONTROL VALVES (PRV = PRESSURE RELIEF, CV = CONTROL)
- PF — PARTICULATE FILTER
- WM — BULK WATER METER

NOTES

1) RETICULATION INSTALLATION METHOD SHALL BE DETERMINED BY LOCATION SPECIFIC GEOLOGICAL CONDITIONS.
2) REFER TO WS/WW REPORT FOR MORE DETAILS.
3) LOCATION OF DEVICES INDICATIVE ONLY (SUBJECT TO DETAILED DESIGN AND REVIEW FROM FENZ/WILDFIRE ENGINEER)
4) HYDRANTS TO BE INSTALLED AS PER SNZ PAS 4509:2008
5) PRESSURE REDUCTION SHALL BE INSTALLED WHERE NECESSARY, TBC AT DETAILED DESIGN STAGE.
6) INDICATIVE STRUCTURES SHOWN WITHIN LOTS. TBC AT DETAILED DESIGN STAGE

FOR RESOURCE CONSENT

CKL
Planning | Surveying | Engineering | Environmental
OFFICE
Tauranga
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ROCKY POINT
TKO Properties LTD
Lakefront Terrace, Bendigo

INDICATIVE WS PLAN
4 OF 5
(OPTION A: TOP TERRACE)

Issue	Description	Checked	Date
01	INDICATIVE WS PLAN (OPTION A)	JS	8/03/24
02	INDICATIVE WS PLAN (OPTION A)	JS	21/03/24
03	INDICATIVE WS PLAN (TDP)	JS	8/07/2024
04	UPDATED SCHEME PLAN	JS	12/07/24
05	UPDATED REV NUMBER	JS	22/07/24

		Date
Designed:	JA	22/2/24
Drawn:	JA	28/2/24
Checked:	KG	29/02/24

Scale: 1:2500 (A3 Original)

Job No: A23205 | Dwg No: 6003 | Rev: 05

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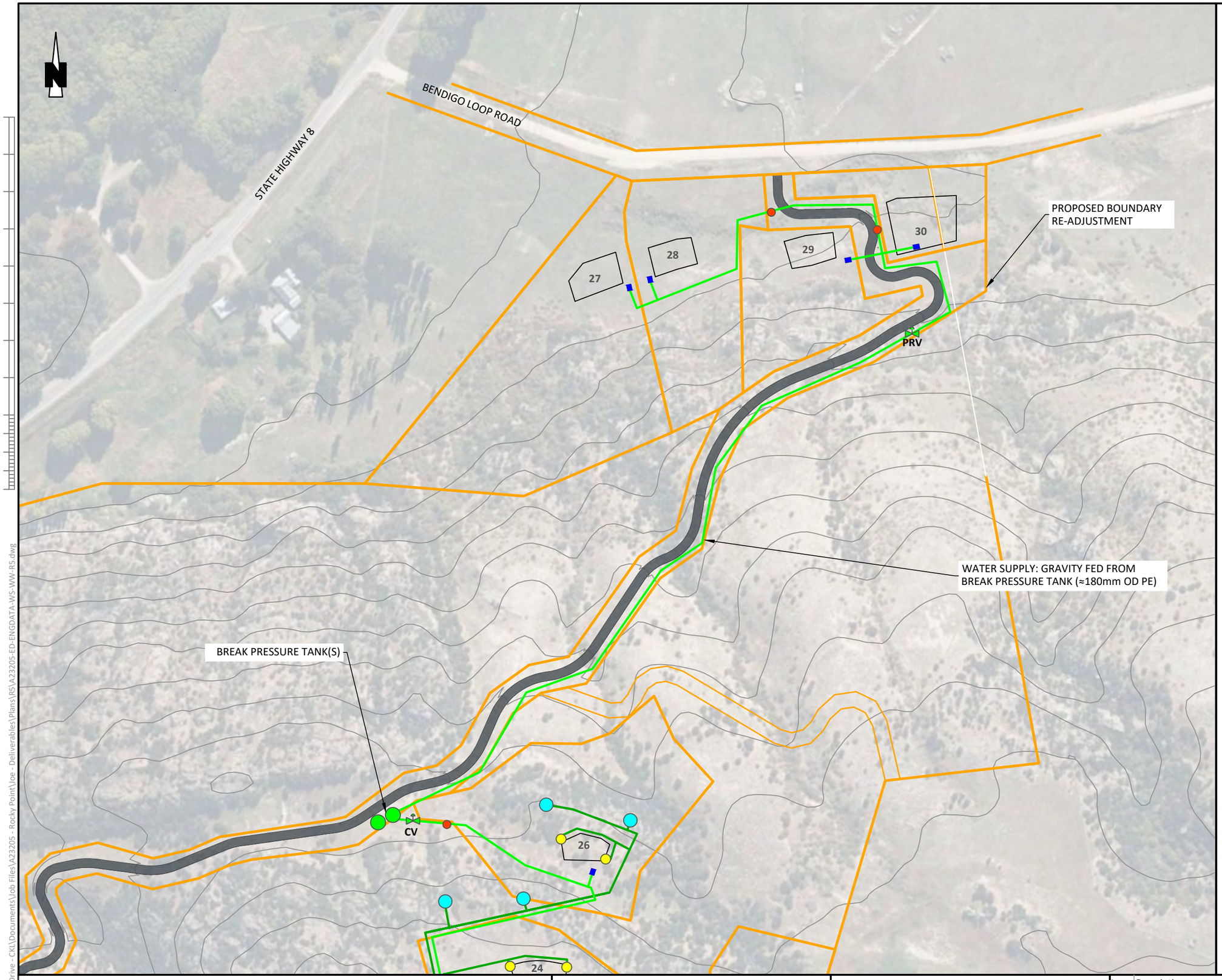

LEGEND

- RETICULATION SYSTEM 1 (DOMESTIC + HYDRANTS)
- RETICULATION SYSTEM 2 (WILDFIRE SPRINKLERS)
- FIRE HYDRANT
- ON-SITE TREATMENT (FILTER/UV, METERING OPTIONAL)
- WATER TANKS
- VEGETATION SPRINKLER
- EMBER SUPPRESSION SPRINKLER
- CONTROL VALVES (PRV = PRESSURE RELIEF, CV = CONTROL)
- PF — PARTICULATE FILTER
- WM — BULK WATER METER

NOTES

1) RETICULATION INSTALLATION METHOD SHALL BE DETERMINED BY LOCATION SPECIFIC GEOLOGICAL CONDITIONS.
2) REFER TO WS/WW REPORT FOR MORE DETAILS.
3) LOCATION OF DEVICES INDICATIVE ONLY (SUBJECT TO DETAILED DESIGN AND REVIEW FROM FENZ/WILDFIRE ENGINEER)
4) HYDRANTS TO BE INSTALLED AS PER SNZ PAS 4509:2008
5) PRESSURE REDUCTION SHALL BE INSTALLED WHERE NECESSARY, TBC AT DETAILED DESIGN STAGE.
6) INDICATIVE STRUCTURES SHOWN WITHIN LOTS. TBC AT DETAILED DESIGN STAGE

FOR RESOURCE CONSENT

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ROCKY POINT
TKO Properties LTD
Lakefront Terrace, Bendigo

INDICATIVE WS PLAN
5 OF 5
(OPTION A: BOTTOM TERRACE)

Issue	Description	Checked	Date
01	INDICATIVE WS PLAN (OPTION A)	JS	8/03/24
02	INDICATIVE WS PLAN (OPTION A)	JS	21/03/24
03	INDICATIVE WS PLAN (BOTTOM)	JS	8/07/2024
04	UPDATED SCHEME PLAN	JS	12/07/24
05	UPDATED REV NUMBER	JS	22/07/24

		Date
Designed:	JA	22/2/24
Drawn:	JA	28/2/24
Checked:	KG	29/02/24

Scale: 1:4000 (A3 Original)

Job No: A23205 | Dwg No: 6004 | Rev: 05

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Appendix 2 Water Quality Testing Results

Analytica Laboratories Limited
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Certificate of Analysis

Courtney Browne
17 Kinross Street
Christchurch
Attention: C Hughes, Wanaka
Phone: 027 2220252
Email: okb4u8@gmail.com

Lab Reference: 24-16748
Submitted by: Matt Suddaby
Date Received: 24/05/2024
Testing Initiated: 24/05/2024
Date Completed: 31/05/2024
Order Number: 6347
Reference:

Sampling Site: Rocky Point, Bendigo (AKA Chinamas Tce)

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories (or at the subcontracted laboratories, when applicable). Samples were in acceptable condition unless otherwise noted on this report.

LOR = Limit of Reporting.

MAV = Maximum acceptable value for compliance per *Water Services (Drinking Water Standards for New Zealand) Regulations 2022*.
Where N/A, a MAV is not outlined in the Drinking Water Standards for New Zealand document.

Please note: temperature on arrival of samples exceeded the recommended 10°C holding temperature.

Domestic Drinking Water Profile (Aggregates/Nutrients)

			Client Sample ID	Rocky Point, Bendigo
			Date Sampled	23/05/2024
Analyte	Unit	LOR	MAV	24-16748-1
Total Dissolved Solids	g/m^3	3	N/A	100
Total Dissolved Salts*	g/m^3	2	N/A	109
pH	pH	1	N/A	7.5
Turbidity	NTU	0.05	N/A	0.7
Electrical Conductivity	µS/cm	0.2	N/A	163
Total Alkalinity (CaCO3)	g $CaCO_3/m^3$	1	N/A	60.8
Total Hardness	g eqv. $CaCO_3/m^3$	0.05	N/A	63
Nitrate-N	g/m^3	0.002	11.3	0.830
Chloride	g/m^3	0.5	N/A	3.87
Sulfate	g/m^3	0.15	N/A	5.84

Domestic Drinking Water Profile (Elemental Analysis)

			Client Sample ID	Rocky Point, Bendigo
			Date Sampled	23/05/2024
Analyte	Unit	LOR	MAV	24-16748-1
Calcium	g/m^3	0.05	N/A	18.1
Magnesium	g/m^3	0.01	N/A	4.34
Potassium	g/m^3	0.05	N/A	1.2

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Domestic Drinking Water Profile (Elemental Analysis)

				Client Sample ID	Rocky Point, Bendigo
				Date Sampled	23/05/2024
Sodium	g/m³	0.01	N/A		9.10
Arsenic	g/m³	0.0005	0.01		<0.00050
Lead	g/m³	0.00005	0.01		0.00045
Boron	g/m³	0.005	2.4		0.021
Iron	g/m³	0.005	N/A		0.072
Manganese	g/m³	0.0005	0.4		0.0023
Copper	g/m³	0.0002	2		0.0089
Zinc	g/m³	0.003	N/A		0.046

Domestic Drinking Water Profile (Microbiology)

				Client Sample ID	Rocky Point, Bendigo
				Date Sampled	23/05/2024
Analyte	Unit	LOR	MAV		24-16748-1
Enumerated E.coli	MPN/100mL	1	1		<1
Total Coliforms Enumerated	MPN/100mL	1	N/A		<1

Temperature on Arrival

				Client Sample ID	Rocky Point, Bendigo
				Date Sampled	23/05/2024
Analyte	Unit	LOR	MAV		24-16748-1
Temp on Arrival*	°C	0	N/A		15.9

Method Summary

Total Dissolved Solids	Filtration folllowed by complete drying at 180°C. (APHA 2540 C - Online edition).
Calculated TDS	Samples analysed as received using a conventional conductivity electrode. (APHA 2510 B - Modified - Auto-titrator - Online edition).EC value multiplied by constant of 0.67 to determine TDS (g/m^3).
pH	Samples measured as received using a conventional pH electrode. (APHA 4500 H^+ B. Online edition).
Turbidity	Samples analysed as received using a conventional turbidimeter. (APHA 2130 B Online edition - Modified).
Electrical Conductivity	Samples analysed as received using a conventional conductivity electrode. (APHA 2510 B - Modified - Auto-titrator - Online edition).
Total Alkalinity ($CaCO_3$)	Samples analysed as received by potentiometric titration. (APHA 2320 B Online edition).
Total Hardness	Result calculated from Total Magnesium and Calcium. (APHA 2340B - Online edition)
NO3-N	Calculated from oxidised nitrogen and Nitrite-N, measured colourimetrically by flow injection analysis. (APHA NO_3- I. Online edition)
Chloride	Analysis by Ion exchange chromatography following sample filtration. (APHA 4110 B - Online edition).
Sulfate	Analysis by Ion exchange chromatography following sample filtration. (APHA 4110B - Online edition).
Recoverable Trace Elements	Samples were analysed as received by the laboratory using ICP-MS following an acid digestion. In house procedure based on US EPA method 200.8.
Enumerated E.coli	Samples analysed by Enzyme substrate E. coli test using Colilert-18 in 51 wells. Incubated at 35°C for 18 hours. APHA 9223 B Online Edition.

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Method Summary

Total Coliform Enumerated	Samples analysed by Enzyme substrate coliform test using Colilert 18 in 97 wells. Incubated at 35°C for 18 hours. APHA 9223 B Online Edition.
Temp on Arrival	Measured on arrival by a digital infra-red laser thermometer.

Sandra Mathews, B.Eng.
Technologist

Alesha Avery, BSc(Tech),
Laboratory Technician

Bhumika Patel
Sample Reception Technician

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Aesthetic Values for Drinking Water Notice 2022

Analyte	MAV	Guideline Value	Unit	Comment
Aluminium	1	< 0.1	mg/L	Above this value, complaints of depositions or discoloration may arise
Ammonia	N/A	< 1.5	mg/L	Odour threshold (alkaline conditions)
Calcium	N/A	N/A	N/A	See 'Hardness'
Chlorine (contingent on the supply being chlorinated)	5	0.3 - 1.0	mg/L as Cl_2	Free available chlorine Taste and odour threshold (pH dependant) Disinfection must not be compromised in trying to avoid taste and odour complaints
2-Chlorophenol	N/A	< 0.0001	mg/L	Taste threshold
		< 0.01		Odour threshold
Colour	N/A	< 15	TCU	Appearance
Copper	2	< 1	mg/L	Staining of laundry and sanitary ware
1,2-Dichlorobenzene	1.5	< 0.0003	mg/L	Odour threshold
		< 0.006		Taste threshold
2,4-Dichlorophenol	N/A	< 0.0003	mg/L	Taste threshold
		< 0.04		Odour threshold
Ethylbenzene	0.3	< 0.002	mg/L	Odour threshold
		< 0.08		Taste threshold
Hardness (total) (Ca + Mg) as CaCO3	N/A	< 200	mg/L	Scale deposition, scum formation (pH and alkalinity dependent) Low hardness (<100) may be more corrosive
		100–300		Taste threshold (Ca; counter ion dependent)
Hydrogen sulphide	N/A	< 0.05	mg/L	Taste and odour threshold
Iron	N/A	< 0.3	mg/L	Staining of laundry and sanitary ware
Magnesium	N/A	N/A	N/A	See 'Hardness'
Manganese	0.4	< 0.04	mg/L	Staining of laundry
		< 0.10		Taste threshold
Monochlorobenzene	N/A	< 0.01	mg/L	Taste and odour threshold
pH	N/A	7.0–8.5		Ideally 7.4 – 8.0. Most water with a low pH has a high plumbosolvency. Water with a high pH has a soapy taste and feel. A pH less than 8 is preferable for effective disinfection with chlorine
Sodium	N/A	< 200	mg/L	Taste threshold (counter ion dependent)
Styrene	0.03	< 0.004	mg/L	Odour threshold
Sulphate	N/A	< 250	mg/L	Taste threshold
Taste and odour	Acceptable to most consumers	Acceptable to most consumers		
Temperature	< 15°C	< 15°C		
Toluene	0.8	< 0.03	mg/L	Odour threshold
		< 0.04		Taste threshold
Total dissolved solids	N/A	< 1000	mg/L	Taste may become unacceptable from 600–1200 mg/L
Trichlorobenzenes (total)	See below	See below		
1,2,3-Trichlorobenzene	N/A	< 0.01	mg/L	Odour threshold
1,2,4-Trichlorobenzene	N/A	< 0.005	mg/L	Odour threshold
1,3,5-Trichlorobenzene	N/A	< 0.05	mg/L	Odour threshold
2,4,6-Trichlorophenol	0.2	< 0.002	mg/L	Taste threshold
		< 0.3	mg/L	Odour threshold
Turbidity	N/A	< 5	NTU	Appearance
Xylene	0.6	< 0.02	mg/L	Odour threshold
Zinc	N/A	< 1.5	mg/L	Taste threshold

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Certificate of Analysis

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3 Mamaku Lane
Christchurch 8022
Attention: Coterra, Wanaka
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Email: okb4u8@gmail.com

Lab Reference: 24-20408
Submitted by: Matt Suddaby/ Jack Lister
Date Received: 27/06/2024
Testing Initiated: 2/07/2024
Date Completed: 2/07/2024
Order Number:
Reference:

Sampling Site: Rocky Point

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories (or at the subcontracted laboratories, when applicable). Samples were in acceptable condition unless otherwise noted on this report.

LOR = Limit of Reporting.

MAV = Maximum acceptable value for compliance per *Water Services (Drinking Water Standards for New Zealand) Regulations 2022*.
Where N/A, a MAV is not outlined in the Drinking Water Standards for New Zealand document.

Total Silica in Water

				Client Sample ID	Rocky Point
				Date Sampled	25/06/2024
Analyte	Unit	*LOR*	*MAV*	24-20408-1	
Total Silica*	g/m³	*0.1*	*N/A*	5.65	

Method Summary

Total Silica Samples were analysed as received by the laboratory using ICP-MS. (US EPA method 200.8 - Modified - Unfiltered aliquot).

Thara Samarasinghe, B.Sc.
Technician

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Aesthetic Values for Drinking Water Notice 2022

Analyte	MAV	Guideline Value	Unit	Comment
Aluminium	1	< 0.1	mg/L	Above this value, complaints of depositions or discoloration may arise
Ammonia	N/A	< 1.5	mg/L	Odour threshold (alkaline conditions)
Calcium	N/A	N/A	N/A	See 'Hardness'
Chlorine (contingent on the supply being chlorinated)	5	0.3 - 1.0	mg/L as Cl_2	Free available chlorine Taste and odour threshold (pH dependant) Disinfection must not be compromised in trying to avoid taste and odour complaints
2-Chlorophenol	N/A	< 0.0001	mg/L	Taste threshold
		< 0.01		Odour threshold
Colour	N/A	< 15	TCU	Appearance
Copper	2	< 1	mg/L	Staining of laundry and sanitary ware
1,2-Dichlorobenzene	1.5	< 0.0003	mg/L	Odour threshold
		< 0.006		Taste threshold
2,4-Dichlorophenol	N/A	< 0.0003	mg/L	Taste threshold
		< 0.04		Odour threshold
Ethylbenzene	0.3	< 0.002	mg/L	Odour threshold
		< 0.08		Taste threshold
Hardness (total) (Ca + Mg) as CaCO3	N/A	< 200	mg/L	Scale deposition, scum formation (pH and alkalinity dependent) Low hardness (<100) may be more corrosive
		100–300		Taste threshold (Ca; counter ion dependent)
Hydrogen sulphide	N/A	< 0.05	mg/L	Taste and odour threshold
Iron	N/A	< 0.3	mg/L	Staining of laundry and sanitary ware
Magnesium	N/A	N/A	N/A	See 'Hardness'
Manganese	0.4	< 0.04	mg/L	Staining of laundry
		< 0.10		Taste threshold
Monochlorobenzene	N/A	< 0.01	mg/L	Taste and odour threshold
pH	N/A	7.0–8.5		Ideally 7.4 – 8.0. Most water with a low pH has a high plumbosolvency. Water with a high pH has a soapy taste and feel. A pH less than 8 is preferable for effective disinfection with chlorine
Sodium	N/A	< 200	mg/L	Taste threshold (counter ion dependent)
Styrene	0.03	< 0.004	mg/L	Odour threshold
Sulphate	N/A	< 250	mg/L	Taste threshold
Taste and odour	Acceptable to most consumers	Acceptable to most consumers		
Temperature	< 15°C	< 15°C		
Toluene	0.8	< 0.03	mg/L	Odour threshold
		< 0.04		Taste threshold
Total dissolved solids	N/A	< 1000	mg/L	Taste may become unacceptable from 600–1200 mg/L
Trichlorobenzenes (total)	See below	See below		
1,2,3-Trichlorobenzene	N/A	< 0.01	mg/L	Odour threshold
1,2,4-Trichlorobenzene	N/A	< 0.005	mg/L	Odour threshold
1,3,5-Trichlorobenzene	N/A	< 0.05	mg/L	Odour threshold
2,4,6-Trichlorophenol	0.2	< 0.002	mg/L	Taste threshold
		< 0.3	mg/L	Odour threshold
Turbidity	N/A	< 5	NTU	Appearance
Xylene	0.6	< 0.02	mg/L	Odour threshold
Zinc	N/A	< 1.5	mg/L	Taste threshold

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Appendix 3 Taumata Arowai – Drinking Water Acceptable Solution for Mixed-Use Rural Water Supplies

The attached document specifies the pre-requisites, monitoring and quality assurance required for the water supply.

Drinking Water Acceptable Solution for Mixed-use Rural Water Supplies

October 2022

This Drinking Water Acceptable Solution for Mixed-use Rural Water Supplies is issued under section 50 of the Water Services Act 2021.

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1. Introduction

1.1. Purpose

Drinking water Acceptable Solutions are regulatory instruments made under the Water Services Act 2021 (**the Act**).[1] They offer practical ways for drinking water suppliers to provide safe drinking water that are proportionate to the scale, complexity, and risk profile of the relevant type of supply.

A drinking water supplier that chooses to adopt and comply with an Acceptable Solution must, for the purposes of the Act, be treated as having complied with the legislative requirements to which the Acceptable Solution relates (other than the duties to provide safe drinking water that complies with Drinking Water Standards under sections 21 and 22).[2]

Drinking water suppliers who comply with the entirety of this Acceptable Solution will be deemed to comply with the requirements arising under the following sections of the Act:

- Duty to take all reasonably practicable steps to supply aesthetically acceptable drinking water (section 24).
- Duty to protect against risk of backflow (section 27).
- Duty to have a drinking water safety plan (section 30).
- Duty to prepare and implement a source water risk management plan (section 43(1)).
- Duty to comply with the Drinking Water Quality Assurance Rules (section 49(3)).

A drinking water supplier who complies with this Acceptable Solution does **not** need to prepare a drinking water safety plan (including a source water risk management plan) or provide a copy to Taumata Arowai.

Drinking water suppliers adopting this Acceptable Solution must also comply with their other obligations under the Act and any other relevant legislation.

[1] Section 50 of the Act provides that Taumata Arowai may, by notice, issue a drinking water Acceptable Solution for use in establishing compliance with the legislative requirements.

[2] Water Services Act, section 51(1).

1.2. Scope

The scope of this Acceptable Solution is limited to drinking water supplies that meet the criteria specified below.

1.2.1. Eligible drinking water supplies

a) An eligible drinking water supply is a mixed-use rural supply when the following criteria are met:
   i. A drinking water supplier (as defined in section 8 of **the Act**) provides water via a network to consumers' properties; and
   ii. Not less than 50% of water supplied is intended for agricultural or horticultural purposes, for example stock water and irrigation, and not more than 50% is used for domestic purposes, including drinking water.[3]

b) A mixed-use rural drinking water supplier must ensure all water intended for drinking, is treated by an end point treatment system[4]. The supplier is responsible for ensuring these treatment systems are installed, operated, and maintained according to this Acceptable Solution.

c) There is no upper or lower limit to the total population served by the mixed-use rural water supply. However, Section 1.2.2 applies a population limit per end-point treatment system.[5]

1.2.2. Building and base population limits for end-point treatment systems

a) Each end-point treatment system must only provide drinking water to three or fewer buildings within the boundaries of one property.

b) The base population for a single building served by an end-point treatment system must not exceed 500 people.

c) The base population for two or three buildings served by a single end-point treatment system must not exceed 100 people.
   i. Due to the lack of a chlorination requirement in this Acceptable Solution, the base population limit for multiple buildings supplied by an end-point treatment system via a limited pipe network, is more restrictive than for a single building.

1.2.3. Allowed exceedance of base population limits

a) The population supplied by each end point treatment system may exceed its base population limit:

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[3] The water supplier is responsible for estimating this ratio of use over the course of a year, and this should be reassessed on an annual basis.

[4] Refer to section 28.

[5] For a mixed-use rural water supply where the base population is less than 25 people, the Drinking Water Quality Assurance Rules – Very Small Community module offers an alternative compliance pathway.

i. For a total of no more than 60 days in any 12-month period; and

ii. Is subject to the water supply having the capacity to supply treated water for these periods; and

iii. Is subject to additional monitoring requirements as stated in the table below.

	Number of buildings downstream of end point treatment system	
Criteria Description	One building	Two or three buildings
Base population limit	500 people	100 people
Monitoring and testing conditions when the population **exceeds** the base population limit	MR6 (see table in Section 4)	MR7 (see table in Section 4)

1.3. Commencement

The commencement date of this Acceptable Solution is 14 November 2022.

2. Mixed-use rural drinking water requirements

This Acceptable Solution may be adopted by a drinking water supplier where all the following requirements (except those specifically identified as recommendations) are met:

2.1. General use criteria

a) All end-point treatment systems are designed, configured, and installed according to this Acceptable Solution.

b) Water provided for flushing toilets and outdoor use may be untreated but must be marked as non-potable in accordance with the Building Code.[6]

c) Backflow prevention devices must be installed on all connections to the mixed-use rural water supply.

i. The location of the device must be after the point of supply and before any untreated storage tanks or the treatment system.

ii. The minimum requirement is for non-testable double check valves.

[6] Clause G12.3.4, Schedule 1 of the Building Regulations 1992.

iii. A testable backflow prevention device must be installed if there is a medium or high backflow risk. Testable backflow prevention devices must be inspected and tested annually.

d) If the source of the mixed-use rural water supply is a spring or bore, the spring or bore water and the system used to collect this water must comply with the following sections and requirements in the Drinking Water Acceptable Solution for Spring and Bore Drinking Water Supplies:

i. Section 2.4. Bore and spring water collection system requirements.

2.2. Prerequisite monitoring requirements

a) Before this Acceptable Solution can be adopted, the drinking water supplier must test the source water for a range of parameters to ensure the safety of the water but also to determine the suitability for cartridge filtration and UV disinfection. Samples must be collected and analysed according to condition MR1 in Section 4.

b) The pre-requisite source water monitoring must meet the following requirements:

i. Results from source water monitoring must not exceed the limits that manufacturers indicate for use of their equipment (including, but not limited to, the limits in the table below).

ii. If a chemical determinand from source water monitoring exceeds a MAV or testing indicates that the source water is unsuitable for cartridge filtration and/or UV disinfection, the drinking water acceptable solution cannot be used without additional pre-treatment as discussed in Section 2.3.

iii. Samples must represent a range of different environmental conditions such as heavy rainfall and dry periods to ensure that treatment is suitable when water quality is most likely to be at its worst.[7]

iv. Source water testing must include at least three (3) samples for the parameters in the following table:

[7] The supplier is responsible for determining the range of environmental conditions during which samples are taken.

Parameter[8]	Limit
Iron	Must not be at a level which compromises the effectiveness of the UV disinfection unit based on the manufacturer's specifications/ guidelines.
Manganese	Must not be at a level which compromises the effectiveness of the UV disinfection unit based on the manufacturer's specifications/ guidelines. Must be below the MAV.
Nitrate, Arsenic, and Boron	Must be below the MAV.
Silica	Must be at a level which is suitable for cartridge filtration with or without additional pre-treatment and meet the manufacturer's specifications/guidelines.[9]
Hardness	Must not be at a level which compromises the effectiveness of the UV disinfection unit based on the manufacturer's specifications/guidelines.
UV transmittance	Must not be at a level which compromises the effectiveness of the UV disinfection unit based on the manufacturer's specifications/guidelines.
***E. coli* and total coliforms**	Presence of *E. coli* and total coliforms indicates that the source water has some microbiological contaminants in it which must be controlled by the treatment system.
Turbidity	Must be at a level that can be treated by cartridge filtration with or without additional pre-treatment to meet the specifications/guidelines of the UV disinfection unit's manufacturer.[10]

2.3. Pre-treatment requirements

a) A drinking water supplier may install pre-treatment (headworks, back-washable filters, aeration, etc) to make the source water suitable for cartridge filtration and UV disinfection, or to reduce a chemical determinand to below its respective MAV.

[8] Unless changes have occurred, which could reasonably be expected to have changed the source water quality, results from samples taken within the last 5 years may be used. Note: The supplier is still responsible for ensuring a range of environmental conditions are represented when samples were taken.

[9] High levels of silica can decrease the lifespan of cartridge filters.

[10] High turbidity can decrease the lifespan of cartridge filters.

b) If pre-treatment is installed, the water supplier is responsible for ensuring that water leaving the pre-treatment system(s) is suitable for the end-point treatment in Section 2.6.

2.4. Untreated water storage requirements

a) Inlets, overflows, and any other small gaps in tanks must be screened to be secure from contamination by vermin, birds, faecal material, or other material.

b) Lids on all storage tanks are secured to prevent contamination by vermin, birds, faecal material, or other material.

2.5. Untreated water storage recommendations

a) Where beneficial to reduce turbidity of raw water, a calmed bottom inlet and floating outtake are installed for untreated water storage tanks.

b) The quantity of untreated water storage is sufficient to support the ordinary drinking water needs of consumers served by the supply for an identified period of time. A minimum of 96 hours average demand of untreated storage is recommended.[11]

2.6. End-point treatment system requirements

a) Each component of the end-point treatment system must be installed:
   i. To meet the peak instantaneous demand for treated drinking water.
   ii. In accordance with the manufacturer's instructions and requirements.

b) The end-point treatment system and all associated pipework and associated fixtures must comply with the Building Act 2004 and the Building Code if relevant.

c) The design and construction of the water treatment system must prevent backflow, being the unplanned reversal of flow of water or mixtures of water and contaminants into the water supply system.

d) Each UV disinfection unit must be validated to at least one of the following standards:
   i. Ultraviolet Disinfection Guidance Manual (USEPA 2006b).
   ii. DVGW Technical Standard W294 (DVGW 2006).
   iii. öNORM M 5873-1: 2020 01 01.[12]
   iv. NSF/ANSI 55 Class A (NSF, ANSI n.d).

e) Where a UV disinfection unit has been installed before 17 October 2022 and written evidence is available from the manufacturer (e.g., manufacturer's website, instruction manual, etc) that the unit delivers a minimum UV reduction equivalent dose of 40mJ/cm^2 then the unit is not required to meet the UV validation requirements set out above at 2.6(d).

f) Each end-point treatment system must (as a minimum):

   i. Have two stage cartridge filtration with 20 micron and 5 micron or less, nominal pore sizes.

[11] This recommended minimum may not be appropriate for areas that are subject to droughts.

[12] UV reactors installed before 1 January 2020 can be certified to öNORM M5873 (Osterreichisches Normungsinstitut 2001).

ii. Have a UV disinfection unit that delivers a minimum reduction equivalent dose of 40 mJ/cm^2 as measured by a UVI or UV dose sensor.
iii. Monitor UV dose continuously and generate a local onsite alarm if the UV dose is below 40 mJ/cm^2 or outside the limits specified by the manufacturer.
iv. Have flow control to ensure water flow is within the specification of the UV unit and be designed to shutdown automatically on a low UVI or UV dose.
v. Have a lamp status indicator if a UV disinfection unit contains more than one lamp.
vi. If applicable, not allow flow of water during a UV disinfection unit's lamp warm-up period until the required UVI or UV dose is achieved (an automatic control valve or start/stop of the pump must be used to control flow during the warm-up period).
vii. Have an air release valve(s) to allow air to be removed from the system on start up.
viii. Have manual isolation valves fitted upstream and downstream of the treatment system to allow for maintenance.
ix. Be sized to ensure flow rates comply with clause G12.3.7(a) (Water supplies) of the Building Code and are adequate for the correct functioning of fixtures and appliances within the building.[13]

2.7. Alternative source for water supply

a) Treated water from a water carrier registered with Taumata Arowai can supplement the mixed-use rural water supply and can be delivered to a treated water storage tank (if there is one) or an untreated water storage tank.

b) Rainwater collected from roof surfaces that is used to supplement a mixed-use rural water supply must be delivered into an untreated water storage tank so that all drinking water provided to the building(s) served by the supply passes through the end-point treatment system. Rainwater collected by roof surfaces and the system used to collect this water must comply with the following sections and requirements in the Drinking Water Acceptable Solution for Roof Water Supplies:

    i. Section 2.2. Roof water collection system requirements.[14]
    ii. RF3 in Section 4. Monitoring and testing.

c) Surface water not tested in accordance with Section 2.2 by the drinking water supplier (excluding rainwater collected from roof surface) or water from a water carrier that is not registered with Taumata Arowai cannot be used to supplement the mixed-use rural water supply.

d) Surface water or water from an unregistered water carrier cannot be used to supplement the roof supply.

[13] Probable instantaneous flow rates for dwellings can be found in AS/NZS 3500.1:2021.

[14] Note that there are also recommendations for roof water collection systems in Section 2.3 of the Drinking Water Acceptable Solution for Roof Water Supplies.

2.8. Treated water tank requirements

If a treated water tank is included as part of the drinking water supply:

a) It must be secure against the ingress of rainwater and surface water.
b) Inlets, lids, overflows, and any other small gaps in tanks must be secure from contamination by vermin, birds, animals, faecal material, or other material.

3. Operation and maintenance

a) The operation and maintenance of the mixed-use rural water supply, including all treatment systems under this Acceptable Solution, is the responsibility of the drinking water supplier.

b) The drinking water supplier must provide information about the drinking water supply to the consumers at the properties connected to it and communicate whether the consumers are required to maintain or test the end-point treatment system. This must include a process to ensure all new consumers are informed of any maintenance or testing requirements.

c) The drinking water supplier must keep and maintain documentation that supports the ongoing operation and maintenance of the whole of the mixed-use rural water supply. This must include (but is not limited to):

   i. A description of the drinking water supply and key components.
   ii. A supply diagram that shows the components of the supply system, including sources, backflow devices, valves, pumps, treatment components, connections, and bypasses.
   iii. Incident and emergency response procedures.a)
   iv. Key contacts, including details for operators, manufacturers, suppliers, regulators, property owners, and consumers.
   v. Maintenance and inspection schedules and associated procedures that meet the drinking water supplier's and/or manufacturer's requirements for equipment used in the supply (e.g., end-point treatment system equipment, any additional pre-treatment systems for example iron and manganese removal, etc).
   vi. Schedule and procedures for inspecting the headworks, untreated and treated storage tanks (e.g., storage tanks are intact to prevent access of vermin or ingress of contaminants) and associated infrastructure.
   vii. Good hygienic practices, including prohibition of people working on a water system who are experiencing any gastrointestinal illness, protection of work sites, materials, and tools from contamination, and minimising the entry of contamination into the water supply during any activity.

d) The drinking water supplier must ensure maintenance and inspections (see Sections 3(c)(v) and 3(c)(vi)) are undertaken at a suitable frequency to ensure the water supply is providing safe drinking water.

e) All activities undertaken according to the maintenance and inspection schedules must be recorded and the documents retained for at least five (5) years to demonstrate the activities have been completed.

f) Operations and maintenance documentation must be consistent with any operation or maintenance requirements provided by the manufacturers of any equipment used as part of the drinking water supply.

4. Monitoring and testing

a) The drinking water supplier must undertake water quality testing and keep records in accordance with the conditions in the following table (the drinking water supplier may choose to carry out additional testing and associated record-keeping):

Mixed-use rural supply monitoring requirements

Condition	Requirement
MR1	All water samples that are used to demonstrate compliance with this Acceptable Solution must be: 1. Analysed by a laboratory accredited by IANZ for the type of analysis being undertaken. 2. Collected according to any instructions and specifications provided by the laboratory.
MR2	Drinking water suppliers must take all reasonably practicable steps to ensure that samples to be tested for *E. coli*, total coliforms, or other microbiological contaminants are delivered to a laboratory within 24 hours of the sample being collected, and where practical at a water temperature that is no higher than the water temperature at the time of sampling but above zero degrees Celsius.

MR3	Water samples must be collected downstream of any pre-treatment system(s) but before end-point treatment and monitored for the following determinands: a) once every 3 months for: i. Nitrate ii. pH iii. UV Transmittance (@ 254 nm) iv. Turbidity v. *E. coli* and total coliforms b) and once every 12 months for: i. Arsenic ii. Boron iii. Silica iv. Hardness v. Iron vi. Manganese.
MR4	If a monitoring result for a chemical determinand (see MR3) exceeds 50% of the MAV in the Water Services (Drinking Water Standards for New Zealand) Regulations 2022, additional monitoring must be undertaken on a monthly basis until four (4) consecutive results are less than 50% of the MAV.
MR5	Water samples must be collected from treated water leaving at least one end-point treatment system once every 3 months for: • Turbidity • *E. coli* and total coliforms. The drinking water supplier is responsible for determining the sampling schedule and locations to be sampled from (e.g., rotating the properties to be sampled from). Samples must be geographically representative of the supply. Turbidity results must not exceed the limits specified by the manufacturer of the UV disinfection unit of the end-point treatment system being sampled from. If the limit specified for the UV disinfection unit is exceeded, the drinking water supplier must investigate and remedy the cause of the elevated turbidity.

MR6	For end point treatment systems serving one building: Samples for *E. coli* and total coliforms must be taken from treated water leaving the end-point treatment system **in the week prior, or otherwise as soon as reasonably practicable,** to the population exceeding 500 people and **twice each week** (with at least three (3) days between samples) until the population no longer exceeds 500 people.
MR7	For end point treatment systems serving two or three buildings: Samples for *E. coli* and total coliforms must be taken from treated water leaving the end-point treatment system **in the week prior, or otherwise as soon as reasonably practicable,** to the population exceeding 100 people and **twice each week** (with at least three (3) days between samples) until the population no longer exceeds 100 people.
MR8	For mixed-use rural supplies which use surface water sources as their primary source: Each month between October and May (inclusive), the water and area within 50 metres of a surface water intake, must be visually inspected for the presence of benthic cyanobacteria mats and planktonic cyanobacterial growth. If there is evidence of cyanobacterial growth, steps must be taken to evaluate the cyanotoxin risk to consumers. If there is a risk of supplying water with cyanotoxins that exceed MAVs, then the drinking water supplier must follow their incident and emergency management procedures as required in Section 5.

5. Incident and emergency management

a) The drinking water supplier must have documented incident and emergency management procedures to ensure the supply of a sufficient quantity of safe drinking water.

b) The drinking water supplier must have a plan to undertake a managed response according to their procedures. The plan must:

i. Outline reasonably anticipated incidents or emergencies (e.g., *E. coli* detection, total coliform detection, power failure, interruption to supply, consumer complaint/illness, sample exceeds a MAV in the Water Services (Drinking Water Standards for New Zealand) Regulations 2022, cyanobacteria present in source, etc.).

c) For the incidents or emergencies identified in 5(b)(i), confirm how the drinking water supplier intends to:

   i. Take immediate action to ensure that the health of water consumers is protected and remedy the situation.

   ii. How water consumers will be communicated with and when it is appropriate to issue boil water notices or do not drink notices.

   iii. Investigate the source or cause of the incident and address it as soon as possible.

   iv. Notify Taumata Arowai that the drinking water is or may be unsafe.

   v. Identify and implement measures required to ensure that the problem does not reoccur.

   vi. Outline what additional laboratory testing will be undertaken for each incident and emergency and if necessary, detail alternative drinking water sources (e.g., bottled water, water carrier, etc).

d) Suppliers must review incident and emergency response plans after every major incident and update the plans based on learnings from the review.

e) All incidents and emergencies must be recorded, and records retained for five (5) years to demonstrate the activities have been completed.

6. Training

a) People who maintain or operate the mixed-use rural water supply must be competent to undertake the tasks necessary to ensure the system provides safe drinking water.

b) The person responsible for the mixed-use rural water supply must have a good understanding of:

   i. the emergency and incident management procedures
   ii. how to comply with this Acceptable Solution.

7. Definitions

Term	Definition
Act	The Water Services Act 2021.
Building Code	Schedule 1 of the Building Regulations 1992. The Building Code is contained in regulations under the Building Act 2004.
benthic cyanobacteria mat	A collective mass of cyanobacteria that forms on the bottom surface of a water body.
calmed bottom inlet	An inlet to a storage tank that delivers water to the bottom of the tank through a U-bend or similar feature, minimising any disturbance of sediment at the bottom of the tank.
cyanobacteria	A major group of micro-organisms capable of photosynthesis, sometimes referred to as blue-green algae.
cyanotoxin	A toxin produced by cyanobacteria.
determinand	A substance or characteristic that is determined or estimated in drinking water.
domestic dwelling	As defined in section 10(2) of the Act: Domestic dwelling means a building that is used as a single household unit, whether it is— (a) tenanted on a long- or short-term basis; or (b) occupied permanently or temporarily (for example, a holiday home) 'Household unit' has the meaning given to it by section 7 of the Building Act 2004.[15] Examples of a 'domestic dwelling' in the Act include a single property with tenants on a lease, or a single holiday house that is rented to tourists on a short-term basis. Examples that are not 'domestic dwelling' in the Act include a multi-dwelling building (for example, multiple separate apartments contained in a single building), or a marae, wharekai (dining hall), or community hall, or a café building.

[15] 'Household unit' is defined (section 7 Building Act 2004) as a building or group of buildings, or part of a building or group of buildings, that is—
(a) used, or intended to be used, only or mainly for residential purposes; and
(b) occupied, or intended to be occupied, exclusively as the home or residence of not more than 1 household; but
(c) does not include a hostel, boardinghouse, or other specialised accommodation

domestic self-supply	Means a stand-alone domestic dwelling that has its own supply of drinking water. As defined in section 10 of the Act.
Drinking Water Quality Assurance Rules	The Drinking Water Quality Assurance Rules 2022, made by Taumata Arowai under section 49 of the Act.
drinking water supplier	As defined in section 8 of the Act: Unless the context otherwise requires, drinking water supplier— (a) means a person who supplies drinking water through a drinking water supply; and (b) includes a person who ought reasonably to know that the water they are supplying is or will be used as drinking water; and (c) includes the owner and the operator of a drinking water supply; and (d) includes a person described in paragraph (a), (b), or (c) who supplies drinking water to another drinking water supplier; but (e) does not include a domestic self-supplier.
drinking water supply	As defined in section 9 of the Act: Unless the context otherwise requires, drinking water supply— (a) means the infrastructure and processes used to abstract, store, treat, transmit, or transport drinking water for supply to consumers or another drinking water supplier; and (b) includes— a. the point of supply; and b. any end-point treatment device; and c. any backflow prevention device; but (c) does not include a temporary drinking water supply provided for under sections 33 or 34 of the Act or a domestic self-supply.
end-point treatment	Treatment of drinking water at the final point of the supply at which the consumer can consume, use, or collect drinking water.
floating outtake	An outlet from a storage tank through a flexible pipe attached to a float, allowing water to be drawn from the top of the tank.
headworks	The infrastructure located near to the extraction point for source water. For groundwater, the headworks will be the bore, the bore head and the pump infrastructure required to extract the water.
maximum acceptable value or MAV	The maximum acceptable value of a determinand that is permitted in drinking water. The full range of MAVs for relevant determinands is set out in the Water Services (Drinking Water Standards for New Zealand) Regulations 2022.

networked supply	A drinking water supply that provides drinking water via a distribution system at a pressure and volume to meet consumer demand, or at a restricted flow and volume. These supplies may include storage facilities within the network to buffer demand. As defined in the Drinking Water Quality Assurance Rules.
operations and maintenance manual	A hardcopy or electronic document that outlines how to operate and maintain the drinking water supply under this drinking water acceptable solution.
planktonic cyanobacteria	Cyanobacteria which are freely floating in a body of water.
roof water	The rainwater collected from the roof of a building or structure.
surface water	A body of water that is open to atmosphere, whether running (streams and rivers) or quiescent (lakes, reservoirs, impoundments and ponds). Surface water does not include spring or bore water.
Taumata Arowai	The New Zealand water services regulator, established under the Taumata Arowai–the Water Services Regulator Act 2020.
total base population	Total base population of the mixed-use rural water supply is the population that is normally supplied drinking water by all end-point treatment systems regardless of any seasonal or temporary increases.
treatment system	A treatment system that complies with this drinking water acceptable solution.
UV	Ultraviolet light.
UVI	The intensity of UV radiation, usually measured in mW/cm2.
Water Services (Drinking Water Standards for New Zealand) Regulations 2022	The Water Services (Drinking Water Standards for New Zealand) Regulations 2022 made under section 47 of the Water Services Act 2021.

Appendix 4 Soil Testing – Communal Disposal Area

To: Infracon Ltd

Date: 02 July 2024

Re: Further testing of soils
Rocky Point
Bendigo Loop Road, Cromwell

This letter is regarding additional testing of soils at Rocky Point.

A further four test pits (TP08 – TP11) and one borehole with infiltration testing were undertaken along the southern extent of the proposed development (as per plans by Baxter Design ref 4371 - SK128, dated 05 June 2024). The location is in the area of the proposed lots 19, 20 & 21 of those plans.

The area is reasonably flat with a mix of bare grass and kanuka with a slope to the west which gets steeper further to the west. The hills along the south drain towards this area, however, the catchment is minimal in the overall aspect of the area. The small valley to the east of the site is intercepted near the eastern end of the flatter area and drains back towards the north via an overland flow path through a shallow saddle in the ridge which forms the northern side of the area.

Investigations in the area show that the soils are consistent within that area and are also reasonably consistent with other parts of the proposed development. While only one infiltration test was undertaken in the area it is considered that this area should have similar infiltration rates.

The measured infiltration rate at the location of BH22 was 26mm/hr *±2mm/hr* (0.62m/day *±0.05* or 7.22 x 10^{-6}m/s *± 0.55 x10^{-6}*). This is slightly higher than other areas measured across the proposed development but still considered to be consistent with the know soils of the area. The testing method for the infiltration was done using the falling head method. This differs from other testing across the proposed development (which was a constant head test) due to equipment failure on the day of fieldwork.

The use of a different method is unlikely to compromise consistency of the test results as these two methods have been compared by Mt Iron Geodrill in the past across different soil types and showed good correlation in results.

The equation used for the falling head was:

$$I_t = \frac{\Delta H 60 r}{\Delta t(r + 2H_{avg})}$$

Where:

- I_t = Tested Infiltration Rate
- ΔH = Change in Head 260mm
- r = Radius of Hole 50mm
- Δt = Time Interval 38 minutes
- H_{avg} = Average Head Height of Time Interval 370mm

The H_{avg} was calculated by:

$$H_{avg} = (\frac{H_t - H_o}{H_t - H_f})/2$$

Where:

- H_o = Initial Height of Water at Start of Time Interval 0mm (ground level)
- H_f = Final Height of Water at End of Time Interval 260mm
- H_t = Total Hole Depth 500mm

The soil category, as per AS/NZS 1547:2012 table 5.1 is Category 4 “Weakly structured Clay Loams”.

Mapping of the overland flow paths (by others) suggests that there is very little uphill catchment area directed to this area. The upslope catchment should be able to be managed with the use of small swales and/or berms if required.

Further investigation would be required to confirm soils at the time of final design, however, based on what is known about the area at this point, it is considered that this location should be suitable for onsite wastewater disposal for both the section proposed and also for a collective system disposal area.

Gavin Tippett
Engineering Geologist
B.Sc (Geol), P.G.Dip.Eng.Geol, M.Sc (Eng.Geol), MEngNZ

ENGINEERING NEW ZEALAND OFFICIAL MEMBER

MT IRON GEODRILL	**Project:** Infracon Bendigo Geotech Bendigo Hills Bendigo	**Client:** Infracon	**Drawing Title:** Site investigation Plan June 2024 Fieldwork	**Scale:** As shown **Job No.** GXXXXX	**Drawing Number** Figure 1 **Revision:** 02/07/2024

TP08

TEST PIT LOG

CO-ORDINATES:	366067	JOB NUMBER:	G23068	EQUIPMENT	
	5022371	PROJECT:	Infracon Bendigo Geotech	TYPE & MODEL:	SK20SR
± m:	6m	LOCATION:	Bendigo Hills	COMPANY:	Heavy Trax Hire
ELEVATION:	342		BENDIGO	OPERATOR:	Stu
GPS DATUM:	UTM	DATE:	04 June 2024	PIT DIMENSIONS:	
HEIGHT DATUM:	NZVD16	LOGGED BY:	G Tippett	Wide: 0.5m	Long: 2.4m

METHOD	DEPTH (m)	BLOWS/50mm	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional	
E	0	Scala Not Undertaken	N			TOPSOIL: brown organic rich silt loam.	D-M	F	TOPSOIL	0
						SILT: yellow brown, high dilatancy silt; trace fine sand.		St-VSt	AEOLIAN	
						Gravelly SILT: yellow grey high dilatancy silt; fine to medium grained, sub-rounded to angular, well graded gravel; minor to some fine to coarse grained, well graded sand.	D	VSt	ALLUVIUM	
						Hole ends 0.6m				
	1									1
	2									2
	3									3
	4									4

METHOD:
- **N** Natural Exposure
- **X** Existing Excavation
- **E** Excavator
- **HA** Hand Auger

SAMPLES:
- **U50** Undisturded Sample 50mm Diameter
- **D** Disturbed Sample
- **V** Vane Shear (kPa)
- **Bs** Bulk Disturded Sample
- **E** Environmental Sample
- **INF** Infiltration test

MOISTURE:
- **D** Dry
- **M** Moist
- **W** Wet
- **S** Saturated

CONSISTENCY / DENSITY:

VS	Very Soft	VL	Very Loose
S	**Soft**	L	Loose
F	**Firm**	MD	Medium Dense
St	**Stiff**	D	Dense
VSt	**Very Stiff**	VD	Very Dense
H	**Hard**		
Fb	**Friable**		

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:
- ◁ Water Inflow
- ▼ **Standing Water Level**
- ▽ **Estimated High Water Level**
- **N** **Nil Water Observed**

TP09

TEST PIT LOG

CO-ORDINATES:	366019 5022354	JOB NUMBER:	G23068	EQUIPMENT TYPE & MODEL:	SK20SR
± m:	6m	PROJECT:	Infracon Bendigo Geotech	COMPANY:	Heavy Trax Hire
ELEVATION:	341	LOCATION:	Bendigo Hills BENDIGO	OPERATOR:	Stu
GPS DATUM:	UTM	DATE:	04 June 2024	PIT DIMENSIONS:	
HEIGHT DATUM:	NZVD16	LOGGED BY:	G Tippett	Wide: 0.5m	Long: 2.4m

METHOD	DEPTH (m)	BLOWS/50mm (0 5 10)	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional	DEPTH (m)
	0					TOPSOIL: brown organic rich silt loam.	D-M	F	TOPSOIL	0
						SILT: yellow brown, high dilatancy silt; trace fine sand.		St-VSt	AEOLIAN	
E		*Scala Not Undertaken*	N			Gravelly SILT: yellow grey high dilatancy silt; fine to medium grained, sub-rounded to angular, well graded gravel; minor to some fine to coarse grained, well graded sand.	D	VSt	ALLUVIUM	
						Hole ends 0.7m				
	1									1
	2									2
	3									3
	4									4

METHOD:
- **N** Natural Exposure
- **X** Existing Excavation
- **E** Excavator
- **HA** Hand Auger

SAMPLES:
- **U50** Undisturded Sample 50mm Diameter
- **D** Disturbed Sample
- **V** Vane Shear (kPa)
- **Bs** Bulk Disturded Sample
- **E** Environmental Sample
- **INF** Infiltration test

MOISTURE:
- **D** Dry
- **M** Moist
- **W** Wet
- **S** Saturated

CONSISTENCY / DENSITY:

VS	Very Soft	VL	Very Loose
S	**Soft**	L	Loose
F	**Firm**	MD	Medium Dense
St	**Stiff**	D	Dense
VSt	**Very Stiff**	VD	Very Dense
H	**Hard**		
Fb	**Friable**		

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:
- ◁ Water Inflow
- ▼ **Standing Water Level**
- ▽ **Estimated High Water Level**
- **N** **Nil Water Observed**

TP10

TEST PIT LOG

CO-ORDINATES:	365922 5022325	JOB NUMBER:	G23068	EQUIPMENT TYPE & MODEL:	SK20SR
± m:	6m	PROJECT:	Infracon Bendigo Geotech	COMPANY:	Heavy Trax Hire
ELEVATION:	329	LOCATION:	Bendigo Hills BENDIGO	OPERATOR:	Stu
GPS DATUM:	UTM	DATE:	04 June 2024	PIT DIMENSIONS:	
HEIGHT DATUM:	NZVD16	LOGGED BY:	G Tippett	Wide: 0.5m	Long: 2.4m

METHOD	DEPTH (m)	BLOWS/50mm (0 5 10)	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional	DEPTH (m)
E	0	Scala Not Undertaken	N			TOPSOIL: brown organic rich silt loam.	D-M	F	TOPSOIL	0
						SILT: yellow brown, high dilatancy silt; trace fine sand.	D	St-VSt	AEOLIAN	
	1					Gravelly SILT: yellow grey high dilatancy silt; fine to medium grained, sub-rounded to angular, well graded gravel; minor to some fine to coarse grained, well graded sand.		VSt	ALLUVIUM	1
						Hole ends 0.6m				
	2									2
	3									3
	4									4

METHOD:
- **N** Natural Exposure
- **X** Existing Excavation
- **E** Excavator
- **HA** Hand Auger

SAMPLES:
- **U50** Undisturded Sample 50mm Diameter
- **D** Disturbed Sample
- **V** Vane Shear (kPa)
- **Bs** Bulk Disturded Sample
- **E** Environmental Sample
- **INF** Infiltration test

MOISTURE:
- **D** Dry
- **M** Moist
- **W** Wet
- **S** Saturated

CONSISTENCY / DENSITY:

VS	Very Soft	VL	Very Loose
S	Soft	L	Loose
F	Firm	MD	Medium Dense
St	Stiff	D	Dense
VSt	Very Stiff	VD	Very Dense
H	Hard		
Fb	Friable		

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:
- ◁ Water Inflow
- ▼ **Standing Water Level**
- ▽ **Estimated High Water Level**
- **N** **Nil Water Observed**

TP11

TEST PIT LOG

CO-ORDINATES:	365882	JOB NUMBER:	G23068	EQUIPMENT	
	5022290	PROJECT:	Infracon Bendigo Geotech	TYPE & MODEL:	SK20SR
± m:	4m	LOCATION:	Bendigo Hills	COMPANY:	Heavy Trax Hire
ELEVATION:	324		BENDIGO	OPERATOR:	Stu
GPS DATUM:	UTM	DATE:	04 June 2024	PIT DIMENSIONS:	
HEIGHT DATUM:	NZVD16	LOGGED BY:	G Tippett	Wide: 0.5m	Long: 2.4m

METHOD	DEPTH (m)	BLOWS/50mm	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional	DEPTH (m)
E	0	Scala Not Undertaken	N			TOPSOIL: brown organic rich silt loam.	D-M	F	TOPSOIL	0
						SILT: yellow brown, high dilatancy silt; trace fine sand.	D	St-VSt	AEOLIAN	
	1					Gravelly SILT: yellow grey high dilatancy silt; fine to medium grained, sub-rounded to angular, well graded gravel; minor to some fine to coarse grained, well graded sand.		VSt	ALLUVIUM	1
	2					Hole ends 0.6m				2
	3									3
	4									4

METHOD:
- **N** Natural Exposure
- **X** Existing Excavation
- **E** Excavator
- **HA** Hand Auger

SAMPLES:
- **U50** Undisturded Sample 50mm Diameter
- **D** Disturbed Sample
- **V** Vane Shear (kPa)
- **Bs** Bulk Disturded Sample
- **E** Environmental Sample
- **INF** Infiltration test

MOISTURE:
- **D** Dry
- **M** Moist
- **W** Wet
- **S** Saturated

CONSISTENCY / DENSITY:

VS	Very Soft	VL	Very Loose
S	Soft	L	Loose
F	Firm	MD	Medium Dense
St	Stiff	D	Dense
VSt	Very Stiff	VD	Very Dense
H	Hard		
Fb	Friable		

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:
- ◁ Water Inflow
- ▼ **Standing Water Level**
- ▽ **Estimated High Water Level**
- **N** **Nil Water Observed**

BH22

BOREHOLE LOG

CO-ORDINATES: 365063
5022381
± m: 4m
ELEVATION (m): 342
GPS DATUM: UTM
HEIGHT DATUM: NZVD16

JOB NUMBER: G23068
PROJECT: Infracon Bendigo Geotech
LOCATION: Bendigo Hills
BENDIGO
DATE: 04 June 2024
LOGGED BY: G Tippett

EQUIPMENT TYPE & MODEL: Hand Auger
COMPANY: Mt Iron Geodrill
OPERATOR: G Tippett

BOREHOLE DIAMETER: 100mm

METHOD	DEPTH (m)	BLOWS/50mm	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional
HA	0	Scala Not Undertaken	N			TOPSOIL: brown organic rich silt loam.	D-M	F	TOPSOIL
				INF		SILT: yellow brown, high dilatancy silt; trace fine sand.	D	St-VSt	AEOLIAN
						Gravelly SILT: yellow grey high dilatancy silt; fine to medium grained, sub-rounded to angular, well graded gravel; minor to some fine to coarse grained, well graded sand.		VSt	ALLUVIUM
	1					Hole ends 0.5m			
	2								
	3								
	4								

METHOD:
- **AS** Auger screwing
- **AD** Auger drilling
- **RR** Roller/Tricone
- **CB** Claw / Blade bit
- **TC** TC bit
- **HA** Hand auger

SAMPLES:
- **U50** Undisturded Sample 50mm Diameter
- **D** Disturbed Sample
- **V** Vane Shear (kPa)
- **Bs** Bulk Disturded Sample
- **E** Environmental Sample
- **INF** Infiltration Test

MOISTURE:
- **D** Dry
- **M** Moist
- **W** Wet
- **S** Saturated

for cohesive soils moisture can be further related to:
- **LL** Liquid Limit
- **PL** Plastic Limit

CONSISTENCY / DENSITY:

VS	Very Soft	VL	Very Loose
S	Soft	L	Loose
F	Firm	MD	Medium Dense
St	Stiff	D	Dense
VSt	Very Stiff	VD	Very Dense
H	Hard		
Fb	Friable		

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordanc with NZS 3604-2011, Section 3.3.7.

WATER:
- ◁ Water Inflow
- ▼ **Standing Water Level**
- ▽ **Estimated High Water Level**
- **N** **Nil Water Observed**

BOREHOLE FALLING HEAD

Equation $I_t=(\Delta H*60*r)/(\Delta t(r+2H_{avg}))$

Where:
I_t = Tested Infiltration Rate
ΔH = Change in Head
r = Radius of Hole
Δt = Time Interval
H_{avg} = Average Head Height of Time Interval

H_o = Initail Height of Water at Start of Time Interval
H_f = Final Height of Water at End of Time Interval
H_t = Total Hole Depth

Time Interval	38	Min
Hole Diameter	100	mm
Hole Radius	50	mm
Intail depth to water	0	mm
Final depth to water	260	mm
Total depth of hole	500	mm

H_o	500	mm
H_f	240	mm
ΔH	260	mm
H_{avg}	370	mm

Equation $H_{avg}=((H_t-H_o)/(H_t-H_f))/2$

I_t	**25.98**	**mm/hr**
	0.62	m/day
	7.22E-06	m/s

Appendix 5 Site Photos

Figure 7: View of site from Bendigo Loop Road (14/12/23)

Figure 8: Example of slopes on site (14/12/23)

Figure 9: View of Clutha River from Lot 1, looking north. (14/12/23)

Figure 10: Existing header tanks supplied by Chinamans Terrace Scheme (4 x 25,000L) (14/12/23)

BEALE
CONSULTANTS

Rocky Point Subdivision
Terrestrial Ecology Impact Assessment

Prepared for TKO Properties Limited
July 2024

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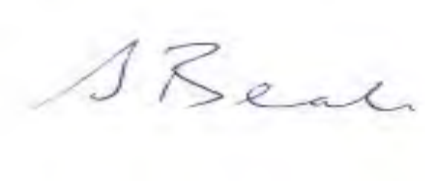
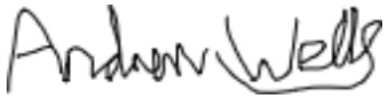
Prepared by Project Team



Simon Beale, Senior Ecologist



Andrew Wells, Senior Ecologist, Wildlands

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Appendix 1 – Plant Species List

Appendix 2 – RECCE Plot Data

Appendix 3 – Memorandum Regarding Lizard Management

Appendix 4 – Desktop Invertebrate Assessment

Appendix 5 – Rocky Point Subdivision – Saline/Sodic Soils Identification and Location

Appendix 6 – Vegetation Succession and Climax Communities at Rocky Point

Appendix 7 – Summary of Offsetting Approach

Appendix 8 – Ecological Enhancement and Monitoring Plan

1. Introduction

1.1. Background

TKO Properties Limited (TKO) is proposing to subdivide a property at Rocky Point which was formerly part of Bendigo Station.

The property is located above the head of Lake Dunstan between the Tarras Cromwell Road (SH8) and the Bendigo Scenic Reserve as outlined on Figure 1-1. The property covers an area of 64.3 ha.

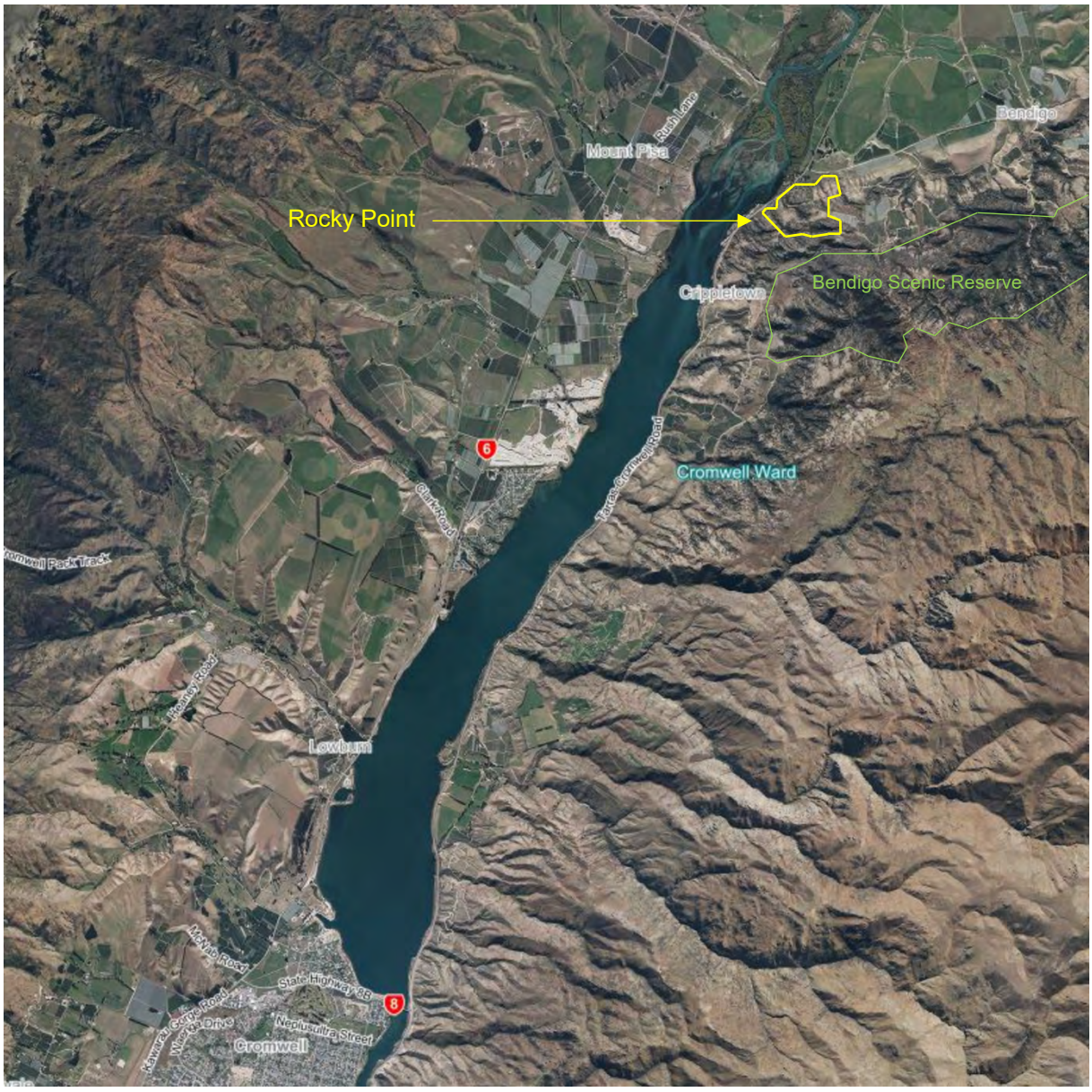

Figure 1-1: Location Plan.
Credit: Central Otago Maps.

A resource consent application. Initially lodged with the Central Otago District Council in July 2023, and updated in July 2024, has sought the creation of 30 Lots of Lot 1 DP 561457 at Rocky Point. Most of the proposed lots would be located in a development area designed for traveller accommodation and clustered dwellings as defined in Schedule 19.16 Concept Plan in the Central Otago District Plan. A network of internal roads would provide vehicular access to the building platforms.

Since receipt of submissions and a peer review of the ecological impact assessment to the application commissioned by the Council following public notification, TKO has revised the subdivision layout. The revised layout as shown on Figure 2-1 has in part been guided by ecological advice provided by Beale Consultants and Wildlands Consultants (Wildlands) and through the identification of areas of saline-sodic soils by Roger Gibson Land and Sea Services. Further details on the revised layout and vegetation clearance requirements is provided in Section 2.2.

1.2. Purpose and Scope of Assessment

The purpose of this ecological impact assessment is to assess the effects of the proposed housing related development on the ecology of the Rocky Point property.

The land affected by the development (i.e., construction of buildings, driveways, access roads and wastewater disposal fields) is defined in this assessment as the development area.

The assessment covers the following items:

- the ecological setting of the property;
- historic vegetation communities and patterns;
- present day vegetation communities, habitats and indigenous fauna;
- ecological processes, values and significance;
- scoring of the magnitude and level of ecological effects of the development; and,
- proposed measures to avoid, minimise, remediate, offset and compensate for adverse ecological effects of the development.

An assessment of the ecological values and ecological significance of the affected indigenous vegetation and habitats of indigenous fauna has been undertaken in accordance with the criteria set out in the Environment Institute of Australia and NZ (EIANZ) Guidelines for Ecological Impact Assessment (2018) and as set out in Appendix 1 of the National Policy Statement for Biodiversity (NPS – IB).

The assessment of ecological effects follows the criteria set out in the EIANZ guidelines for scoring of the magnitude of ecological effect and level of ecological effect.

The assessment is accompanied by:

- A plant species list (Appendix 1);
- A summary of survey plot data (Appendix 2);
- A lizard management plan (refer Appendix 3);
- A desktop assessment of invertebrate values (Appendix 4);
- A report on the identification and location of saline/sodic soils (Appendix 5);
- A report on vegetation succession and climax communities at Rocky Point (Appendix 6);
- A summary report on the offsetting approach (Appendix 7);
- An Ecological Enhancement and Monitoring Plan (Appendix 8).

1.3. Assessment and Survey Methodology

A review of literature was undertaken in advance of the site investigation. This involved a review of any existing published and unpublished scientific literature that relate to the Bendigo area and review of historic and recent aerial and satellite imagery. The imagery was used to identify at a gross scale the vegetation communities and habitats occurring within the property.

Walk over surveys of the Rocky Point property were conducted on 2 December 2022 and 24 April 2023 spanning 11 man hours to record the plant communities, plant species and habitat types within the development area and adjacent land, and to record native bird species, either observed or heard during the surveys. A list of plant species recorded during the walk over surveys and follow up RECCE plot surveys (described below) has been compiled (see Appendix 1).

Systematic surveys spanning 40 man hours were conducted on 25, 26 September, 23 October and 14 November 2023 in the company of botanist Neill Simpson to record the locations of threatened and at risk plants such as spring annuals across Rocky Point and the adjacent Bendigo Hills Estate to address a survey oversight.

A drive over to inspect *Raoulia australis* dominant cushionfields in the vicinity of Rocky Point and the hillslopes bordering the Ardgour Valley was conducted on 30 September 2023. This was followed by a helicopter fly over of the Dunstan Ecological District and adjoining Central Otago and Pisa Ecological Districts conducted on 5 December 2023 over a period of 3 hours. These inspections served to assess the extent of cushionfield remaining across the lower elevation hillslopes with a focus on the lower hillslopes on the western flanks of the Dunstan Range within the Dunstan Ecological District. These surveys were followed up with on the ground inspections on 13 February, 25 March and 29 April 2024 in the company of TKO and Andrew Wells from Wildlands to assess potential offset and compensation sites. These surveys collectively spanned 30 man hours.

Property wide walk over surveys and RECCE plot surveys (Hurst and Allen 2007) were conducted in the company of Andrew Wells on 10, 14, 15 and 30 May 2024. The RECCE plot surveys covered areas of cushionfield and kānuka shrubland/scrub within and outside of the Rocky Point development area (Figure 1-2), potential offset sites areas in the adjacent Bendigo Hills Estate and offset benchmark sites at Devils Creek and Firewood Creek near Cromwell. These surveys spanned 45 man hours.

RECCE plot data collected was topographic attributes, percentage cover by height tier, numbers of trees, sapling and seedings, diameter at breast height (DBH) and canopy cover and height estimations. Two plots sizes were used; 4 m^2 within cushionfields and 100 m^2 within kānuka shrubland/scrub. A summary of the plot data is provided in Appendix 2.

During the RECCE plot surveys samples of *Raoulia australis* cushion plants were collected and taken to Springburn Nursery for propagation trials.

A property wide walk over survey of lizards and lizard habitat has been undertaken initially by Mandy Tocher in April 2023 and this work has been continued by Samantha King of Wildlands who conducted a further site survey in the company of Andrew Wells on 17 April 2024, spanning seven hours. The purpose of this survey was to gain further site information on which to base the development of effects management measure for lizards, culminating in the preparation of a lizard management plan (see Appendix 3). The detailed lizard survey and report previously undertaken by LizardExpertNZ (2023) formed an important component of this.

A desktop assessment of invertebrate values was conducted by Vikki Smith, Wildlands, in June 2024. A report documenting this assessment is provided as Appendix 4.

An investigation of possible areas of saline/sodic soils at Rocky Point was undertaken by Roger Gibson on 8 April and 7 May 2024 spanning 12 man hours. Soil samples were collected and analysed from locations assessed as potentially containing saline/sodic soils within and outside of the development area. A report with maps (see Appendix 5) showing the location of soils saline/sodic soils at Rocky Point relative to the original subdivision layout was prepared.

The total survey effort to date has amounted to 152 person hours.

Beale Consultants has now made in excess of ten visits to the site in the company of these various specialists.

The work of this expert group has been instrumental in refining the proposed development from the earlier 33 lot scheme to the re-organised 30 lot scheme now being proposed.

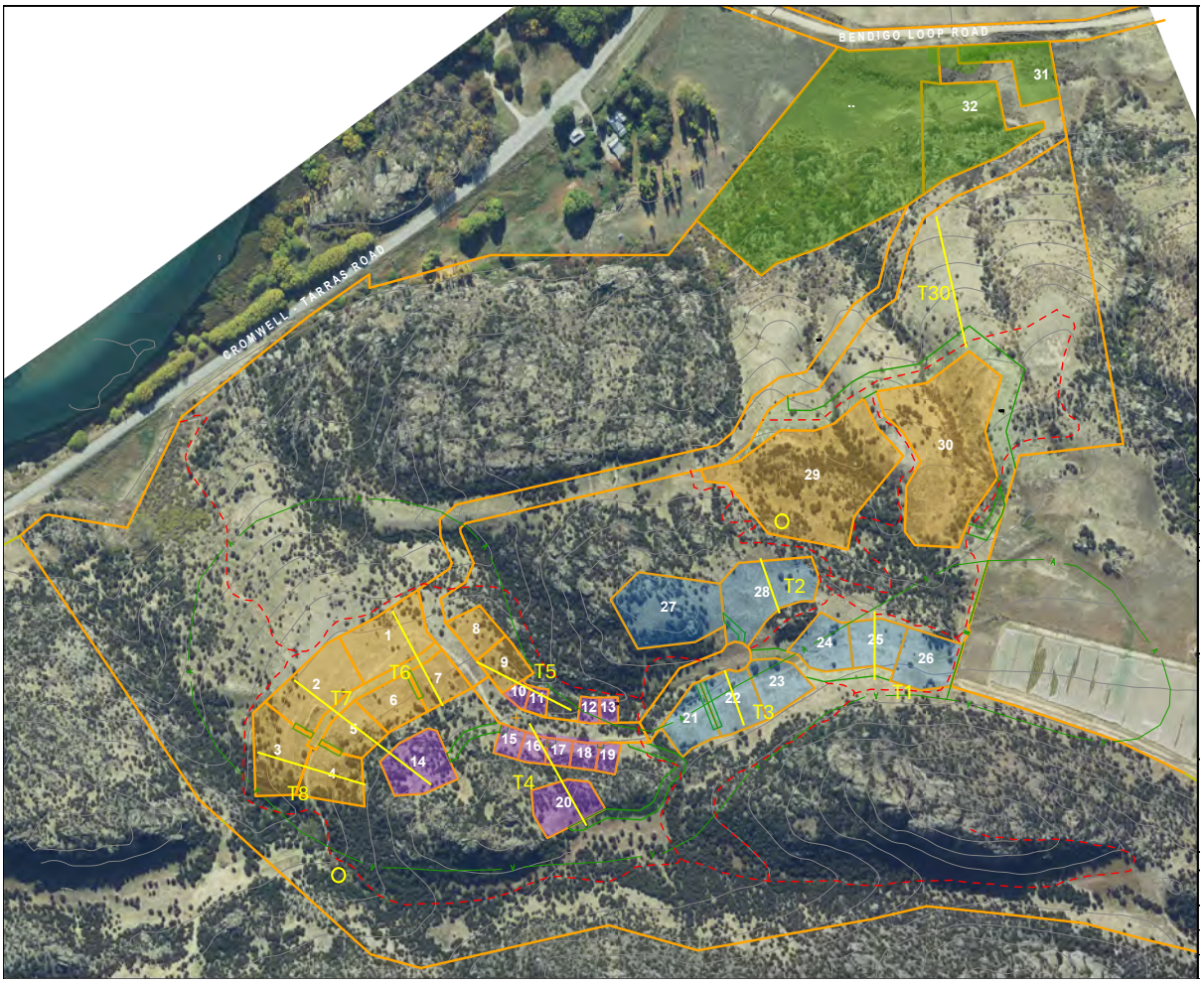

Figure 1-2: Location of RECCE transects and plots overlayed on original subdivision plan.

2. Description of Proposal

2.1. Overview

2.1.1. Subdivision Configuration

TKO is proposing concentric areas of occupation in twenty-two out of a total of thirty lots to be created at Rocky Point as shown on Figure 2-1. The remaining eight lots are smaller in size and allocated to chalet style housing without curtilage areas.

The innermost area of occupation for each lot will be the designated building platform which will incorporate the dwelling, any garaging or supplementary building, and any metalled hard standing used for parking and egress around buildings. It is assumed that these areas will be cleared of all vegetation to make way for construction.

The next concentric area is the curtilage area. The curtilage areas have been specifically designed for each lot to enable suitable living space around each building platform. Covenants will be established limiting modification of the curtilage areas.

The configuration of the building platforms, curtilage areas and driveways are shown in more detail on the Baxter Design landscape plans.

The building platforms will be connected to a wastewater scheme reticulated to a wastewater disposal field located west of Lot 20. As detailed in the Water and Wastewater Investigation of CKL Limited.

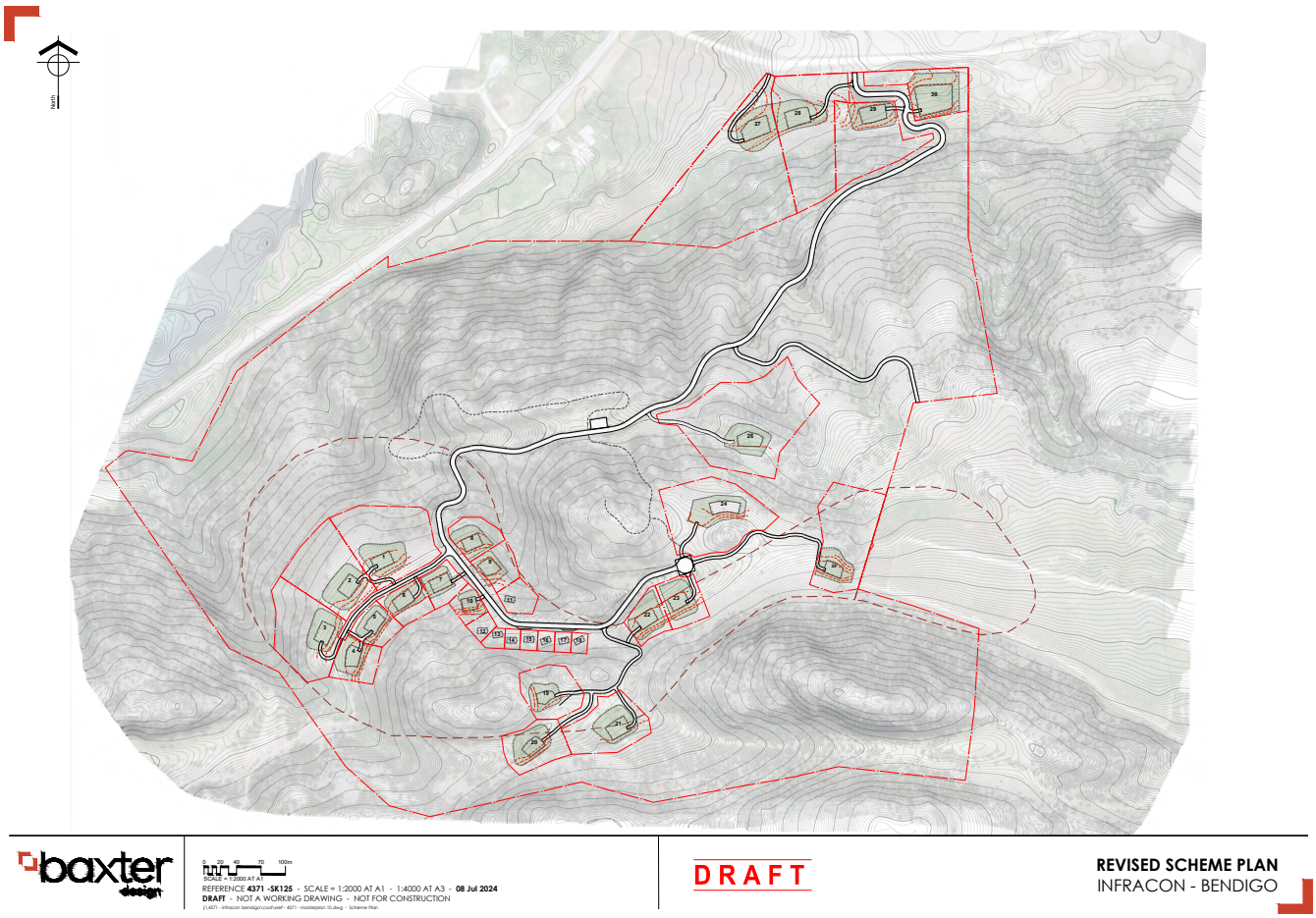

Figure 2-1: Rocky Point Subdivision Plan. The proposed lots are shown as dotted red lines. Curtilage areas are shaded in green

2.1.2. Access

The Rocky Point development will be accessed off Bendigo Loop Road.

The access road will be vested as public road up to the turning head between Lots 23-24, as shown on Figure 2-1. Underground services will be installed within the road corridors.

2.1.3. Landscape and Vegetation Protection

The balance of the property beyond the building platforms and curtilage areas will be defined as a Landscape and Vegetation Protection Area (LVP). The LVP will be the subject of a covenant prohibiting vegetation clearance and imposing an obligation on owners to undertake weed control. The LVP will be managed by an owner representative group.

2.2. Vegetation Clearance

Within the development area, stands of kānuka and individual trees along with areas of cushionfield, grassland vegetation and exotic herbfield will be permanently removed during development of the building platforms, curtilage areas, driveways and access roads. Gravel for the roads and track upgrades will be sourced from an off-site weed free source.

Areas affected by the development will be clearly defined on the ground in advance of the works to ensure the movement of machinery and other construction related activities avoid disturbance to adjoining areas of kānuka shrubland and scrub, grey shrubland, cushionfield, grassland and rocky terrain.

Vegetation cleared from within the development area will either be chipped for mulch for plantings, or stacked within adjacent areas of kānuka shrubland/scrub to provide for invertebrate habitat.

A schedule summarising the approximate areas of indigenous dominant vegetation that would be cleared during the development is set out in Table 2-1.

Table 2-1: Indigenous Vegetation Clearance Schedule.

Indigenous dominant vegetation community	**Current extent (m^2)**	**Areas to be cleared (m^2)**	**Percentage cleared (m^2)**
Kānuka shrubland/scrub	343,942	13,539	3.9
Cushionfield	139,649	39,880	26.6

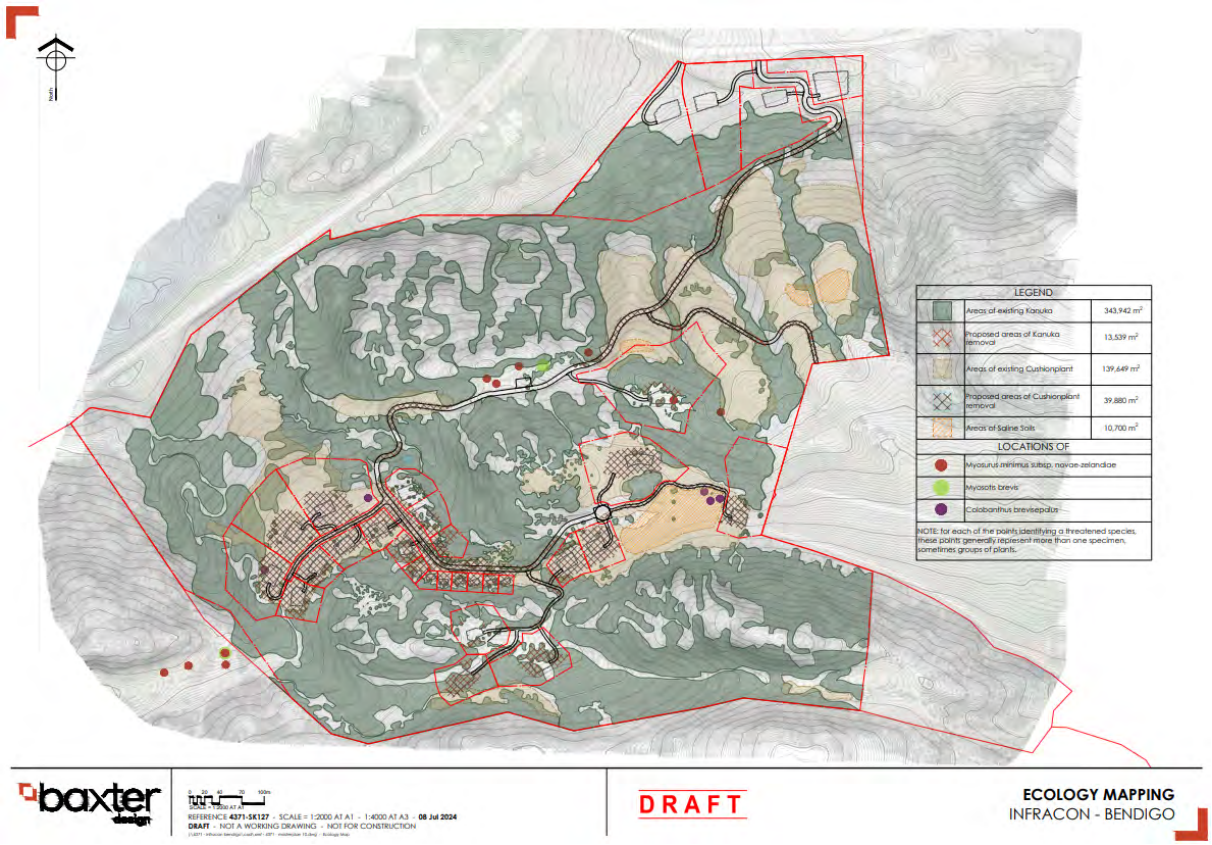

Figure 2-2: Rocky Point Vegetation Map.

3. Ecological Setting

3.1. Overview

Rocky Point is located within the Dunstan Ecological District (Dunstan ED) and Central Otago Ecological Region. The Dunstan ED is described by McEwen (1987) as :

"Tilted, block-faulted schist range to 1692 m a.s.l surrounding lowlands, glacial outwash gravels, moraines: dry, subcontinental climate, snow lies for weeks in winter; shallow to moderately deep soils with variable loess cover on rolling, hilly and steep slopes, shallow to deep soils on terrace and fans in valleys; formerly mostly tussockland, no beech forest, rare small Hall's totara remnants E, extensive kānuka shrubland SW; local endemics; burnt, grazed , rabbits."

The current indigenous ecosystem as portrayed by ORC Ecosystem and Habitat Mapping and sourced from the Land Cover Database (LCDB5) as Makahikatoa (*Kunzea serotina*) shrubland and scrub.

The Makahikatoa shrubland/scrub and cushionfields as mapped (see Figure 5-2) collectively covers 51.2 ha. or 75% of Rocky Point.

The Makahikatoa shrubland/scrub on Rocky Point is contiguous with more expansive areas of Makahikatoa shrubland/scrub within the Bendigo Scenic Reserve and private properties to the north and south of the reserve.

Raoulia australis dominant cushionfield at Rocky Point although somewhat fragmented in its distribution on Rocky Point is representative of large areas of cushionfield that cover the low elevation west and north facing hillslopes between 200 – 700 m asl to the south and north of Rocky Point within the Dunstan ED. These areas of cushionfield were observed during a helicopter fly over conducted in December 2023 as previously discussed. An estimated 168.9 ha. of cushionfield has been mapped within a 5 km radius of Rocky Point.

Makahikatoa shrubland/scrub and cushionfields within and surrounding Rocky Point are referred to by Wildlands (Appendix 6) as early to very early successional communities associated with semi-arid highly degraded land.

Two prominent gullies cross Rocky Point, one following the southern and western boundary and the other bisecting the mid reaches of the property. Neither gully contains any wetlands or streams and on inspection appear to function as stormwater flow paths.

The property lies in the montane bio-climatic zone, ranging in altitude from *c.* 200 to *c.* 450 m a.s.l.

GrowOtago online maps indicate a median rainfall in the Bendigo area of between 400 – 500 mm per annum.

3.2. Land Environments

Land Environments of New Zealand (LENZ) classification is commonly used in ecological assessments to detail a project's ecological setting. LENZ groups together land environments throughout the country with similar environmental characteristics such as climate, landform, geology and soils as these influence the distribution of indigenous vegetation and habitat types. The LENZ classification is hierarchical in scale, from the high Level 1 classification to the most detailed Level IV classification. The Rocky Point property encompass LENZ Level IV Environments N4.1e and N8.1b (refer Figure 3-1).

The landforms of Land Environment N4.1e are described as rolling lower hillslopes and basin floors and Land Environment N8.1b as gently undulating floodplains. The soils are described as imperfectly to well drained, of moderate fertility derived from fine schist alluvium and colluvium with some loess (Leathwick et al, 2002). The soils experience moderate to very high annual water deficits, reflecting the semi-arid nature of the local climate as described previously.

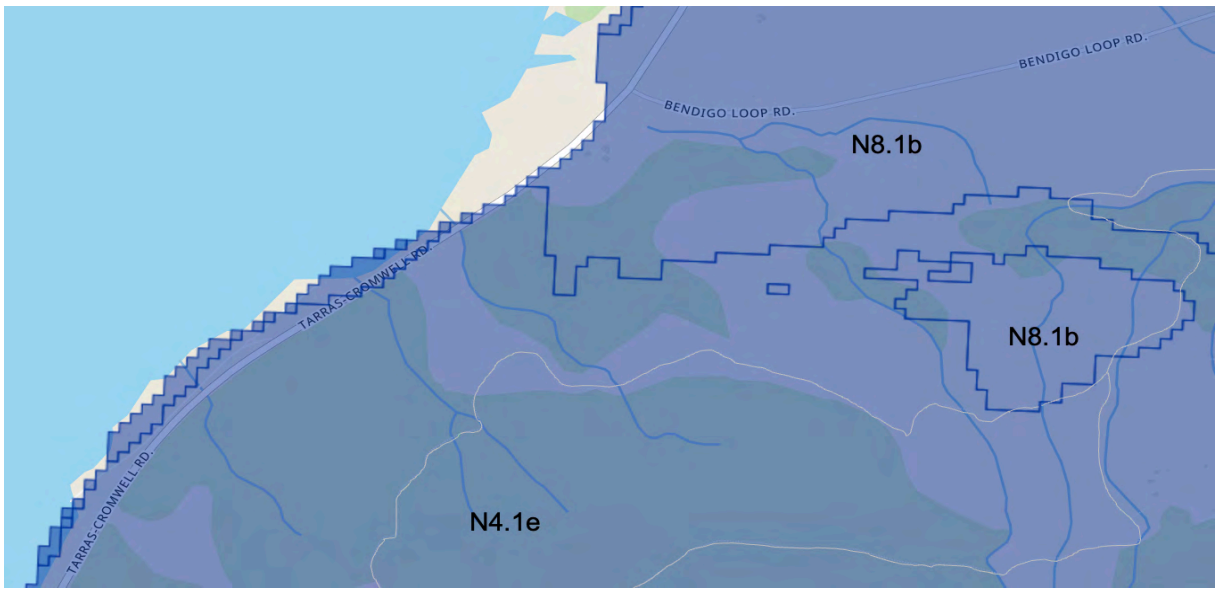

Figure 3-1: LENZ Level IV Land Environments at Rocky Point.
Source: https://data.mfe.govt.nz/layer/52358-land-environments-new-zealand-lenz-level-4-polygons-2009/

An analogous Threatened Environments Classification 2012 (TEC[1]) was developed by Landcare Research (Walker et al., 2007) to help identify places in New Zealand in which the terrestrial indigenous ecosystems, vegetation types and habitats are much reduced and poorly protected. Examination of the TEC with respect to the LENZ Level IV Environments that occur at Rocky Point indicates that the indigenous vegetation remaining at a national scale in land environments N4.1e is 23.7% and in N8.1b 5.2%.

At Rocky Point Land Environment N8.1b comprises the terrace bordering Bendigo Loop Road and is predominately covered in exotic grassland interspersed with exotic forbs and shrubs of sweet briar.

4. Pre-settlement vegetation in Central Otago

Extensive research undertaken by Wildlands and analysis of mapping of "potential terrestrial ecosystem", (i.e. those ecosystems that would have occurred in Otago prior to human settlement) across Otago by Wildlands based on the Singers and Rogers (2014) classification of indigenous ecosystem types indicates that Rocky Point would have supported forest vegetation communities across almost the entire site. Details on the research and potential terrestrial ecosystem mapping is provided in the report "*Vegetation succession and climax communities at Rocky Point*" (Appendix 4).

Exceptions as noted by Wildlands were cushionfield/herbfield communities confined to localised areas of saline soil as identified recently by Gibson Land and Sea Services (Appendix 3) and possible persistence of shrubland on postglacial terrace escarpments located at the northern end of Rocky Point. Alluvial deposits at the northeast of the site bordering Loop Road may have supported a podocarp-broadleaved species forest according to Wildlands. The remainder of the site would have likely been covered in a forest with a canopy of kōwhai, fierce lancewood, ribbonwood, *Olearia lineata* and kānuka, and an understorey of diverse shrubs including *Coprosma* spp., *Olearia* spp., *Carmichaelia* spp. and *Veronica* spp. Recent research suggests that a high abundance and local dominance of kōwhai in the forest canopy at the site was likely. This forest is mapped under the Singers and Roger classification as TI2, "kānuka, Olearia scrub/treeland" and locally extends up to about 700 m asl from Rocky Point to south of John Bull Creek and east to Bendigo Creek.

[1] The TEC combines data from three national databases; LENZ, the Land Cover Database (LCDBv4.0, based on 2012 satellite imagery), and a 2012 update of the national protected areas network.

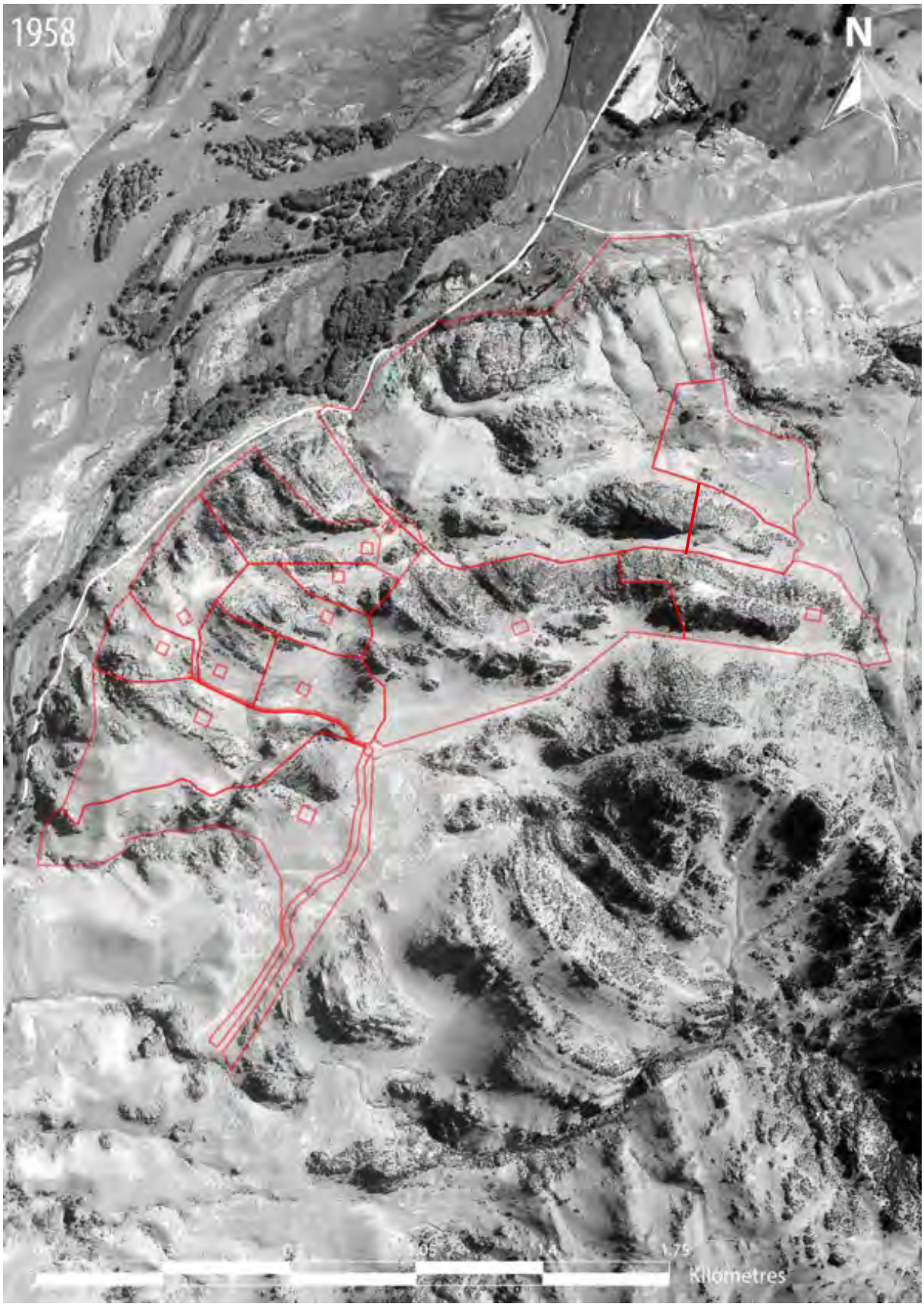

Figure 4-1: Historic aerial imagery of Rocky Point and the adjacent Bendigo Hills Estate.

5. Current Vegetation and Habitats

5.1. Overview

The vegetation communities currently encountered within Rocky Point are associated with the following habitats:

- Kānuka shrubland/scrub;
- Cushionfield;
- Grey shrubland;
- Sweet briar shrubland;
- Exotic herbfield;
- Exotic grassland; and
- Rocky substrates.

A large part of the property, especially the rocky and steeper terrain is covered in early successional kānuka (*Kunzea serotina*) shrubland/scrub while open areas within and bordering the shrubland feature very early successional cushionfields dominated by golden scabweed (*Raoulia australis*) and exotic herbfield dominated by scarlet pimpernel (*Anagallis arevensis*), hemlock (*Conium macualtum)* and stonecrop *(Sedum acre).*

Figure 5-1: Google Earth Image showing vegetation patterns within Rocky Point and surrounding land. The dark grey expanses represent areas of kānuka shrubland/scrub and grey shrubland, the tan coloured patches, represent areas of cushionfield and grassland and the green patches, exotic herbfield. Imagery: Google Earth; 6-11-2021.

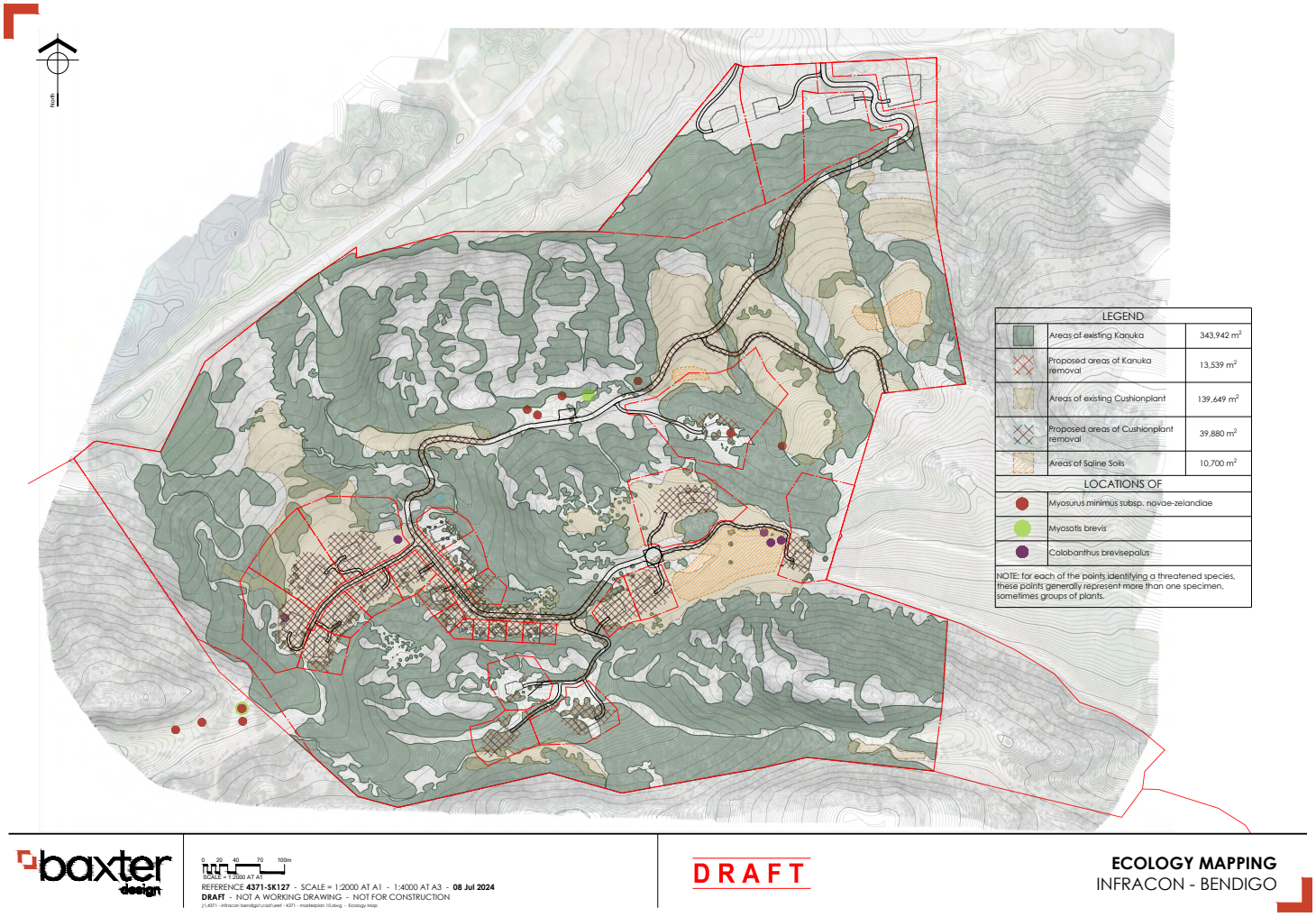

Figure 5-2: Distribution of kānuka shrubland/scrub and cushionfield across Rocky Point and locations of recorded threatened spring annuals and pin cushion.

Fragmented areas of grey shrubland occur within and around the margins of some areas of kānuka shrubland-scrub within prominent gullies.

Relic specimens of mature kōwhai and mature small leaved shrubs occur on some rocky outcrops that provided fire refuges. Here regeneration of kōwahi is occurring in the absence of rabbit and goat browse.

Kānuka shrubland/scrub occupies 367,000 m^2 or approximately 54% of Rocky Point and cushionfield 141,000 m^2 occupies approximately 21% of the property. The balance of the property is made up of rocky terrain, mixed herbfield-grassland and sweet briar shrubland.

5.2. Kānuka shrubland/scrub

The kānuka shrubland/scrub canopy is generally between 3 to 4 metres in height and of a variable density with a closed canopy associated with areas of scrub based on a classification of growth forms provided in Atkinson (1962). Based on walk over survey observations, areas of kānuka scrub tend to be associated with the southern facing rocky bluffs and in the more confined gullies as opposed to the more undulating terrain and rocky outcrops where kānuka shrubland prevails. This observation is confirmed from RECCE plot data.

In terms of species diversity the kānuka shrubland/scrub canopy is monospecific, being an attribute of an early successional plant community. It is almost completely dominated by one species, makahikatoa *(Kunzea serotina*) and generally lacks an understorey of native plants.

Over much of the property there is evidence of active regeneration of kānuka across rocky to gravelly substrates and within the cushionfields (see Figures 5-3 and 5-4).

Figure 5-3: Kānuka shrubland/scrub bordering areas of cushionfield and exotic herbfield in Lots 15-19.

The kānuka shrubland/scrub at Rocky Point is contiguous with an expansive cover of kānuka shrubland/scrub across the adjoining Bendigo Hills Estate and the Bendigo Scenic Reserve.

Figure 5-4: Kānuka succession across cushionfield in Lot 4.

5.3. Grey shrubland

Within the kānuka scrub covered gullies and across some of the rockier areas and outcrops there are pockets of grey shrubland. These feature relic specimens of tree daisy (*Olearia lineata*), and matagouri (*Discaria toumatou*), mingimingi (*Coprosma propinqua*), korokia (*Corokia cotoneaster*), *Olearia odorata* and porcupine shrub (*Melicytus alpinus*). The lianes *Rubus schmidelioides*, *Muehlenbeckia australis* and *Muehlenbeckia complexa* festoon some of the mature shrubs.

Figure 5-5: Group of mature mingimingi and matagouri situated occupying an open area within kānuka scrub in the western gully.

Mature bushes of sweet briar (*Rosa rubiginosa*) are often co-dominant with small leaved native shrubs in grey shrubland. In some areas sweet briar growth dominants the shrublands such as across rocky terrain and within incised gullies in the vicinity of Lots 27 to 30.

5.4. Cushionfield (Native Herbfield)

Extensive cushionfields occur on the terraces where Lots 1-10 and 22-24 are located and across the broad spurs bordering the access road off the Bendigo Loop Road.

The cushionfields are dominated by golden scabweed (*Raoulia australis*). This cushion plant provides suitable conditions for other native herbaceous plants to persist such as *Geranium sessiliflorum,* white fuzzweed (*Vittadinia australis*) and the woolly rock fern *Cheilanthese distans*.

RECCE plot data shows densities of *Raoulia australis* along the transects within the development area vary between 40 to 80%.

Invasive exotic plants are often locally dominant, most notably scarlet pimpernel *(Anagallis arevensis),* hemlock (*Conium maculatum*), stonecrop *(Sedum acre),* moth mullein (*Verbascum virgatum*), Californian thistle (*Cirsium arvense*) and stinging nettle (*Urtica urens*).

Extensive areas of cushionfield occur beyond Rocky Point especially across the lower north to west facing hillslopes between Rocky Point and the Point Station east of Tarras as observed during a helicopter fly over.

Soil sampling and analysis by Roger Gibson identified areas of saline-sodic soils in three areas of cushionfield where elevated concentrations of sodium and electrical conductivity were recorded. These areas as reported on and mapped by Roger Gibson are depicted on Figure 5-2. The largest area is associated with a broad terrace where Lots 21 to 24 are to be located.

No halophytic plants typically associated with salt pans were recorded by Roger Gibson and Beale Consultants during the RECCE plot surveys and walk over surveys of these areas.

Figure 5-6: Cushionfield in Lots 24 and 25.

5.5. Exotic herbfield

Exotic herbfield dominated by the exotic herbs scarlet pimpernel forms extensive bright green mats across some of the basin floors and terraces, merging with areas of cushionfield, tussock grassland, exotic grassland and kānuka shrubland. Other plants common to the herbfield include hemlock (*Conium maculatum*), Californian thistle, moth mullein, stinging nettle and St John's Wort (*Hypericum perforatum*). The woolly rock fern *Cheilanthese distans* is locally common across stonier sites.

5.6. Grassland

Areas of grassland of varying stature and cover occur often around the bases of rocky outctrops and across stoney ground, often occurring in association with exotic herbfields. The grassland features a diverse array of grasses including browntop (*Agrostis capillaris*), sweet vernal (*Anthoxanthum odoratum*), hard tussock (*Festuca novae-zelandiae*), ripgut brome (*Bromus diandrus*), vulpia hairgrass (*Vulpia myuros*), silvery hairgrass (*Aira caryophyllea*) and Kentucky bluegrass (*Poa pratensis*) along with herbaceous plants such as sheep's bur (*Acaena agnipila*), Vipers bulgloss (*Echium vulgare*), moth mullein, woolly mullein (*Verbascum thapsus*) haresfoot trefoil (*Trifolium arvense)*, cotton fireweed (*Senecio quadridentatus*), St John's wort, yarrow (*Achillea millefolium*), horehound (*Marrubium vulgare*) and sheep's sorrell (*Rumex acetosella*).

5.7. Rocky Substrates

Rocky substrates associated with the numerous rock slabs, rock outcrops and rocky bluffs and overhangs and pockets of stony ground bordering outcrops provide suitable refugia for a range of native plants. Notable plants include kōwhai (*Sophora microphylla*), porcupine shrub, korokio, mountain cottonwood (*Ozothalmus vauvilliersii*), the rosette herb *Brachyglottis bellidioides* var. *bellidioides*, *Poa colensoi*, bristle tussock (*Rytidosperma setifolium*), the sedge *Carex breviculmis*, the wood rush *Luzula traversii* var. *traversii* and the necklace fern *Asplenium flabellifolium.*

Figure 5-7: Kowhai trees growing from cervices in a large rock outcrop in Lot 14.

Figure 5-8: Shrubland of korokia (*Corokia cotoneaster*), porcupine shrub (*Melicytus alpinus*) and mingimingi (*Coprosma propinqua*) occupying a large rock outcrop in Lot 26.

5.8. Vegetation Succession and Climax Communities

Since the 1950s Wildlands describes the pattern of vegetation change due to changes in land management based on a review of aerial imagery. Between 1975 and 2001 they refer to a notable increase in the density and extent of kānuka in gullies and rock outcrops and across hillslopes at Rocky Point. This trend of increasing density and extent of kānuka has continued and is obvious in 2024 imagery and from field observations.

Field observations by Wildlands from walk over surveys and RECCE plot surveys indicates that the expansion of kānuka is occurring into areas of cushionfield vegetation and bare ground at Rocky Point which Wildlands report is consistent with the successional pattern observed in aerial imagery. This evidence also indicates that the cushionfield vegetation is a largely human induced early successional community. Wildlands refer to the patches of saline/sodic soils identified by Gibson (see Appendix 5) where no regeneration of kānuka was observed indicating these areas will remain as cushionfield/herbfield vegetation.

Wildlands predict over the next 50 years (in the absence of further human disturbance) that the kānuka dominated shrubland will further increase at Rocky Point and will be progressively succeeded by a low forest of kōwhai, kānuka and *Olearia lineata* and a diverse shrub understorey. Anecdotal evidence indicates that ceasing of grazing at Rocky Point six years ago, has led to an increase in the extent kānuka shrubland. This is consistent with research on herbivory as a disturbance mechanism in dryland New Zealand. Sheep grazing is considered to promote open vegetation through limiting woody recruitment, which in turn limits litter accumulation and soil-moisture retention and transfers nutrients out of the ecosystem. These changes in turn create conditions favourable for an increase in rabbit numbers, which impose additional limitations on the recruitment of woody species (Rogers et al, 2005).

Wildlands also predict that the presence and abundance of specific Threatened and At Risk plant species will vary greatly as succession proceeds. Wildlands notes for example, that species such as *Colobanthus brevisepalus* (At Risk-Declining) and At Risk-Declining species of *Raoulia* have likely greatly declined in abundance at Rocky Point over the past 50 years, while other species such as dwarf mistletoe (*Korthalsella salicornioides*; Threatened-Nationally Critical), spring annuals (Threatened and At Risk) and kānuka (At Risk-Declining) have greatly increased in abundance over this time.

Based on observed abundances of key woody species during RECCE surveys of Rocky Point and benchmark sites at Pigeon Creek, Devils Creek and Firewood Creek and research on palynological studies focussing on Central Otago, Wildlands consider the pre-settlement vegetation or climax community across much of Rocky Point would have comprised a kōwhai dominant forest approximately 8-14 metres tall. Other canopy trees present would have included fierce lancewood, kōhūhū, *Olearia lineata*, lowland ribbonwood and narrow-leaved lacebark, with less frequent kānuka, weeping māpou (*Myrsine divaricata*) and *Coprosma virescens*, and possibly occasional Hall's tōtara and mountain toatoa in deeper soils at the southern gully. A diverse assortment of shrubs would have been present throughout the forest understorey, contributing to the canopy in open areas. The most abundant shrub species are likely to have included *Coprosma* spp., *Olearia* spp., korokio, weeping māpou, *Veronica* spp., and *Carmichaelia* spp. across most of Rocky Point.

Wildlands adds that the small localised patches of saline soils identified at the site are most unlikely to have contained woody-dominant vegetation, due to the extreme soil conditions. These areas would most probably have comprised herbaceous cushionfield communities dominated by *Raoulia australis* in pre-settlement times, but possibly also with indigenous halophytic plants.

5.9. Threatened and At Risk Plant Species

The RECCE and walk over surveys recorded the following Threatened and At Risk plant species at Rocky Point: kānuka (*Kunzea serotina*), the pygmy mistletoe (*Korthalsella salicornioides*) on host kānuka trees, *Olearia lineata*, matagouri, golden scabweed *Raoulia australis*, the spring annuals New Zealand mousetail, *Myosurus minimus subsp. novae-zelandiae* and *Myosotis brevis* and the pin cushion *Colobanthus brevisepalus.*

The location of spring annuals and pin cushion plants recorded during the surveys are shown on Figure 5-1.

The threat classification of kānuka is a precautionary measure owing to the threat of myrtle rust which is having a serious impact on Myrtaceae worldwide. Since myrtle rust was detected in New Zealand there have been very few occurrences of myrtle rust on *Kunzea* which remains widespread from Marlborough through to Central Otago. The threat of myrtle rust on kānuka and mānuka however should not be discounted owing to the effects of climate change.

Within the Dunstan and adjoining Lindis and Pisa Ecological Districts matagouri remains widespread but occurs only sporadically at Rocky Point , generally as scattered mature plants. The tree daisy *Olearia lineata* is also sporadic in its distribution on the property occurring as scattered relic stands of mature plants, generally in gullies and within fragmented areas of grey shrubland.

Golden scabweed is widespread in its distribution, especially across the terraces and broad spurs at Rocky Point.

The spring annuals New Zealand mouse tail (*Myosurus minimus subsp. novae-zelandiae)* and *Myosotis brevis* were recorded in and around the margins of kānuka shrubland beyond the development area amongst mossfield and cushionfield where there is a general absence of exotic forbs and grasses. The recorded locations are shown on Figure 5-2. The RECCE plot and walk over surveys did not detect New Zealand mousetail or *Myosotis brevis* in the affected cushionfields.

Apart from one recorded location in Lot 3, pin cushion plants were recorded outside of the development area.

The walk over surveys and RECCE plot surveys of the development area and adjacent land were sufficiently extensive and thorough to provide a high level of confidence about the occurrences of the spring annuals and pin cushion plants. The habitats where these plants were recorded is consistent with the habitat descriptions provided by the New Zealand Plant Conservation Network.

A botanical survey conducted along the nearby Bendigo loop track on 4 January 2009 recorded a number of Threatened and At Risk plants additional to those recorded during the site surveys. Table 5-1 lists the Threatened and At Risk species recorded from the 2009 survey and Rocky Point surveys.

Table 5-1: Threatened and At Risk plant species recorded in Rocky Point development area and/or Bendigo Loop Track.

Species	Threat Classification	Habitat	Recorded in development area	Not recorded but possibly present in development area
Acaena buchananii	At Risk-Declining	Grassland		✓
Carex inopinata	Threatened – Nationally vulnerable	Base of rocky overhangs		
Carex parvispica	At Risk-Declining	Base of rocky overhangs		
Colobanthus brevisepalus	At Risk-Declining	Cushionfield	✓	
Discaria toumatou	At Risk-Declining	Grey shrubland		
Epilobium angustum	At Risk – Naturally Uncommon	Turfs & periodically wet stony ground		
Juncus distegus	At Risk – Naturally Uncommon	Grassland		✓
Korthalsella salicornioides	Threatened – Nationally critical	Kānuka shrubland/scrub	✓	
Kunzea serotina	Threatened – Nationally vulnerable	Kānuka shrubland/scrub	✓	
Myosotis brevis	Threatened – Nationally vulnerable	Kānuka shrubland – scrub, cushionfield and mossfield		✓
Myosurus minimus subsp. novae-zelandiae	Threatened – Nationally vulnerable	Kānuka shrubland/scrub, cushionfield and mossfield		✓
Olearia lineata	At Risk-Declining	Grey shrubland		
Raoulia australis	At Risk-Declining	Cushionfield	✓	
Raoulia beauverdii	At Risk-Declining	Cushionfield		✓
Rytidosperma thomsonii	At Risk-Declining	Grassland		✓

A search of areas of grassland in the development area did not find any specimens of *Acaena buchanii*, *Juncus distegus* and *Rytidosperma thomsonii.* This may be attributed to the absence of areas of favourable grassland, tussockland and turf habitat in the development area.

5.10. Invasive Plant Species

The occasional wilding *Pinus radiata* and *Pinus contorta* was observed across the rocky terrain with kānuka shrubland while the occasional *Buddleja davidii* was observed in cushionfield. Plants of flowering currant (*Ribes sanguineum*) and cotoneaster (*Cotoneaster franchetti*) are becoming well established amongst the sweet briar shrubland on the lower hillslopes in the vicinity of Lots 27 – 30. These woody species have the propensity to spread rapidly and dominate indigenous plant communities at a landscape scale unless controlled on an ongoing basis.

The exotic forbs hemlock, stonecrop, stinging nettle and scarlet pimpernel are well established in the development area, particularly on areas of cushionfield threatening their ecological integrity and value.

6. Fauna

6.1. Avifauna

During the walk over surveys Australasian harrier (*Circus approximans*), was observed on a regular basis soaring over the area, while grey warbler (*Gerygone igata*) and New Zealand fantail (*Rhipidura fuliginosa*) were heard or observed in the vicinity of areas of kānuka shrubland. A bellbird (*Anthornis melanura*) was observed in a lone old kōwhai tree. Other birds observed or heard across the property were the introduced California quail, rock pigeon, welcome swallow, blackbird, starling, yellowhammer, chaffinch, goldfinch and dunnock.

Although not observed or heard during the site inspection, suitable habitat for Kārearea - Eastern falcon (*Falco novaeseelandiae*) exists at Rocky Point. Kārearea is of conservation concern as is classified as nationally vulnerable. Kārearea is likely to utilise the kānuka shrubland-scrub and the numerous rocky outcrops and bluffs and grassland as hunting habitat and potentially nesting habitat. The varied habitats at Rocky Point provide varied food sources in the form of small birds, rabbits, hares and large insects such as grasshoppers and beetles (Heather & Robertson, 2005).

6.2. Herpetofauna

A lizard survey was undertaken by Dr Tocher of Lizard Expert NZ (LENZ) (refer Appendix 1) across both properties in March 2023. This involved a 3-day visual encounter survey/walk during suitable weather conditions.

During the survey two lizard species McCann's skink *Oligosoma maccanni*) and Kawarau gecko (*Woodworthia* "Cromwell") were commonly observed in the various habitat types occurring on the properties such as rocky habitats, open areas and shrublands. Dr Tocher attributes this wide distribution to the variety of rock habitat in the form of loose rock slabs and outcropping encountered. Additionally, both species were observed making full use of the cushionfields for cover.

In addition to Dr Tocher's survey, Rocky Point was visited by Wildlands herpetologist, Samanta King on 17 April 2024 involving a walk over assessment and opportunistic manual searches.

The findings of the Wildland survey concur with the LENZ survey results. In addition, Kawarau gecko was observed occupying kānuka tree trunks, under loose bark and within crevices.

Both LENZ and Wildlands conclude that McCann's skink and Kawarau gecko are widespread through all vegetation types and rocky substrates in moderate to high densities at Rocky Point.

Kawarau gecko has a threat classification of At Risk - Declining[2] and McCann's skink has a threat classification of Not Threatened.

6.3. Invertebrates

A desktop assessment of terrestrial invertebrate fauna was undertaken by Wildlands (see report, Appendix 4). This involved searching the Global Biodiversity Information Facility (GBIF) for species records. The GBIF search retrieved 78 terrestrial invertebrates, characterised by mainly beetles, wasps, bees and ants. The invertebrate fauna was predominantly indigenous and includes notable species, defined as locally endemic, known or suspected to be declining, particularly sensitive to habitat loss or predation by introduced mammals, or listed as Threatened or At Risk. This are listed below.

[2] Hitchmough RA, et al. 2021. Conservation status of New Zealand reptiles, 2021. New Zealand Threat Classification Series 35. Department of Conservation, Wellington. 15 pp.

Table 6-1: Notable Invertebrates recorded within five kilometres of Rocky Point.

Species name	Common name	Threat Classification	Notability	Likelihood of being on-site
Vanessa gonerilla	New Zealand red admiral	Not assessed	Declining due to habitat loss	Medium-high
Cerius otagensis	Cromwell	Threatened – Nationally Critical (Leschen et al. 2020)	Only four specimens ever found; sensitive to habitat loss; locally endemic	Low
Hypsithocus hudsonae	Alpine shield bug	At Risk – Naturally Uncommon (Stringer et al. 2012)	Locally endemic, may be sensitive to habitat loss	High
Paranotoreas fulva	Looper moth	At Risk – Relict (Hoare et al. 2017)	Declining due to habitat loss	High
Zizina oxleyi	New Zealand blue butterfly	Not Threatened (Hoare et al. 2017)	Declining due to competition from common blue	High
Orthodera novaezealandiae	New Zealand praying mantis	At Risk – Declining (Buckley et al. 2012)	Declining due to competition from South African mantis	High
Phaulacridium otagoense	Otago short-horned grasshopper	At Risk – Declining (Trewick et al. 2022)	Declining due to habitat loss and possibly predation	High
Holcaspis ovatella	Ground beetle	Not assessed	Locally endemic – only found in Otago	High
Mecodema tibiale	Ground beetle	Not assessed	Locally endemic – only found in Otago	High

Source: Table 1 of the Terrestrial Invertebrate Desktop Assessment report.

Wildlands note that the affected cushionfield, exotic herbfield, rocky substrates and grassland are likely to be important for notable moths, beetles, and grasshoppers. Some of invertebrates are classified as Threatened or At Risk and a number are locally endemic, rely on specific host plants or are believed to be declining due to habitat loss. By comparison the young or early successional kānuka is considered by Wildlands as unlikely to be harbouring high indigenous invertebrate biodiversity and likely to be of little value to notable species.

7. Summary of Key Ecological Features

Key ecological features inherent to Rocky Point are:

- Extensive areas of dryland kānuka shrubland/scrub associated with rocky terrain, bluffs and gullies;
- High degree of connectivity between areas of kānuka shrubland/scrub located in Rocky Point with areas of kānuka shrubland/scrub in Bendigo Hills Estate and Bendigo Scenic Reserve;
- Extensive areas of dryland cushionfields dominated by golden scabweed with has a threat classification of At Risk-Declining;
- Presence of the Nationally Critical pygmy mistletoe on host kānuka trees;

- Presence of the Nationally Vulnerable New Zealand mousetail, the forget-me-not *Myosotis brevis;*
- Presence of the At Risk-Declining pin cushion *Colobanthus brevisepalus*;
- Relic specimens of the At Risk-Declining *Olearia lineata*, the At Risk-Declining matagouri and regionally uncommon kōwhai;
- Extensive populations of the At Risk-Declining Kawarau gecko;
- Likely presence of the Nationally Vulnerable eastern falcon (Kārearea);
- Presence of notable invertebrate species associated with cushionfield, exotic herbfield, rocky substrates and grassland.

8. Ecological Values and Significance

The ecological value and significance of the affected indigenous vegetation types and habitats of indigenous fauna within the development area has been assessed using the combination of the attributes/criteria set out in Table 4 of the Environment Institute of Australia and New Zealand (EIANZ 2018) Guidelines and in Schedule 4 of the partially operative Otago Regional Policy Statement (RPS).

The assessment matters and attributes used to assign values to the affected indigenous vegetation communities and habitats are sourced from Tables 4, 5 and 6 of the EIANZ Guidelines and transposed in Tables 8-1, 8-2 and 8-3 below.

Table 8-1: Attributes to be considered when assigning ecological value or importance to a site.

Assessment Matters	Attributes
Representativeness	Criteria for representative vegetation and aquatic habitats: • Typical structure and composition • Indigenous species dominate • Expected species and tiers are present • Thresholds may need to be lowered where all examples of a type are strongly modified Criteria for representative species and species assemblages: • Species assemblages that are typical of the habitat • Indigenous species that occur in most of the guilds expected for the habitat type.
Rarity/ distinctiveness	Criteria for rare/distinctive vegetation and habitats: • Naturally uncommon, or induced scarcity • Amount of habitat or vegetation remaining • Distinctive ecological features • National priority for protection Criteria for rare/distinctive species or species assemblages: • Habitat supporting Nationally Threatened or At Risk species, or locally uncommon species • Regional or national distribution limits of species or communities • Unusual species or assemblages • Endemism

Diversity and Pattern	• Level of natural diversity, abundance and distribution • Biodiversity reflecting underlying diversity • Biogeographical considerations – pattern, complexity • Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation
Ecological Context	• Site history, and local environmental conditions which have influenced the development of habitats and communities • The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA) • Size, shape • Buffering function • Condition and sensitivity to change • Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material • Species role in ecosystem functioning – high level, key species identification, habitat as proxy • Is important for indigenous fauna during some part of their life cycle.

Table 8-2: Criteria used in assigning ecological value to terrestrial plant and animal species under the rarity/distinctiveness assessment matter.

Ecological Criteria	Value
Nationally Threatened species. Found in the site either permanently or seasonally	Very high
Species listed as At Risk-Declining found in the site either permanently or seasonally	High
Species listed as any other category of At Risk found in the site, either permanently or seasonally	Moderate
Locally (ED) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species including pests and species having recreational value	Negligible

Notes:
Determination of the threat status of species is derived from the New Zealand Threat Classification System.

Table 8-3: Criteria for assigning ecological value to a site.

Value	Description
Very high	Area rates High for 3 or all the four assessment matters. Likely to be nationally important and recognised as such
High	Area rates High for 2 of the assessment matters. Moderate and Low for the remainder, or Area rates High for 1 of the assessment matters. Moderate for the remainder. Likely to be regionally important and recognised as such.

Moderate	Area rates High for one assessment matter. Moderate and Low for the remainder, or Area rates Moderate for 2 or more assessment matters. Low to Very Low for the remainder. Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for 3 matters and Moderate. Low or Very Low for remainder.

Table 8-4: Summary of ecological values assigned to the development area.

Assessment Matters	**Ecological Value**	**Ecologically Significant**
Representativeness: The kānuka shrubland/scrub and grey shrubland communities existing in the development area, despite being modified are representative of the plant communities occurring in the dryland and generally rocky montane zone in the Dunstan Ecological District. The dryland cushionfields represent modified examples of cushion plant communities that have been reduced in extent in the ecological district due to land development.	High	Yes
Rarity/Distinctiveness: The development area impinges on Level IV land environment N8.1b where there is less than 20 percent remaining in indigenous cover. Flora with threat classifications of Nationally Critical, Nationally Vulnerable and At Risk-Declining occur in the development area. Rocky areas and cushionfield within the development area provide suitable habitat for the At Risk - Declining Kawarau gecko and notable invertebrate species, many locally endemic that rely on specific host plants. The kānuka shrubland/scrub and rocky outcrops provide suitable host plants for Pygmy mistletoe (Nationally critical) and feeding habitat and potentially breeding habitat for the Nationally vulnerable kārearea (Eastern Falcon).	Very High	Yes
Diversity and Pattern: The kānuka shrubland - shrub, cushionfield and grassland within the development area, support a diverse assemblage of indigenous plants and are important in terms of habitat utilisation and availability for daily or seasonal cycles of indigenous invertebrate fauna. The Bendigo area is important from a biogeographic perspective in supporting one of the largest tracts of kānuka (*Kunzea serotina*) scrub and shrubland in the lower South Island.	High	Yes

Ecological Context: The kānuka shrubland/scrub occurring the development area forms a contiguous tract with kānuka shrubland -scrub that occurs in the adjacent Bendigo Hills Estate and the Bendigo Scenic Reserve. This allows for unimpeded dispersal and movement of indigenous fauna via ecological corridors and pathways provided by the kānuka scrub and shrubland.	High	Yes
Overall ecological value	Very High	
Ecologically significant		Yes

A very high score assigned to the ecological value of the development area. The affected vegetation communities and habitats present in the development area score high to very high with respect to the assessment matters, set out in Tables 8-1, 8-2 and 8-3.

The site is ecologically significant in terms of the assessment criteria set out in Appendix 1 of the NPS-IB as the representativeness, rarity/distinctiveness, diversity and pattern and ecological context criteria are all triggered.

9. Assessment of Ecological Effects

9.1. EIANZ Criteria

The assessment of ecological effects follows the EIANZ criteria which involves the scoring of the magnitude of ecological effect and level of ecological effect of the proposed development on affected vegetation communities and habitats and indigenous flora and fauna in the development area. The scoring criteria are set out in Tables 9-1 and 9-2.

Table 9-1: Criteria for scoring magnitude of effect (EIANZ, 2018).

Magnitude	**Description**
Very High	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or

	attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature

Table 9-2: Criteria for scoring level of effect (EIANZ, 2018).

Ecological value → Magnitude ↓	**Very high**	**High**	**Moderate**	**Low**	**Negligible**
Very High	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

9.2. Magnitude and Level of Ecological Effect

9.2.1. Metrics

The scoring of the magnitude of ecological effect of the development in the absence of effect management measures is based on two attributes:

- the change to the baseline condition of the affected indigenous dominant plant communities (kānuka shrubland/scrub, cushionfield) at Rocky Point; and
- effects on the populations of indigenous flora and fauna, notably species with threat rankings of Nationally Critical, Nationally Vulnerable and At Risk-Declining.

The change to the baseline condition takes account of the percentage of each plant community and associated habitat that would be permanently removed (Table 2-1) within the property and the degree of fragmentation that will occur to each community.

9.2.2. Kānuka shrubland/scrub

The permanent removal of approximately 13,539 m^2 of kānuka shrubland/scrub during the development represents approximately 3.9% of the kānuka shrubland/scrub cover on Rocky Point.

In accordance with EIANZ criteria this scale of removal represents a low magnitude of ecological effect. This score is attributed to a discernible change to the existing baseline conditions but retention of the underlying character and composition of the kānuka shrubland/scrub. The degree of fragmentation to the kānuka shrubland and scrub is assessed as low.

The level of effect of the development on kānuka shrubland/scrub is scored as moderate (Table 9-2) when the magnitude of effect (low) is combined with the ecological value (Very high).

Biodiversity offsetting is proposed to address the residual adverse effects caused by a permanent loss of kānuka shrubland - scrub. These are detailed in Section 11.

9.2.3. Cushionfield

The permanent removal of approximately 39,880 m^2 of cushionfield during the development represents approximately 26% of the cushionfield that occurs on Rocky Point. Approximately 24,500 m^2 of the affected cushionfield is located within the Schedule 19.16 Concept Plan, Development Area (refer Section 1.1).

In accordance with EIANZ criteria the permanent removal of cushionfield on Rocky Point represents a high magnitude of ecological effect as this will lead to a major alteration to a key element of the existing baseline conditions through effects such as fragmentation leading to a post-development character being fundamentally changed at a local level.

The level of ecological effect of construction on the cushionfield is scored as very high in accordance with the EIANZ criteria (Table 9-2). This is attributed to a high ecological value assigned to the cushionfield, due to the At Risk-Declining threat classification of the principal cushion plant *Raoulia australis* (At Risk-Declining) and due to a high score assigned to the magnitude of effect.

Biodiversity offsetting is proposed to address the residual adverse effects caused by a permanent loss of cushionfield vegetation. These are detailed in Section 11.

9.2.4. Populations of Nationally Threatened Spring Annuals

The magnitude of ecological effect of the development on *Myosotis brevis* and New Zealand mousetail (*Myosurus minimus subsp. novae-zelandiae)* is scored as negligible to low respectively based on the RECCE plot surveys and walk over surveys. The surveys recorded a population of New Zealand mousetail in Lot 26 bordering the curtilage area but in no other parts of the development area. No specimens of *Myosotis brevis* were recorded in the development area.

The level of ecological effect is scored as low to moderate reflecting the very high score for ecological value attributed to their threat ranking.

Avoidance measures are proposed involving the shifting of the building platform in Lot 26 in a westward direction beyond the site of the recorded population of New Zealand mousetail.

9.2.5. Populations of *Raoulia australis*

In accordance with EIANZ criteria the permanent removal of the cushion plant *Raoulia australis* represents a high magnitude of ecological effect which is correlated to the extent of permanent loss of cushionfield from within the development area. RECCE plot data shows that the percentage cover of *Raoulia australis* within the sampled cushionfields varies between 60 to 80%.

The level of ecological effect is scored as very high in accordance with the EIANZ criteria (Table 9-2).

Biodiversity offsetting is proposed to address the residual adverse effects caused by a permanent loss of *Raoulia australis*. These are detailed in Section 11.

9.2.6. Populations of Pygmy Mistletoe

During the RECCE plot surveys and walk over surveys no specimens of pygmy mistletoe were observed in the kānuka shrubland. This result could be reflective of the timing of the surveys when considering that pygmy mistletoe was observed over a wide area during a lizard survey conducted in early January 2023.

It is assumed that some kānuka trees hosting pygmy mistletoe will be removed from within the estimated 1.28 ha. of affected kānuka shrubland/scrub.

On this basis the magnitude of ecological effect on the population is scored in the low to moderate range and level of ecological effect as moderate - high.

Biodiversity offsetting which includes plantings of kānuka is proposed to address the residual adverse effects, including permanent loss of kānuka trees hosting pygmy mistletoe.

9.2.7. Populations of *Colobanthus breisepalus*

The magnitude of ecological effect of the development on the pin cushion *Colonbanthus breisepalus* is scored as low based on the RECCE plot surveys and walk over surveys. The surveys recorded a population in Lot 3 bordering the curtilage area but in no other parts of the development area. Populations were recorded in cushionfields within the saline ecosystem bordering Lot 25 and in cushionfield bordering Lot 1.

The level of ecological effect is also scored as low.

Remedial measures are proposed involving the uplifting of the cushion plant in Lot 3 hosting the pin cushion and transfer to a nearby area of cushionfield outside of the development area. It is noted that samples of *Raoulia australis* cushion plants were uplifted and transferred to the Springburn nursery for propagation trials in mid April 2024. To date all the plants have survived and are showing no signs of die back.

9.2.8. Populations of *Olearia lineata*, Matagouri and Kōwhai

These species will not be affected by the development.

9.2.9. Lizards

Dr Tocher reports that all the habitat types that occur on the properties as listed in Section 5.1 support large populations of Kawarau gecko and McCann's skink. This is attributed to the presence of loose rock slabs and outcropping throughout all the habitat types. Dr Tocher notes that both lizard species make full use of the cushionfields for cover, at least over some parts of the year, including in and around the proposed building platform and curtilage areas.

Dr Tocher draws attention to the susceptibility of the lizards to death or injury from vehicle movements and foot traffic especially those occupying the undersides of loose rock slabs.

These potential effects underscore the need for a lizard management plan (LMP), which Dr Tocher states will serve the dual purpose of being a likely CODC consent requirement and supporting documentation to a Wildlife Act permit application to DOC. The LMP as noted by Dr Tocher will detail how the actual or potential adverse effects on indigenous lizards will be appropriately avoided, minimised, mitigated and compensated for.

Wildlands concur that it is entirely feasible that the LMP will be able to demonstrate "overall protective benefit" to local McCann's skink and Kawarau gecko populations at Rocky Point. The LMP will follow DOC principles in enabling the successful lizard management outcomes. These are set out in Section 10 – Effects Management Hierarchy Measures.

In the absence of avoidance, minimisation and mitigation measures the magnitude of effect of the development on lizard habitat in accordance with the EIANZ guidelines is assessed as moderate. This score reflects the residual adverse effects of the development that would be caused by the loss of lizard habitat and effects on the populations of Kawarau gecko and McCanns skink on the properties.

The level of ecological effect is assessed to be low and high based on a moderate magnitude of effect on two species of lizards with assigned low and high ecological values respectively.

9.2.10. Avifauna

The magnitude and level of ecological effects on indigenous avifauna, most notably the nationally vulnerable kārearea - Eastern falcon and possibly the At Risk-Declining Pīhoihoi - New Zealand Pipit is assessed as low.

Breeding pair surveys of kārearea and New Zealand Pipit are recommended in late spring/early summer to inform possible avoidance or minimisation measures required during the development.

9.2.11. Invertebrates

Wildlands have identified the following potential permanent and temporary adverse effects of the development on invertebrate fauna in the absence of effects management.

Permanent effects identified are:

- Loss, degradation and fragmentation of invertebrate habitat, notably cushionfield. This will result in a reduction in available habitat for notable species and isolation of species that are limited in their ability to move between patches of habitat. Habitat fragmentation may result in edge effects although these are according to Wildlands likely to be limited to reduced humidity around the edges of kānuka scrub increasing the risk of desiccation to invertebrates such as molluscs.
- Increased predation due to human activity which in turn leads to an increase in predators such as vespid wasps, sparrows, rats and mice as well as the use of pesticides that will adversely impact on pollinators, including notable species.
- Artificial lights from house and streetlamps and other artificial sources is likely to alter the behaviour of flying insects and also interfere with their ability to navigate.

Temporary effects concern direct injury and mortality during construction and indirect effects from dust and vibration that can affect invertebrate physiology and behaviour.

The proposed effects management hierarchy measures and control of weeds in the saline ecosystems as proposed by TKO are supported by Wildlands in addressing these potential adverse effects.

Wildlands support the planting of shrub species in and around the site to address habitat fragmentation and recommends that predator control extends to mustelids and rats in addition to cats and hedgehogs.

Wildlands also recommends the implementation of a Dust Management Plan to mitigate the effects of dust generation, limiting high vibration activities to outside of peak activity times for invertebrates during sunny days between October and March and use of shaded lamps that emit light towards the red end of the electromagnetic spectrum.

In conclusion Wildlands state the implementation of the above effects management measures will ensure the effects of the proposed development on terrestrial invertebrates will be adequately addressed.

Based on the assessment of Wildlands, the magnitude and level of ecological effect of the development on terrestrial invertebrates is scored as low based on the implementation of the effects management measures.

10. Effects Management Hierarchy

This section sets out the effects management hierarchy measures that will be implemented by TKO in managing the adverse effects of the proposed Rocky Point development on indigenous biodiversity as set out in the NPS – IB. The NPS requires that:

(a) adverse effects are avoided where practicable; then
(b) where adverse effects cannot be avoided, they are minimised where practicable; then
(c) where adverse effects cannot be minimised, they are remedied where practicable; then
(d) where more than minor residual adverse effects cannot be avoided, minimised, or remedied, biodiversity offsetting is provided where possible; then
(e) where biodiversity offsetting of more than minor residual adverse effects is not possible, biodiversity compensation is provided; then
(f) if biodiversity compensation is not appropriate, the activity itself is avoided.

The effects management measures will be integral to the construction methodology in informing the design and implementation of the works.

10.1. Avoid Adverse Effects

- Areas of saline/soils as identified by soil scientist Roger Gibson and the cushionfields associated with these areas have been avoided.
- Kānuka trees and shrubs known to be hosting the Nationally Critical pygmy mistletoe have been avoided. If any trees are consequently identified in the development area that host pygmy mistletoe, these will be flagged in advance of the works and avoided if practicable.
- Areas of more mature kānuka shrubland/scrub and associated vegetation communities that are in a more advanced stage of natural succession and generally have higher ecological values have been avoided. This includes scrub in the gullies and rock outcrops with relic kōwhai.
- Habitat favoured by populations of the nationally threatened *Myosurus minimus* subsp. *novae-zelandiae* and *Myosotis brevis* have been avoided. Habitats favoured by these plants mostly exist outside of the development area around the margins of kānuka shrubland/scrub with southerly aspects where there is minimal cover of exotic grasses and forbs.
- Specimens of At Risk-Declining *Olearia lineata* and kowhai, matagouri and mingimingi have been avoided and clumps of porcupine shrub and korokia have been avoided owing to their scarcity at a local level, their habitat value for indigenous lizards and invertebrate fauna and their distinctiveness. Only a few individual porcupine shrub and korokia are likely to be removed.
- Stacked rock habitat of high value to lizards has been avoided and implementation of setbacks or no disturbance zones around rock outcrops and loose rock piles is proposed.
- On-site quarrying of rock for road metal will be avoided.
- Rock and gravel will be imported from weed free sources to avoid the introduction of new weed species to Rocky Point.

10.2. Minimise Adverse Effects

- Formulating a development design that minimises where practicable the development footprints for dwellings, curtilages, roads, water tanks, laydown areas, car parks and wastewater disposal facilities. The development is to be actively managed through consent notice conditions in order to minimise adverse effects on biodiversity values. No vegetation or rock outcrops shall be disturbed or removed beyond the development footprints.
- Implementing site controls that require all works associated with construction of dwellings and supporting infrastructure including machinery movements and storage, laydown and parking areas to take place within construction zones clearly defined on the ground.
- Clearly defining accessways on the ground to confine the movements of construction machinery and vehicles.
- Prohibiting the moving or use of rock slabs for construction purposes.
- Installing underground services within road footprints.
- Trimming of indigenous woody vegetation where possible during construction as opposed to complete removal of trees and shrubs.
- Retention of root beds of felled trees and shrubs to minimise off-site effects caused by erosion.
- Siting of water and diesel tanks and other heavy construction related plant and material at designated sites to prevent damage to vegetation outside of the development footprints

10.3. Remediate Adverse Effects

- Uplifting and transposing *Raoulia australis* cushion plants hosting pin cushion (At Risk-Declining) and transposing into cushionfield located in the mapped saline/sodic soils beyond the development area.

- Creating schist rock habitats, under the supervision of a herpetologist, ahead of the development works through retrieving and hand placing of slab rocks across areas naturally impoverished of rock, on open and sunny sites, outside of high foot traffic areas and outside of building platforms and curtilage areas as well as across uphill and downhill road batters. The rocks should be stacked so that a variety of lizard cervices and basking platforms are created and protected from wet weather. Any additional specific measures required under the Lizard Management Plan will also be implemented. This may include undertaking lizard salvage and relocation.

- Stacking of cleared woody vegetation around the edges of kanuka shrubland/scrub outside of the development area or in open spaces, including the offset sites (See Section 11.7) to provide additional habitat for invertebrates.

- The development area shall be monitored over the duration of the works and over the duration of the maintenance period (2 years) to detect whether any problem weed species that currently do not occur on the property have been accidentally introduced to the area. All necessary steps will be undertaken to eradicate these weeds.

- Ongoing weed and pest control will be undertaken by the Rocky Point service company.

- Placing a ban on cats and controlling hedgehogs to reduce predation on lizards and invertebrates.

- Placing restrictions on the use of herbicides and pesticide, insecticides within and outside of the curtilage areas.

10.4. Biodiversity Offset

- Biodiversity offsetting as noted in Section 9 and described in Section 11 is proposed to address residual adverse effects of the development on areas of kānuka shrubland/scrub and cushionfield, populations of golden scabweed (*Raoulia australis*), and potentially populations of pygmy mistletoe, pin cushion, Kawarau gecko and McCann's skink and notable invertebrate species.

10.5. Summary of Effects and Effects Management Hierarchy Measures

Table 10-1: Tabulation of effects of Rocky Point development on indigenous vegetation and indigenous fauna and effects management hierarchy measures

Adverse effects **At a property wide level**	Potential Magnitude of Effect	Rationale for Magnitude of Effect Score	Ecological Value	Level of Effect	Effects Management	Level of Residual Effect	Biodiversity Offset	Level of Residual Effect with Biodiversity Offset (30+ years)
Removal of 3.76 ha. cushionfield	High	Cushionfield permanently removed during development represents c. 26% of extent of this plant community on Rocky Point.	Very high	Very high	**Avoidance, minimisation and remediation** of adverse effects of removal of cushionfield from within the development area is not possible.	High	✓	Low
Removal of 1.28 ha of kānuka treeland-scrub	Low	Kānuka treeland-scrub permanently removed during development represents c. 3.5% of extent of this plant community on Rocky Point.	High	Low	**Avoidance, minimisation and remediation** of adverse effects of removal of kānuka treeland-scrub from within the development area is not possible.	High	✓	Low
Reduction in population of *Raoulia australis*	High	RECCE plot surveys show that *Raoulia australis* has an average cover of 60% across the sampled cushionfields in the development area.	High	Very high	**Avoidance, minimisation and remediation** of adverse effects of removal of the cushion plant *Raoulia australis* from within the development area is not possible.	High	✓	Low
Reduction in population of Pygmy mistletoe	Low	Surveys to date have not recorded plants in the development area.*	Very high	Moderate	**Avoidance, minimisation and remediation** of adverse effects of removal of host kānuka trees from	Moderate	✓	Low

					within the development area is not possible.			
Reduction in population of NZ Mousetail	Negligible	Surveys to date have recorded plants in the vicinity of the proposed buidling platform in Lot 26. Much of the development area does not provide suitable habitat for this species.	Very high	Low	**Remediation** of adverse effects will involve uplifting of sods of soil containing NZ Mousetail in Lot 26 and transposing to a nearby area of suitable habitat outside of the development area.	Low	NR	Positive
Reduction in population of *Myosotis brevis*	Negligible	Surveys to date have not recorded plants in the development area. Much of the development area does not provide suitable habitat for this species.	Very high	Low	NR	Low	NR	Positive
Reduction in population of *Colonbanthus breisepalus*	Negligible	Pin cushions were recorded sporadically in cushionfield in the development area.	High	Very low	**Remediation** of adverse effects will involve uplifting of cushion plants hosting pin cushions and transposing to areas of cushionfield within demarcated saline soils outside the development area.	Low	NR	N/A
Removal of lizard habitat and reduction in lizard populations	High	Surveys have recorded high densities of Kawarau gecko and McCanns skink	High	Very high	**Avoiding** areas of rocky habitat where possible. **Remediation** of adverse effects through enrichment planting of lizard friendly plants, retention and. replacement of distrubed during constrcution and rokcy habitat creation.	Potentially high	✓	Low
Removal of invertebrate	High	Desktop assessment has identified diverse high	High	Very high	The **avoidance** measures recommended for lizards and	Potentially high	✓	Low

habitat and reduction in invertebrate populations		quality invertebrate habitats, particularly cushionfield, exotic herbfield and grassland that notable species are dependent on.			**remedial** measures around creation of rocky habitat and stacking of cleared woody vegetation will additionally benefit invertebrates.			
Effect on Kārearea and Pīhoihoi breeding habitat	Low	Based on preliminary opinion of ornithologist Graham Parker based on review of draft EcIA.	Very high	Moderate	**Avoidance or mitigation** measures will be informed by breeding pair surveys to be undertaken between late August and early January.	Negligible - low	NR	N/A
Fragmentation of cushionfield and kānuka shrubland/scrub and short term reduction in connectivity	High	Due to extent of removal of cushionfield and to a lesser extent kānuka shrubland/scrub at Rocky Point.	Very high	Very high	**Minimisation** through protection and managment of cushionfields and kānuka shrubland/scrub outside of development area including retention of cushionfield associated with saline ecosystems.	Moderate	✓	Low
Exotic/invasive weed spread	Low-Moderate	Potential for weed spread by construction machinery	-	-	**Avoidance** through cleaning of machinery prrior to site entry and sourcing gravel from weed free source.	Nil	NR	N/A

Notes:

NR – Not required.

11. Proposed Biodiversity Offset

11.1. Overview

A biodiversity offset as described below will involve planting of forest and shrub species that includes high value plant species representing the pre-settlement climax communities at Rocky Point as identified by Wildlands (see Section 5-8). The offset plantings are proposed at three sites in the adjacent Bendigo Hills Estate, as described below.

An offset accounting model has been used to assess the biodiversity outcomes achieved through the proposed plantings and plant management post planting. See Wildlands report 7080b in Appendix 6 for fuller details of methodology.

Two slightly different offset plantings have been developed and modelled; one to offset the loss of kanuka shrubland (shrubland offset) and one to offset the loss of cushionfield (cushionfield offset). The plantings and densities for each offset are set out on Table 11-1. The total area of offset plantings is 5.7 ha.

Table 11-1: Shrubland and Cushionfield Offset Plantings.

		Shrubland offset plantings	Cushionfield offset plantings
Climax community species	**Plant type**	**Planting density (plants/ha)**	**Planting density (plants/ha)**
Asplenium flabellifolium	Fern	0	0
Cheilanthes sieberi	Fern	0	20
Polystichum neozelandicum	Fern	20	0
Polystichum vestitum	Fern	30	0
Asplenium richardii	Fern	0	20
Pellaea calidirupium	Fern	0	0
Raoulia australis	Herb	0	0
Carmichaelia compacta	Shrub	50	200
Coprosma dumosa	Shrub	100	100
Coprosma crassifolia	Shrub	650	1600
Coprosma propinqua	Shrub	200	600
Coprosma virescens	Shrub	250	300
Corokia cotoneaster	Shrub	250	600
Melicope simplex	Shrub	250	60
Melicytus alpinus	Shrub	100	1150
Olearia odorata	Shrub	100	110
Veronica salicifolia	Shrub	250	100
Myrsine divaricata	Small tree	100	110
Olearia lineata	Small tree	100	200
Veronica pimeleoides	Subshrub	0	50
Vittadinia australis	Subshrub	0	50
Cordyline australis	Tree	400	80
Griselinia littoralis	Tree	400	50
Hoheria angustifolia	Tree	200	0
Kunzea serotina	Tree	2500	1600
Myrsine australis	Tree	150	0
Pittosporum tenuifolium	Tree	500	200
Plagianthus regius	Tree	300	0
Pseudopanax ferox	Tree	200	100
Sophora microphylla	Tree	400	200
Muehlenbeckia australis	Vine	0	0
Muehlenbeckia complexa	Vine	0	0
Rubus schmidelioides	Vine	0	0
Rocks, litter etc			0
		Total 7500/ha	**Total 7500/ha**
		7500	7500

The cushionfield offsetting model anticipates replacement of *Raoulia australis* cushionfield with indigenous woodland. This is based on research undertaken by Wildlands and potential ecosystem mapping which shows woody vegetation would have dominated the site, except on steep terrace risers and saline/sodic soils, which would have supported shrubs and cushion plants. Offsetting the impacted cushionfield with forest/shrubland communities is therefore appropriate.

11.2. Objectives

1. To replace the area of indigenous vegetation lost through the development with an area of replanted 'climax-community' indigeous vegetation that is at least as large as the area of vegetation lost.

2. To provide additional ecological benefits through introducing indigenous components to the ecosystem that are now almost entirely absent at Rocky Point and the wider district as a result of previous land management, specifically through:

   - recreating plant compositions and structures that were most probably present in pre-settlement climax vegetation at the site, and that are appropriate for present-day conditions.

   - increasing plant diversity at Rocky Point and surrounding area by re-introducing a variety of species that would have formerly been key components of the vegetation, but that are now locally extinct and/or very rare. It is anticipated that these plants will provide a seed source for further spread into Rocky Point, and into the nearby Bendigo Scenic Reserve.

11.3. Plant Densities

The density of the plantings as listed on Table 11-1, 7500/ha are based on average spacings of 2.5 m for trees and 1.3 m for shrubs across the offset sites.

11.4. Offset Timeframe

A timeframe of 30 years has been adopted for the offset. This timeframe is appropriately conservative, and accounts for the expected slow development of self-sustaining forest and shrubland communities in the dry climate of the site.

11.5. Offset Model Components

The components used to construct the two offset models were:

- Indigenous cover (ground and woody)
- Indigenous species richness
- Indigenous tree basal area
- Number of indigenous seedlings
- Number of indigenous saplings.

Basal area is a key component in assessing the offset, because at a plot level it increases continuously and is therefore a very reliable indicator of the state of woody ecosystem development, whereas aspects of cover, species richness, and numbers of seedlings and saplings can increase or decrease depending on the stage of succession.

11.6. Offset Model Outcomes

11.6.1. Shrubland Offset

The model has generated the following outcomes for the shrubland offset:

- Ground cover is very negative
- Diversity is positive
- Basal area is positive

- Seedlings and saplings are slightly negative when kōhūhū and kāpuka are taken into account along with the other species in the model.

These outcomes reflect a closed and dense forest canopy at 30 years while the ground cover is mainly formed by slow growing self-colonising ferns. The canopy shade will also inhibit seedlings and saplings.

Positive basal area is a key outcome because that relates to tree size and function and hence forest development.

11.6.2. Cushionfield Offset

The model has generated the following outcomes for the cushionfield offset:

- Ground cover is very negative
- Diversity is positive
- Basal area is positive
- Seedling and saplings are negative.

The negative outcome for ground cover and for seedling and sapling components is due to a more natural and diverse vegetation that competitively excludes kānuka regeneration over time. Positive basal area is again a key outcome, indicating a gain in overall vegetation development.

11.7. Offset Sites

The offset sites have been selected due to their south to south-westerly aspect, favourable soils and dominance of exotic grasses and forbs. These are named Hemlock Gully, Panorama Rise and Pylon Flat as illustrated on Figures 11-1, 11-2 and 11-3. The relative location of the sites to each other and to Rocky Point and the Bendigo Scenic Reserve is shown on Figure 11-4.

The shrubland offset plantings have been applied to the Hemlock Gully and Panorama offset sites (3 ha) and the cushionfield offset planting to the Pylon Flat offset site (2.7 ha).

11.7.1. Hemlock Gully

Hemlock Gully site (1.77 ha) as the name suggests is dominated by hemlock as shown on Figure 11-1 that colonises a shallow gully representing part of an ephemeral seepage wetland. The percentage cover of hemlock including associated litter recorded in RECCE plots was between 60 to 90%.

The gully is bordered by groups of mature *Olearia lineata* and kānuka. The Mt Koinga Track passes through this site.

Figure 11-1: Thicket of dead hemlock at the upper end of the Hemlock Gully offset site.

11.7.2. Panorama Rise

The Panorama Rise site (1.27 ha) covers hillslopes of a moderate gradient situated between a metalled road and kānuka shrubland. The site is covered mostly in exotic grassland and incorporates small stands of kanuka and scattered shrubs of sweet briar. RECCE plots placed in the site show that exotic grasses occupy between 60-90% of the plots, exotic forbs up to 25% and the balance is mossfield, loose mats of lichen and bare ground.

Figure 11-2: Exotic grassland dominant cover in the Panorama Rise offset site.

11.7.3. Pylon Flat

Pylon Flat site (2.7 ha) forms part of an extensive terrace that abuts the Bendigo Scenic Reserve and is bisected by the Clyde-Twizel transmission line. It includes as a western extension part of a gully head bounded by three farm tracks. The vegetation cover is a mosaic of cushionfield, exotic grassland and

exotic herbfield and large patches of bare ground. RECCE plot data shows that the cushion plant *Raoulia australis* occupied about 5% of the plots, exotic forbs up to 30%, exotic grasses between 10-30 % and bare ground was variable between 20 to 80%.

Figure 11-3: Patches of *Raoulia australis* amongst areas of bare ground and low swards of exotic grasses that typify the Pylon Flat offset site.

Figure 11-4: Proposed offset sites.

11.8. Alignment with NPS - IB

An assessment of the proposed offset against the principles as set out in Appendix 3 of the NPS - IB is set out in Table 11-2.

Table 11-2: Assessment of Appendix 3, NPS-IB – Principles for biodiversity offsetting.

	Principle	Assessment
1)	**Adherence to effects management hierarchy:** A biodiversity offset is a commitment to redress more than minor residual adverse effects, and should be contemplated only after steps to avoid, minimise, remedy, and offset adverse effects are demonstrated to have been sequentially exhausted.	The effects management hierarchy has been undertaken as part of the Ecological Impact Assessment and residual adverse effects remain. These effects are the unavoidable loss of cushionfield, kānuka shrubland/scrub and the At Risk-Declining pin cushion *Colobanthus brevisepalus*. Residual adverse effects of loss of cushionfield and kānuka shrubland/scrub plant communities at Rocky Point are to be addressed by way of a biodiversity offset. The offset will involve plantings of forest communities including high value tree and shrub species and active on-site management[3] leading to the establishment of areas of diverse indigenous forest and shrubland that will in turn improve the connectivity at a landscape scale between the Bendigo Hills Scenic Reserve and the Bendigo Hills Estate and Rocky Point.
2)	**When biodiversity offsetting is not appropriate:** Biodiversity offsets are not appropriate in situations where indigenous biodiversity values cannot be offset to achieve a net gain. Examples of an offset not being appropriate include where: (a) residual adverse effects cannot be offset because of the irreplaceability or vulnerability of the indigenous biodiversity affected:	In the case of irreplaceability, a helicopter fly-over and ground surveys have identified that cushionfields are widespread over low altitude hill country between Northburn Station near Cromwell and The Point Station near Tarras. The loss of cushionfield at Rocky Point will not lead to a significant reduction in percentage terms in the extent of cushionfield communities that occur in the Dunstan Ecological District. The cushionfields are not vulnerable and represent an early successional plant community that colonises degraded land. Local farmers characterise it as a band aid that covers the land until other forms of vegetation are able to re-establish. The populations of cushion plants on these farming properties increased during the 20th century as a result of browse pressure from stock grazing and rabbits. Areas where rabbits are now being controlled and grazing is directed towards more productive areas clearly show that other vegetation (both native and exotic) are returning to compete with the cushionfield. In this sense, preservation of the current extent of cushionfield across this area, assuming their retention, would necessitate maintaining the current dryland farming practice of (merino) grazing and rabbit populations and undertaking active control of weed infestations.

[3] Active management measures may be subject to changes based on an adaptive approach informed by monitoring using fixed quadrats and fixed photo-points. These measures will be documented in an Ecological Enhancement and Monitoring Plan (EEMP).

	(b) effects on indigenous biodiversity are uncertain, unknown, or little understood, but potential effects are significantly adverse or irreversible: (c) there are no technically feasible options by which to secure gains within an acceptable timeframe.	The vulnerability of and long term successional trend towards a reduction in cushionfield and an increase in a kānuka dominant landscape at Rocky Point is clearly apparent from site walk overs, from RECEE plot data and examination of historic aerial imagery. Cushionfields are vulnerable however to the spread of woody weeds, notably invasive broadleaved weeds such as hemlock, stonecrop and scarlet pimpernel. Successional kānuka shrubland is abundant at Rocky Point, and in over 1,000 ha of protected conservation land at Bendigo Scenic Reserve and Bendigo Historic Reserve. The factors mentioned above also anticipate replacement of *Raoulia australis* cushionfield with indigenous woodland, a conclusion consistent with research undertaken by Wildlands and potential ecosystem mapping which shows woody vegetation would have dominated the site, except on steep terrace risers and saline/sodic soils, which would have supported shrubs and cushion plants. Replanting provides a viable method for offsetting both kānuka shrubland and cushionfield communties. Anthropogenic effects on cushionfield and kānuka shrubland vegetation such as subdivision developments are well understood. The ecological assessment has identified adverse residual effect owing to the loss of cushionfield and kānuka shrubland/scrub communities from within the development area. A biodiversity offset is proposed to address the residual adverse effects of the development in conjunction with a range of measures proposed by TKO that will yield significant positive ecological outcomes.. Planting of offset sites will commence in the autumn or spring period following granting of consent.
3)	**Net gain:** This principle reflects a standard of acceptability for demonstrating, and then achieving, a net gain in indigenous biodiversity values. Net gain is demonstrated by a like-for-like quantitative loss/gain calculation of the following, and is achieved when the indigenous biodiversity values at the offset site are equivalent to or exceed those being lost at the impact site: (a) types of indigenous biodiversity, including when indigenous species depend on introduced species for their persistence; and (b) amount; and (c) condition (structure and quality).	The biodiversity accounting model outputs show that the offset actions will result in positive basal area and species diversity outcomes. Basal area is the most indicative measure of the progressive development of forest/shrubland ecosystems. Negative scores for the other components of the model (indigenous cover, and number of seedlings and saplings) reflect successional processes by indigenous woody species other than kānuka.

4)	**Additionality:** A biodiversity offset achieves gains in indigenous biodiversity above and beyond gains that would have occurred in the absence of the offset, such as gains that are additional to any minimisation and remediation undertaken in relation to the adverse effects of the activity.	Additionality will be achieved through a range of positive ecological actions proposed by TKO. These are: • Formal protection of Rocky Point outside of the development area. • Compensation/Enrichment plantings at four locations in Rocky Point that will lead to restoration of vegetation communities, i.e., through re-introduction of forest and shrub species. A number of the species do not currently exist in Rocky Point. • Enhancement of saline ecosystem cushionfields through weed control. • Enhanced connectivity in Rocky Point due to the plantings. • Improved habitat quality for indigenous flora and fauna.
5)	**Leakage:** Biodiversity offset design and implementation avoids displacing harm to other indigenous biodiversity in the same or any other location.	The offset sites are dominated by exotic grassland and forbs. Indigenous biodiversity is a minor component of the offset sites based on RECCE plot data.
6)	**Long-term outcomes**: A biodiversity offset is managed to secure outcomes of the activity that last as least as long as the impacts, and preferably in perpetuity. Consideration must be given to long-term issues around funding, location, management, and monitoring.	The offset sites with appropriate management as set out in the EEMP will develop into forest and shrubland ecosystems in perpetuity.
7)	**Landscape context:** Biodiversity offsetting is undertaken where this will result in the best ecological outcome, preferably close to the impact site or within the same ecological district. The action considers the landscape context of both the impact site and the offset site, taking into account interactions between species, habitats and ecosystems, spatial connections, and ecosystem function.	The offset sites are located in Bendigo Hills Estate adjacent to Rocky Point. The sites are also adjacent to or close to Bendigo Scenic Reserve. The plantings will enhance connectivity at a landscape scale.
8)	**Time lags:** The delay between loss of, or effects on, indigenous biodiversity values at the impact site and the gain or maturity of indigenous biodiversity at	Planting at the offset sites will commence from the date of granting of resource consent. It is expected the ecological benefits will start to be realised in a short

	the offset site is minimised so that the calculated gains are achieved within the consent period or, as appropriate, a longer period (but not more than 35 years).	time frame, within 10 year of planting when the planting are expected to be producing seed.
9)	**Science and mātauranga Māori:** The design and implementation of biodiversity offset is a documented process informed by science, and mātauranga Māori.	The EEMP which applies to management of the offset sites and compensation planting sites is informed by scientific and Māori knowledge of the ecology of cushionfields and kānuka shrubland. The proposed plantings include taonga species that are presently absent or in low numbers at Rocky Point and within the Dunstan ED.
10)	**Tangata whenua and stakeholder participation:** Opportunity for the effective and early participation of tangata whenua and stakeholders is demonstrated when planning for biodiversity offsets, including its evaluation, selection, design, implementation, and monitoring.	The proposed offsets will be subject to scrutiny by stakeholders who have submitted on the resource consent application.
11)	**Transparency:** The design and implementation of biodiversity offset, and communication of its results to the public, is undertaken in a transparent and timely manner.	See comment in 10 above Monitoring will be undertaken on an annual basis as detailed in the EEMP. Monitoring data and associated reports will be provided to Council and key stakeholders on request.

12. Positive Effects

In addition to the avoidance, minimisation, remediation and offsetting measures set out in Sections 10 and 11, the development includes specific measures proposed by TKO that will yield positive ecological outcomes outside of the offsetting model outcomes. These are discussed below.

12.1.1. Formal Protection of Balance Land

Land at Rocky Point outside of the development area which comprises approximately 91% of the land area of the property will be subject to a covenant requiring the protection of indigenous vegetation and habitats for indigenous fauna.

12.1.2. Compensation (Enrichment) Plantings

TKO are proposing to undertake enrichment plantings at four sites in Rocky Point beyond the development area as shown on Figure 9-1 and around the perimeter of the building platforms. The former will comprise a mix of tree and shrub species.

Planting site 1 (*c.* 4,000 m^2) is in an area of exotic grassland, sweet briar and scattered *Coprosma propinqua* near SH 8. Planting sites 2-4, each *c.* 400 m^2 are in the kānuka scrub filled western gully

where favourable soils exist, positioned within existing canopy gaps and in areas where exotic species (hemlock, sweet briar and crack willow) currently dominate.

The compensation or enrichment planting will comprise species identified by Wildlands as likely components of the pre-settlement vegetation types that occurred on the alluvial gravels at the base of the hillslopes at the north of Rocky Point and within the gullies and basins in Rocky Point. Wildlands state the vegetation across the alluvial gravels such as beside SH 8 would have likely comprised a forest with the occasional emergent mataī above a broadleaf canopy of kāpuka, ribbonwood, kōwhai, narrow-leaved lacebark, māpou and fierce lancewood. Within the gullies a variant to the (*Mataī)/kāpuka-ribbonwood-māpou-fierce lancewood* forest would have existed dominated by kōwhai, lowland ribbonwood, kōhūhū, fierce lancewood, narrow-leaved lacebark with a lesser abundance of shrubs such poataniwha (*Melicope simplex*), *Coprosma virescens*, *Copromsa crassifolia*, *Olearia lineata, Olearia odorata,* and *Myrsine divaricata.*

The shrub plantings proposed around the building platforms would comprise a mix of *Olearia* and *Coprosma* species, porcupine shrub, korokio and mountain cottonwood and the creeping wire vine *Muehlenbeckia axillaris*.

Figure 12-1: Indicative location of compensation (enrichment) planting sites.

12.1.3. Underrepresented Forest Vegetation

The offset and compensation plantings that include representations of the likely pre-settlement forest vegetation serve to restore forest communities that are the most under-represented vegetation type in the Dunstan ED and Central Otago ER and the highest priority regionally for restoration. At a regional level many of the species proposed for planting are not present or virtually absent and are unlikely to establish without human intervention. The highest priority for ecosystem restoration is diverse woody communities, and the proposed plantings would provide one of the few locations in the region where this is being done at a landscape scale.

12.1.4. Improved Connectivity and Buffering

The connectivity and buffering functions of Rocky Point will be enhanced through the combination of the offset and compensation plantings benefiting the ecological function of the kānuka shrubland/scrub and grey shrubland in Bendigo Hills Estate and Bendigo Scenic Reserve.

12.1.5. Improved Habitat Quality

The plantings over time will enhance habitat quality for indigenous fauna through floristically and structurally diverse forest and shrubland communities.

12.1.6. Enhancement of an Ephemeral Seepage Wetland

The offset plantings proposed in Hemlock Gully will enhance the ecological value of an ephemeral seepage wetland.

12.1.7. Property Wide Weed Control

Conifers, hawthorn, elderberry, Buddleia, wild plum, wild cherry and garden escapees *Cotoneaster franchetti and wild Iris* will be controlled on an ongoing basis through programmed control measures. The programmes will be informed by surveillance monitoring undertaken by a suitably qualified expert. Further details are provided in the EEMP (See Appendix 7).

12.1.8. Cushionfield Specific Weed Control

Weed control specific to cushionfields will be undertaken in the mapped areas of saline/sodic soil that constitute saline ecosystems. This will involve controlling the invasive forbs hemlock, moth mullein, stonecrop, Californian thistle and scarlet pimpernel with a proprietary herbicide. Through control of these weeds, it is expected that the ecological integrity of the cushionfields at these locations will be maintained. This will benefit notable invertebrate species dependent on permanent availability of cushionfield habitat and possibly increase invertebrate abundance and diversity according to Wildlands.

12.1.9. Rabbit and Goat Control

Rabbits will be controlled on an ongoing basis across Rocky Point through a combination of measures such as night shooting, pindone poisoning and gassing of burrows to achieve sustainable pest numbers.

Goats will be controlled through daytime shooting operations. These are typically undertaken with a helicopter.

Programming of the control measures will be informed by twice yearly surveillance/walk over inspections by a suitably qualified expert.

Only professional rabbit and goat control contractors shall be used in this role as recreational shooters tend to spook the animals and reduce the effectiveness of shooting and poisoning operations.

12.1.10. Stock Exclusion

The exclusion of stock in combination with control of rabbits and goats will reduce browse pressure to an extent that will allow for the ongoing regeneration of indigenous woody species across Rocky Point,

including species other than kānuka which are likely limited by herbivory. Research on dryland disturbance mechanisms as noted in Section 5.8 indicates that sheep grazing promotes open vegetation through limiting woody recruitment creating conditions favourable for an increase in rabbit numbers, which impose additional limitations on the recruitment of woody species (Rogers et al, 2005). Reinstatement of sheep grazing at Rocky Point would be detrimental to woody species recruitment, based on research findings.

Natural Character

The effects on the natural character of Rocky Point will be restricted to the development area. However, over the property as a whole the natural character will be maintained through the retention of the gully systems, saline ecosystems, rocky outcrops and bedrock, over 90% of kānuka shrubland/scrub and over half of cushionfields, These areas which constitute 90+% of the property area will be subject to formal protection.

The proposed weed and pest control measures also serve to maintain the natural character of Rocky Point while natural character will be enhanced at the proposed compensation (enrichment) planting sites.

13. Conclusions

The proposed development by TKO will occur within a defined development area that covers approximately 7% of the land area at Rocky Point. The land outside of the development area will be subject to a covenant that will stipulate protection of indigenous vegetation and habitats of indigenous fauna.

The ecological value of the affected kānuka shrubland/scrub and cushionfield communities and populations of Threatened and At risk flora and fauna is scored as high to very high in accordance with the criteria set out in the EIANZ Guidelines. Additionally, the affected vegetation and habitats of indigenous fauna are ecologically significant in terms of the assessment criteria set out in Appendix 1 of the NPS-IB.

The very high ecological value and ecological significance assigned to the development area is attributed to the existence of areas of kānuka shrubland/scrub and cushionfields and the habitats they provide for Threatened and At Risk flora and fauna.

The level of ecological effect of the development on the affected areas of kānuka shrubland/scrub and cushionfield scored as moderate to very high respectively in accordance with the EIANZ Guidelines. The very high score assigned to the cushionfields reflects the area of cushion plant communities that would be permanently removed and fragmented at Rocky Point. However, this ecological effect of the development on cushionfield when considered in context to the Dunstan ED would be of a lower order of magnitude owing to the extent of cushionfield that remains on similar landforms and elevations in the Dunstan ED.

The level of ecological effect on Threatened spring annuals, i.e., New Zealand mousetail and *Myosotis brevis* is assessed as low as the walk over surveys and RECCE plot surveys did not record specimens in the development area.

A range of effects management hierarchy measures are proposed by TKO. These include the avoidance of areas of saline/sodic soils that constitute saline ecosystems and avoiding where possible kānuka trees that host the Threatened pygmy mistletoe.

Biodiversity offset measures are proposed to address the residual adverse effects of the development that cannot be avoided, minimised or remediated. These involve the plantings of forest and shrubland plant communities including high value species representing the pre-settlement climax communities at Rocky Point. Plantings will be established at three offset sites on Bendigo Hills Estate where favourable conditions for plant establishment exist. The application of a biodiversity accounting model shows that an overall net gain in biodiversity will be achieved over a 30-year time frame.

In addition to the biodiversity offset, TKO propose to formally protect the Rocky Point property outside of the development area, establish compensation or enrichment plantings of forest and shrubland

species at four sites in Rocky Point, control exotic weeds across cushionfields in the saline ecosystems and undertaken property wide weed and pest control. These measures represent significant positive effects additional to the offset.

Importantly the offset and compensation plantings that include representations of the likely pre-settlement forest vegetation serve to restore forest communities that are the most under-represented vegetation type in the Dunstan ED and Central Otago ER and the highest priority regionally for restoration. At a regional level many of the species proposed for planting are not present or virtually absent and are unlikely to establish without human intervention. The highest priority for ecosystem restoration is diverse woody communities, and the proposed plantings would provide one of the few locations in the region where this is being done at a landscape scale.

Management of the plantings, weed and pest control and monitoring that ensure high plant survival rates and effective weed and pest control measures are detailed in the EEMP.

The proposed development includes biodiversity offset and ecological enhancement measures that address the ecological effects of the development and ensure no overall long-term loss of biodiversity values.

References

Atkinson, I.A.E. 1962: Semi quantitative measurements of canopy composition as a basis for mapping vegetation. Proceedings of the New Zealand Ecological Society 9: 1–8.

de Lange, P.J., Rolfe J., Cameron, E.K., Barkla, J.W., Courtney, S.P., Champion, P.D., Perrie, L.R., Beadel, S.M., Ford, K.A., Breitwieser, I., Schonberger, I., Hindmarsh-walls, R., Heenan, P.B., Ladley, K. 2017. Conservation status of New Zealand indigenous vascular plants. New Zealand Threat Classification Series 22. Department of Conservation, Wellington.

Gibson, R. 2021. Bendigo Hills Estate Subdivision. Ecological Assessment. Roger Gibson Land and Sea Services.

Hurst, J.M.; Allen, R.B. 2007. The RECCE method for describing New Zealand Vegetation – Expanded Manual, Version 4. Landcare Research Contract Report (LC0708/029), Manaaki Whenua – Landcare Research, Lincoln.

Leathwick, J.R. 2001. New Zealand's potential forest pattern as predicted from current species-environment relationships. New Zealand Journal of Botany, 2001, Vol. 39: 447-464.

Leathwick, J.R., Morgan, F., Wilson, G., Rutledge, D., Johnston, K., McLeod, M. 2002. Land Environments of New Zealand. A Technical Guide. Ministry for the Environment, Wellington.

McEwen, W. M., (editor) 1987. Ecological Regions and Districts of New Zealand. NZ Topographic Map (1:500,000). Third Revised Edition - Sheet 4. Department of Conservation, Wellington, New Zealand.

McGlone MS 2001. The origin of the indigenous grasslands of southeastern South island in relation to pre-human woody ecosystems. New Zealand Journal of ecology 25: 1–15.

Robertson, C.J.R; Hyvonen, P; Fraser, M.J; Pickard, C.R. 2007. Atlas of Bird Distribution in New Zealand. 1999-2004. The Ornithological Society of New Zealand, Inc., Wellington.

Robertson, H.A.; Baird, K., Dowding, J., Elliot, G., Hitchmough, R., Miskelly, C.M., McArthur, N., O'Donnell, C.F.J., Sagar, P., Scofield, P., and Taylor, 2016. Conservation status of New Zealand birds, 2016. New Zealand Threat Classification Series 19. Department of Conservation, Wellington.

Rogers G.M., Walker S., Lee W.G. 2005. The role of disturbance in dryland New Zealand: past and present. Department of Conservation, Wellington. Science for Conservation 258

Singers, N.J.D.; Rogers, G.M. 2014. A classification of New Zealand's terrestrial ecosystems. Department of Conservation, Wellington. Science for Conservation 325.

Walker, S., King, N., Williams, S., Burrows, L., Cieraad, E., Meurk, C., McCoverton., Price, R., Smale, M. 2009. Secondary woody vegetation patterns in New Zealand's South Island dryland zone. New Zealand Journal of Botany, 2009, Vol. 47: 367-393.

Walker, S., Cieraad, E., Barringer, J. 2015. The Threatened Environment Classification for New Zealand 2012: a guide for users. Landcare Research Contract Report 2184.

Appendix 1 – Plant Species List

Plant Species List

The following is a list of native and naturalised plants observed across the site during the course of the site visit. This list is by no means exhaustive and identifies the more common plants encountered on the site. Nomenclature for indigenous plants follows the New Zealand Plant Conservation Network, Wilson (1993) and Johnson & Brooke (1998). Naturalised plants are indicated by *.

Trees, Shrubs, Sub-Shrubs		Kānuka treeland-scrub	Cushionfield	Exotic herbfield-Grassland	Rocky terrain
Kānuka	*Kunzea serotina*	*a*	*a*	*o*	*a*
Kōwhai	*Sophora microphylla*				*o*
Matagouri	*Discaria toumatou*	*r*		*o*	
Tree daisy	*Olearia lineata*	*r*		*o*	*o*
Tree daisy	*Olearia odorata*	*vr*			
Mingimingi	*Coprosma propinqua*	*o*			
Korokia	*Corkoia cotoneaster*	*o*			*o*
Porcupine shrub	*Melicytus alpinus*	*o*			*o*
Mountain cottonwood	*Ozothamnus vauvilliersii*				*vr*
	Ozothamnus				*vr*
Patotara	*leptophyllus*			*o*	*o*
	Styphelia nesophila				
Gorse*	*Ulex europaeus*			*o*	
Broom*	*Cytisus scoparius*			*o*	
Sweet briar*	*Rosa rubinginosa*	*o*		*a*	*o*
Cotoneaster*	*Cotoneaster franchetti*			*o*	
Hawthorn*	*Crataegus monogyna*	*o*		*o*	*o*
Elderberry*	*Sambucus nigra*			*o*	
Flowering currant*	*Ribes sanguineum*			*o*	
Plum*	*Prunus sp.*			*o*	*o*
Radiata pine*	*Pinus radiata*	*o*			*o*
	Pinus contorta	*o*			*o*
Buddleia*	*Buddleja davidii*		*o*	*o*	*o*
Vines					
Bush lawyer	*Rubus schmidelioides*	*o*			
Bush lawyer	*Rubus schmidelioides* var. *subpauperatus*	*o*			
Pohuehue	*Muehlenbeckia australis*	*o*			
Creeping pohuehue	*Muehlenbeckia complexa*	*r*		*o*	
Blackberry*	*Rubus fruticosus*			*o*	
Mistletoes					
Pygmy mistletoe	*Korthalsella salicornioides*	*r*			
Forbs					
Golden scabweed	*Raoulia australis*		*a*		
Scabweed					
New Zealand Mousetail	*Myosorus minimus* var. *minimus*	*o*	*o*		
	Myosotis brevis	*o*	*o*		
Pin cushion	*Colobanthus brevisepalus*		*o*		

	Brachyglottos bellidioides var. *belllidioides*				*vr*
Moth mullein*	*Verbascum virgatum*		*a*	*a*	
Woolly mullein*	*Verbascum thapsus*			*o*	
Scarlet pimpernel*	*Anagallis arvensis*				
	Geranium sessiliflorum		*o*		
Stonecrop*	*Sedum acre*		*a*	*a*	
Hemlock*	*Conium macualtum*		*a*	*a*	
Fuzzweed	*Vittadina australis*		*a*	*a*	
Purple Fuzzweed*	*Vittadina gracilis*		*a*	*a*	
Stinging nettle*	*Urtica urens*		*a*	*a*	
Mouse ear* hawkweed	*Pilosella officinarum*		*a*	*a*	
Tussock hawkweed*	*Hiercium lepidulum*		*o*	*a*	
Horehound*	*Marrubium vulgare*				
Californian stinkweed*	*Navarretia squarrosa*			*o*	
				o	
Sheep's bur*	*Acaena agnipila*				
Yarrow*	*Achillea millefolium*		*o*	*a*	
Vipers bulgloss	*Echium vulgare*		*o*	*a*	
Californian poppy*	*Eschscholzia californica*			*a*	
Poppy*	*Papaver sp.*		*a*	*o*	
St John's wort*	*Hypericum perforatum*		*a*	*o*	
Sheep's sorrell	*Rumex acetosella*			*a*	
Catsear*	*Hypochaeris radicata*		*a*	*a*	
Californian thistle*	*Cirsium arvense*			*a*	
Scotch thistle*	*Cirsium vulgare*			*o*	
Harefoot trefoil*	*Trifolium arvense*			*a*	
Catsear*	*Hypochoeris radicata*		*o*	*o*	
Selfheal*	*Prunella vulgaris*			*o*	
Cotton fireweed*	*Senecio quadridentatus.*			*o*	
Grasses, Sedges					
Silver tussock	*Poa cita*		*r*		
Hard tussock	*Festuca novae-zelandiae*			*o*	*o*
				o	
Blue tussock	*Pao colensoi*				*o*
	Carex wakatipu				*o*
	Carex breviculmis				*o*
Bristle tussock*	*Luzula traversii* var.				*o*
Ripgit brome*	*traversii*			*o*	*o*
Vulpia hairgrass*	*Rytosperma gracile*			*a*	*o*
Silvery hairgrass*	*Rytosperma setifolium*				*o*
Cocksfoot*	*Bromus diandrus*			*a*	*o*
Browntop*	*Vulpia myuros*			*a*	*o*
Sweet vernal*	*Aira caryophyllea*			*a*	*o*
Brome grass*	*Dactylis glomerata*			*a*	*o*
Chewings fescue*	*Agrostis capillaris*			*a*	*o*
Kentucku bluegrass*	*Anthoxanthum odoratum*			*a*	*o*
	Bromus spp.			*a*	
	Festuca rubra			*a*	
	Poa pratensis			*a*	*o*
Ferns					
Necklace Fern	*Asplenium flabellifolium*	*o*			*o*
Little hard fern	*Blechnum penna-marina*				*o*

Woolly rock fern	*Cheilanthese distans*		*a*	*o*	*o*
Rock fern	*Pyrrosia sp.*				*r*

Mosses

Hypnum sp.	*o*		*o*	*o*
Polytrichum sp.	*o*		*o*	*o*

Appendix 2 – RECCE Plot Data

RECCE PLOT DATA

Development Area Sites

	T1			T2			T3			T4			T5			T6			T7					T8				T30		
	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3	P4	P5	P1	P2	P3	P4	P1	P2	P3
Percentage Raoulia australis cover (%)	20	60	70	25	40	5	30	20	50		<1		45	20	25	35	80	50	10	75	70	60	70	15	85	60	20	60	25	15
Exotic herb cover (%)	5	5	3	15	15	95	7	60	7	16	5	10	12	15	5	5	10	5	5	5	10	18	7	<5	<3	<2	<8	10	25	<9
Fern cover (%)				5	5		5		5	5	1	5	5	5	<1	<1		5	<1	<1		<1							<1	<1
Bryophyte-lichen cover (%)	<1	<2	<1	10	<1	<1		40	5	85	45	15	35	10	15	50	10	10	20	5	5	6	10	25	<1	6	6		5	<1
Bare ground-rock-gravel-litter (%)	75	35	40	60	50	10	70		50	90	80	75	60	75	60	50	15	45	75	20	25	25	30	75	15	40	75	45	65	85
Kanuka Trees (No.)									3	10	14	4	8	7	6														1	
Kanuka Tree Canopy Cover (%)										35	60	15	15	25	75														5	
Kanuka Saplings (No.)	2			1						7	8	2		2	12		4		3	1	3			5		2				
Kanuka Saplings Cover (%)										5	5	5																		
Kanuka Seedlings (No.)	1										1	7	12	3	4	2	6			8	30			15		23				
Colobanthus brevisepalus																		1										15		
Basal Area	0	0	0	0	0	0	0	0	0	3.2	7.9	1.9	1.2	3.4	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Offset Sites

	Hemlock Gully			Panorama Rise		Pylon Flat	
	P1	P2	P3	P1	P2	P1	P2
Percentage Raoulia australis cover (%)				5	<5	5	<5
Percentage Exotic Herb Cover (%)	80	95	55	95	110	22	55
Percentage Sweet Briar Cover (%)		15		<5	1		
Fern cover (%)						<1	
Bryophyte-lichen cover (%)	6		1	15	6	<1	15
Bare ground-rock-gravel-litter (%)	25	10	45	15	6	85	20
Kanuka Trees (No.)							
Kanuka Tree Canopy Cover (%)							
Kanuka Saplings (No.)							
Kanuka Saplings Cover (%)							
Kanuka Seedlings (No.)							
Kowhai Trees							
Kowhai Saplings							
Kowhai Seedlings							
Olearia lineata							
Matagouri							
Mingimingi							
Coprosma virescens							
Porcupine shrub							
Korokia							
Mountain cottonwood							
Weeping mapou							
Pohuehue							
Small leaved pohuehue							
Bush lawyer							
Sweet briar							
Basal Area	0	0	0	0	0	0	0

Benchmark Sites

	West Gully	Lot 29 Rocky Crest	Devils Creek	Firewood Creek
Percentage Exotic Herb Cover (%)		7		5
Percentage Sweet Briar Cover (%)				
Fern cover (%)		<1		
Bryophyte-lichen cover (%)				
Bare ground-rock-gravel-litter (%)	15	85		90
Kanuka Trees (No.)	3	2	2	
Kanuka Tree Canopy Cover (%)		75*	45*	
Kanuka Saplings (No.)		5		
Kanuka Saplings Cover (%)				
Kanuka Seedlings (No.)				
Kowhai Trees			11	21
Kowhai Saplings			4	1
Kowhai Seedlings			6	1
Olearia lineata	1			
Matagouri	1			
Mingimingi	1	1	17	
Coprosma virescens			11	
Porcupine shrub		1	22	
Korokia		14		
Mountain cottonwood		1		
Weeping mapou			1	
Pohuehue			1	
Small leaved pohuehue			4	
Bush lawyer				1
Sweet briar	4	10	25	
Basal Area	13.8**	0.6**	9.4****	24.5****
	0.5***	7.8****		

* - Overall trees/shrub cover
** - Kānuka
*** - Olearia lineata
**** - Kōwhai

Appendix 3 – Memorandum Regarding Lizard Management

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Report no. 7211

5 July 2024

TKO Properties Ltd
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Alexandra 9370

Dear Tim

ROCKY POINT SUBDIVISION – MEMORANDUM REGARDING LIZARD MANAGEMENT

BACKGROUND

TKO Properties Limitied (TKO) is proposing to subdivide a property at Rocky Point which was formerly part of Bendigo Station, Central Otago. The property is located above the head of Lake Dunstan between the Tarras Cromwell Road (SH8) and the Bendigo Scenic Reserve. The property covers an area of 68.6 ha.

An initial lizard survey was carried out across the entire Bendigo Estate site (Bendigo Hills Estate and Rocky Point properties) by Dr Mandy Tocher (Lizard Expert NZ; LENZ), under Wildlife Act Authority 62386-FAU, in March 2023[1]. Two lizard species were commonly found and widespread over the site: Kawarau gecko (*Woodworthia* "Cromwell"; At Risk – Declining) and McCann's skink (*Oligosoma maccanni*; Not Threatened).

All native lizard species are protected by the Wildlife Act (1953, s63 (1) (c)), which is administered by the Department of Conservation (DOC). Under the Act lizards must not be harmed, disturbed or killed without a Wildlife Act Authority (WAA) from DOC. It is standard practice for a Lizard Management Plan (LMP) to be prepared and provided with a WAA application.

TKO have engaged Wildland Consultants Ltd (Wildlands) to prepare the LMP and WAA application for the Rocky Point subdivision. This memo outlines examples of lizard management that are likely to be included in the LMP.

LIZARD SURVEY

Lizard survey methods

A three-day visual encounter survey/walk through survey was carried out over the Bendigo Estate site by Dr Mandy Tocher (LENZ) from 17 to 19 March, 2023, under WAA 62386-FAU. The surveys were carried out in weather conditions suitable for lizard activity in Central Otago. Where possible, lizards detected were captured and identified prior to release. In addition to Dr Tocher's survey in 2023, the Bendigo Estate site was also visited by Wildlands

[1] Tocher M. 2023. *Lizard Survey Report: Proposed Bendigo Hills Estate Subdivision.* Lizard Expert NZ Contract Report. Prepared for TKO Properties Ltd. 18 pp

herpetologist, Samantha King, on 17 April 2024, whereby a walk over assessment and opportunistic manual searches were undertaken (under WAA 96003-FAU).

Lizard survey results

Dr Tocher found that Kawarau gecko and McCann's skink were common and widespread over the Rocky Point site. Kawarau gecko were found so commonly across the property that they (or their sloughed skinks) were predictably present under most loose slabs on the property. Although McCann's skink were not observed as frequently as Kawarau gecko, they were still commonly observed foraging and taking refuge under living and dead scab weeds and using them as basking platforms.

The findings of the Wildlands survey undertaken in April concurred with the LENZ survey results. Both species of lizards were detected across the site. In addition, Kawarau gecko were also detected in crevices and underneath loose bark of kānuka.

Lizard habitat

Seven vegetation types occur over the site[2], including:

- Kānuka scrub and shrubland
- Cushion field (native herbfield)
- Grey shrubland
- Silver tussock grassland
- Exotic herbfield
- Exotic grassland
- Rocky substrates

Throughout each of the identified vegetation types, loose rock slabs and/or outcropping are present, which provide habitat for the two lizard species identified within the site. The surveys by LENZ and Wildlands confirmed that in areas where rocks and outcrops are less abundant, lizards of both species were found using scab weeds for cover. In addition, Kawarau gecko was observed occupying kānuka tree trunks, under loose bark and within crevices. Therefore, lizards are widespread through all of the vegetation types, in moderate-high densities across the Rocky Point subdivision site.

SIGNIFICANCE

The lizard habitats identified throughout the site meet the ecological significance criteria for rarity/distinctiveness and ecological context in the Otago Regional Policy Statement (ORPS) and the National Policy Statement for Indigenous Biodiversity (NPS-IB) because of the presence of an At Risk – Declining species, endemic to the Otago region; Kawarau gecko.

LIZARD MANAGEMENT PLAN

Due to the presence of indigenous lizards, the proposed subdivision requires a WAA under the Wildlife Act. A LMP is required to accompany the WAA application and must be submitted to DOC and approved prior to undertaking any activities that may potentially impact lizard populations, and any lizard management proposed to mitigate these effects.

Wildlands considers that it is entirely feasible that the LMP will be able to demonstrate "overall protective benefit" to local McCann's skink and Kawarau gecko populations at this site. Protective benefit ensures that lizards and their habitats are better off following the activity than they were before. The LMP will follow the principles outlined by the

[2] Beale Consultants 2023: Bendigo Hills Estate & Rocky Hills Subdivisions Terrestrial Ecology Impact Assessment.

Department of Conservation in their guidelines[3]. These principles describe steps to take and enable the outcome of successful lizard management (including salvage, if determined to be the right mitigation option). The LMP will include the following requirements:

Minimisation

- Where possible, key lizard habitats will be avoided by any development works, and additional works will be completed to enable avoidance, such as:
    - Building platform design
    - Curtilage area design and construction
    - Restrictions to gardening/resident landscaping – following the Landscape and Vegetation Protection Area.
    - Vehicle movements minimised
    - Services to be provided in a minimal way that prevents additional earthworks (such as installing cables underneath road ways).

Remediation

- Enrichment planting of lizard friendly plants to improve the naturalness of the existing lizard habitat; and to increase both plant and lizard diversity. This will include low flammable lizard friendly plants.
- Retain and place back into existing habitats rocks which are removed during earthworks.
- Rocky habitat creation to improve lizard habitat at a local scale and replace rocky habitats lost.

Mitigation

- Undertake lizard salvage and relocation, where and if required, if key lizard habitats (such as rocky outcrops or kānuka shrubland) cannot be avoided.
- Placing restrictions on the use of herbicides and pesticides within and outside of the curtilage areas.
- Provide landowners with information in order to encourage biodiversity.
- Hedgehog control if and where practical.
- Incidental Discovery Protocols for any lizard encounters during earthworks, post-salvage.

Offset

It is acknowledged that calculating offsets for lizards is difficult, owing to the cryptic nature of the species and the inability to determine species abundance or density without repeat and intensive surveys. An offset package has been prepared as part of the EcIA, which is likely to benefit lizards.

Compensation

Compensation options, if required, will be sought in collaboration with DOC. Supporting wider lizard conservation or research focused on threatened species is likely to be a better use of funding than investing in further mitigation of high numbers of McCann's skink (e.g., supporting intensive pest management and post-release monitoring programmes, that are likely to be unnecessary with no tangible outcomes realised).

[3] Department of Conservation 2019: Key Principles for lizard salvage and transfer in New Zealand. Lizard Technical Advisory Group. Department of Conservation, Wellington. Available online: https://www.doc.govt.nz/contentassets/02b1a908bcb34ff1a37652 ad357d3e2c/lizard-salvage-and-transfer-nz.pdf

SUMMARY

McCann's skink and Kawarau gecko were found at high densities throughout the entirety of the proposed Rocky Point subdivision site. Because all native lizard species are protected by the Wildlife Act and the habitats within the site meet the significance criteria under the ORPS and NPS-IB, a LMP and WAA are required before further works take place.

Wildlands are currently preparing the LMP to address any effects the subdivision works may have on lizards and ways to manage them. We consider that the LMP will sufficiently address and provide appropriate effects management, and that protective benefit can be achieved for indigenous lizards at Rocky Point. The LMP will be submitted to DOC, by Wildlands, as a part of the WAA application, on behalf of TKO.

Yours sincerely

Samantha King
Senior Herpetologist and Ecologist
Wildland Consultants Ltd

Appendix 4 – Desktop Invertebrate Assessment

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4 July 2024

Simon Beale
Beale Consultants Ltd
Alexandra

Dear Simon

TERRESTRIAL INVERTEBRATE DESKTOP ASSESSMENT OF A PROPOSED SUBDIVISION AT ROCKY POINT, CENTRAL OTAGO

Beale Consultants Ltd approached Wildland Consultants Ltd (Wildlands) on behalf of TKO Properties to undertake an invertebrate desktop assessment for a five-hectare housing development at Rocky Point, Central Otago. Previous ecological surveys have examined other ecological values, including the vegetation and habitats available.

METHODS

The terrestrial invertebrate desktop survey involved searching the Global Biodiversity Information Facility (GBIF.org 2024[1]) for species records. To filter the data, a polygon was drawn encompassing the site plus the area within five kilometres of the site perimeter. The Scientific Name filter was also applied, using the terms Arachnida, Athoracophoridae, Rhytididae, Insecta, and Onychophora to represent spiders, leaf-veined slugs, indigenous giant land snails, insects, and velvet worms respectively.

From the records retrieved by the GBIF search, freshwater invertebrates were removed. Observations that were not identified further than order, or were marked as doubtful, were deleted. This dataset was used to characterise the fauna based on the most commonly-represented orders. Of the remaining records, those identified to a useful level (usually genus or species) were scanned for notable species[2]. These were compared with vegetation and habitat on-site to judge the likelihood of each notable species occurring within the project area.

[1] GBIF.org (17 April 2024) GBIF Occurrence Download https://doi.org/10.15468/dl.2st5by

[2] Notable species are locally endemic, known or suspected to be declining, particularly sensitive to habitat loss or predation by introduced mammals, or listed as Threatened or At Risk.

SURVEY RESULTS

The GBIF search retrieved records of 78 terrestrial invertebrates that met the search terms. The invertebrate fauna was characterised mainly by beetles, and wasps, bees and ants. Of these, 70 had been identified to a level at which they could be assessed. The invertebrate fauna was predominately indigenous, with several exotic species recorded. Notable species are presented in Table 1.

Table 1: Notable invertebrates recorded within five kilometres of the site.

Species name	Common name	Threat Classification	Notability	Likelihood of being on-site
Cerius otagensis	Cromwell	Threatened – Nationally Critical (Leschen et al. 2020)	Only four specimens ever found; sensitive to habitat loss; locally endemic	Low
Holcaspis ovatella	Ground beetle	Not assessed	Locally endemic – only found in Otago	High
Hypsithocus hudsonae	Alpine shield bug	At Risk – Naturally Uncommon (Stringer et al. 2012)	May be sensitive to habitat loss; Locally endemic	High
Mecodema tibiale	Ground beetle	Not assessed	Locally endemic – only found in Otago	High
Orthodera novaezealandiae	New Zealand praying mantis	At Risk – Declining (Buckley et al. 2012)	Declining due to competition from South African mantis (*Miomantis caffra*)	High
Paranotoreas fulva	Looper moth	At Risk – Relict (Hoare et al. 2017)	Declining due to habitat loss	High
Phaulacridium otagoense	Otago short-horned grasshopper	At Risk – Declining (Trewick et al. 2022)	Declining due to habitat loss and possibly predation	High
Vanessa gonerilla	New Zealand red admiral	Not assessed	Declining due to habitat loss	Medium
Zizina oxleyi	New Zealand blue butterfly	Not Threatened (Hoare et al. 2017)	Declining due to competition from common blue (*Zizina otis labradus*)	High

Amateur and expert observations alike are stored in GBIF, and though some data standards are applied, a desktop survey is no substitute for a field survey by a qualified entomologist. However, Wildlands is confident that the desktop and on-site vegetation surveys conducted so far have provided sufficient information for the following assessment and recommendations.

INVERTEBRATE HABITAT VALUES

The cushionfield and exotic herbfield, rocky substrates, and tussock grassland are likely to be important for notable moths, beetles, and grasshoppers, some of which are At Risk or Threatened (Table 1). We note that the cushionfield, which is the most valuable invertebrate habitat at the site, is a transitional (c.f. climax) community. It is likely reverting to kānuka scrub

and then mixed scrub and forest. Nevertheless, it is probably of importance to invertebrate biodiversity. The values that remain in this habitat need to be conserved.

Since the kānuka scrub is likely to be young (mostly <30 years old), it is unlikely to be harbouring high indigenous invertebrate biodiversity (Dugdale and Hutcheson 1997) and likely has low to moderate value to indigenous invertebrate biodiversity. As it ages, its habitat values will increase. Kānuka scrub is currently likely to be of little value to notable species other than New Zealand praying mantis, which may be around the edges and in more open areas of shrubland.

POTENTIAL EFFECTS OF THE PROPOSED DEVELOPMENT ON INVERTEBRATES

Discussed in this section are potential effects that may impact invertebrates **if no effects management is applied.** All estimated impacts are conservative, as the species listed in Table 1 may not be on-site.

Permanent effects

The effects below are likely to impact invertebrates for at least 35 years.

Habitat loss
The development is likely to degrade and destroy indigenous invertebrate habitat, including cushionfield and kānuka scrub. Abrupt removal of the cushionfield will reduce available habitat for all notable species in Table 1, except for New Zealand praying mantis, which inhabits taller upright vegetation such as shrubs.

Habitat fragmentation
Patches of habitat will be removed during development, leaving fragmented habitat with reduced connectivity. Habitat fragmentation will result in further isolation of populations that are already limited in their ability to move between patches of habitat in different areas. Edge effects will also become an issue, particularly in the kānuka scrub, as the edges of habitat have different properties from the interior. Edge effects in this case will most likely be limited to reduced humidity around the edges of the scrub, leading to increased risk of desiccation for indigenous invertebrates such as molluscs, and increased access to the habitat by introduced predators.

Increased predation
Human activity attracts introduced pests, including vespid wasps (genus *Vespula*), sparrows (*Passer domesticus*) and other introduced birds, and mammals such as rats (*Rattus* spp.). Humans may also allow pet cats to roam outside. Many pests associated with humans are detrimental to invertebrate populations.

Collateral damage from domestic pesticide use
Humans living in the proposed housing development may use pesticides around the outside of their houses and gardens, which will impact pollinators and potentially the species listed in Table 1.

Disruption to nocturnal flying insects from lighting
Lighting from houses, street lamps, and other artificial sources is likely to alter the behaviour of flying insects, which are attracted to light and can become trapped around the light sources.

Temporary effects

The effects below are likely to impact invertebrates during the construction period only.

Disturbance from dust and vibration
The roots of vegetation on-site hold soil in place; their removal will increase dust mobility. Vehicles on-site will likely disturb dust and also cause vibration. Dust may impact invertebrates by blocking spiracles, irritating the cuticle, affecting access to food, and increasing desiccation of soft-bodied and mucous-coated species. Vibrations are a crucial part of the way some invertebrates perceive their world, and vibrations and noise from machinery may interfere with many aspects of their physiology and behaviour (Raboin & Elias, 2019).

Direct injury and mortality
When their habitat is removed, some individual invertebrates will be killed. Others may be squashed or struck by vehicles during construction. Mulching cleared vegetation is likely to kill invertebrates dwelling therein.

APPROPRIACY OF PROPOSED EFFECTS MANAGEMENT FOR INVERTEBRATES

Preliminary effects management has been proposed as part of the offset-compensation package and Assessment of Ecological Effects. Table 2 outlines the proposed effects management and its efficacy in addressing effects on invertebrates.

Other effects management outlined in the Ecological Impact Assessment that will benefit invertebrate biodiversity and some of the notable species in Table 1 includes:

- Creating rocky habitat ahead of the development works through stacking slab rocks across areas naturally impoverished of rock, on open and sunny sites.
- Limiting the extent of construction areas including laydowns and construction related parking.
- Prohibiting moving or using rock slabs for construction purposes.
- Avoiding rock habitat and having set-backs or no disturbance zones around rock outcrops.

While these actions are listed as lizard management, they should also be considered invertebrate management.

ADDITIONAL EFFECTS MANAGEMENT SUGGESTED FOR INVERTEBRATES

The following recommendations should be followed to manage all effects for invertebrates to achieve no net loss of indigenous invertebrate biodiversity.

Habitat loss
To address the loss of invertebrate habitat, the offset and compensation planting areas need to be of sufficient size to take account of the lost habitat and the time delay to restore replacement habitat. This may require a larger area of habitat to be restored than the area lost, and this will need to be assessed by way of an offset model.

Table 2 – Analysis of proposed effects management for invertebrates.

Community/ habitat affected	Effects to be addressed	Effects management proposed	Additional effects management needed?
Kānuka scrub	Habitat loss	Planting kānuka and other late successional indigenous plant species, to cover an area larger than that which has been removed.	**Yes:** the plants replacing the lost habitat will take at least 10 years before they present habitat of equal or better quality.
	Habitat fragmentation	Strategic planting and weed control to encourage spread of indigenous shrub developing into forest.	
Cushionfield	Habitat loss	Enhancement of remaining cushionfields in saline ecosystems by removing tall exotic herbs.	**No:** this management will ensure permanent habitat availability for cushionfield invertebrates which would otherwise disappear as it is a transitional (c.f. climax) habitat. Enhancement will also increase the carrying capacity of the permanent cushionfield so that invertebrate abundance and possibly diversity can increase there.
	Habitat fragmentation		
All habitats	Increased predation	Prohibiting outdoor cats as pets.	**Yes:** introduced species, particularly rats, mice, hedgehogs, and wasps, will still present a threat to invertebrates.
	Habitat loss/fragmentation	Vegetation clearance will avoid damage to vegetation beyond the defined construction sites. The clearance of mature *Olearia lineata*, matagouri, mingimingi, and Corokia should be avoided.	**Yes** for kānuka scrub (see above)
	Collateral damage from domestic pesticide use	Placing restrictions on the use of herbicides and pest control within and outside of curtilage areas	**Unknown:** the restrictions are not specified.
	Disturbance from dust and vibration	All machinery movements shall be limited to the construction sites and defined accessways at all times.	**Yes:** invertebrates, including notable species, may still be adversely impacted by dust and vibration.
	Direct injury and mortality	All machinery movements shall be limited to within the construction sites and defined accessways at all times.	**Yes:** invertebrates, including notable species, may still be adversely impacted by direct injury and mortality.
	Disruption to nocturnal flying insects from lighting	None	**Yes**: insects, including notable species, may be adversely impacted by artificial lighting.

Cleared coarse woody vegetation should be stacked around the edges of the replacement habitat, or in open spaces within the habitat, to provide additional habitat for invertebrates. Large logs should be cut to lengths approximately 50 cm long and stacked in the replacement habitat.

Habitat fragmentation
Connectivity loss can be remedied by planting indigenous shrubs in and around the site when construction is complete. The shrubs should aim to connect patches of habitat.

Increased predation
Hedgehogs, mustelids, and rats should be controlled in the compensation area and the enhanced cushionfield. Vespid wasps should be controlled throughout the site by destroying nests and encouraging residents to report wasp nests.

Collateral damage from domestic pesticide use
Restrictions on pesticide use should include a ban on insecticide spray and generalised non-targeted treatments designed to kill invertebrates within the curtilage areas. Targeted (species-specific) control of pest ants, wasps, aphids, and other household and garden pests should remain permitted, though sprays that may drift and kill non-target species should be discouraged.

Disturbance from dust and vibration
The impacts of dust should be minimised by implementing a Dust Management Plan (DMP). The DMP could include actions such as watering surfaces when they become dusty and limiting dust-producing activities on days when dust is most likely to be spread (such as during warm, dry weather). The effects of vibration on indigenous invertebrates can be minimised by limiting high-vibration activities (such as pneumatic drilling and driving heavy machinery) at peak activity times for invertebrates, such as above 13^{o}C on a sunny day between October and March.

Direct injury and mortality
Direct injury and mortality should be minimised by limiting activity after dark on warm summer nights, and avoiding vehicle movement around cushionfields at peak activity times for invertebrates, such as above 13^{o}C on a sunny day between October and March.

Instead of mulching cleared vegetation, it should be stacked in the restored habitat to allow invertebrates living therein to move gradually into the shrubland.

Disruption to insects from artificial lighting
Using lamps that emit light towards the red end of the electromagnetic spectrum will reduce their attractiveness to insects. Lamps should be shaded where possible. Placing lamps in areas where their light will not reach far, such as behind vegetation, will further minimise their impact on insects.

CONCLUSIONS

The proposed development has potential impacts of detriment to terrestrial indigenous invertebrates, but these will be mitigated using the protocols outlined in this document. If

these measures are implemented, effects of the proposed development on invertebrates will be adequately addressed. Much of the effects management for invertebrates is similar to effects management for other taxa, particularly for lizards, so that actions taken to manage effects for one taxon will also help another.

Yours sincerely

Vikki Smith
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Wildland Consultants Ltd

Reviewed and approved for release by:

Justyna Giejsztowt
Ecology Team Leader, Christchurch Office
Wildland Consultants Ltd

REFERENCES

Buckley T.R., Palma R.L., Johns P.M., Gleeson D.M., Heath A.C.G., Hitchmough R.A., Stringer I.A.N. 2012: The conservation status of small or less well known groups of New Zealand terrestrial invertebrates. New Zealand Entomologist 35(2): 137-143. DOI: 10.1080/00779962.2012.686319.

Dugdale, J., & Hutcheson, J. 1997: Invertebrate values of kanuka [sic] (*Kunzea ericoides*) stands, Gisborne Region. *Science for Conservation series.* ISBN 0-478-01921-1. Department of Conservation, Wellington.

Hoare, R.J.B.; Dugdale, J.S.; Edwards, E.D.; Gibbs, G.W.; Patrick, B.H.; Hitchmough, R.A.; Rolfe, J.R. 2017: Conservation status of New Zealand butterflies and moths (Lepidoptera). New Zealand Threat Classification Series 20. Department of Conservation, Wellington. 13 p.

Leschen, R. A. B.; Marris, J. W. M.; Emberson, R. M.; Nunn, J.; Hitchmough, R. A.; Stringer, I. A. N. 2012: The conservation status of New Zealand Coleoptera. New Zealand entomologist 35(2): 91–98.

Stringer IAN.; Hitchmough RA.; Lariviere M.-C.; Eyles AC; Teulon DAJ.; Dale PJ.; Henderson RC. 2012: The conservation status of New Zealand Hemiptera. New Zealand Entomologist 35(2): 110–115.

Trewick S., Hegg D., Morgan-Richards M., Murray T., Watts C., Johns P., and Michel P. 2022. Conservation status of Orthoptera (wētā, crickets and grasshoppers) in Aotearoa New Zealand, 2022. New Zealand Threat Classification Series 39. Department of Conservation, Wellington.

Ward D, Early J, Schnitzler F-R, Hitchmough, R, Rolfe, J, and Stringer, I. 2017. Conservation status of New Zealand Hymenoptera. New Zealand Threat Classification Series 18. 14 p.

Appendix 5 – Rocky Point Subdivision – Saline/Sodic Soils Identification and Location

ROCKY POINT SUBDIVISION

Bendigo

SALINE/SODIC SOILS Identification and Location

May 29th 2024

Roger Gibson Land and Sea Services

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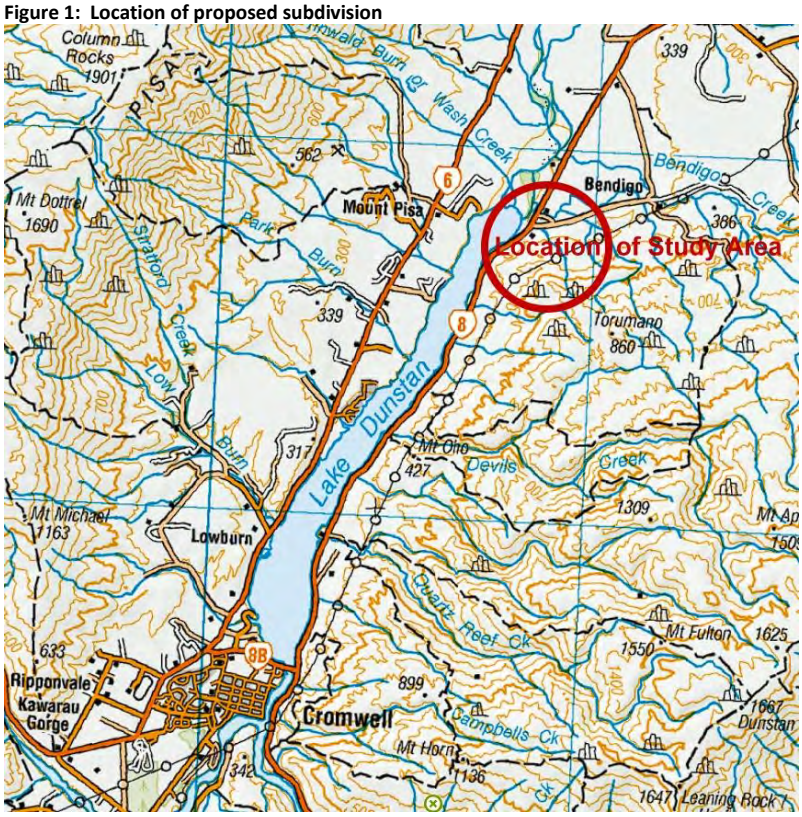
1 Introduction

1.1 Overview

TKO Properties LTD has applied for Resource Consent from the Central Otago District Council to undertake a subdivision at Rocky Point, Bendigo. During the consent process it was identified that information was lacking on the presence of Saline/Sodic soils within the subdivision area. Gibson Land and Sea services (GLS) has been commissioned by TKO Properties to identify areas of interest for saline/sodic soils. This report presents the findings using aerial imagery, a site visit and chemical analysis of surface soil samples.

Figure 1: Location of proposed subdivision



1.2 Limitations

GLS has exercised the normal level of care and expertise expected by members of the environmental science profession. No warranties, express or implied, are made. The confidence in the findings is limited by the Scope of Work, and by limited data due to the size of the area and time available and the visit being at one time of year. No systematic survey to cover the entire area and all its variations in time or space has been undertaken and a full range of soils that are present at the location may not have been seen or recorded.

The results of this assessment are based upon an inspection of aerial photography, site inspection of areas identified of interest by GLS, and chemical analysis of soil samples undertaken by Hill-Labs. All conclusions and recommendations regarding the property are the professional opinions of GLS, subject to the qualifications made above.

While normal assessments of data reliability have been made, GLS assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside GLS, or developments resulting from situations outside the scope of this project.

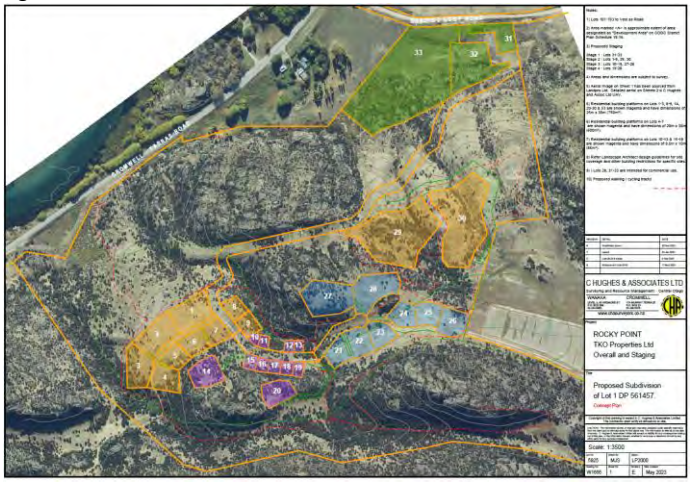
2 Environment

2.1 Environment

The study area is located adjacent to the northern end of Lake Dunstan (Figure 1) and its western boundary extends along approximately 1.5km of State Highway 8 and rises towards the east to an altitude of approximately 217 metres.

The study area straddles the boundary of the Dunstan and the Pisa Ecological District of the Central Otago Ecological Region (Grove and Ward, 1994). These ecological districts can be generalised as having a dry pseudo-subcontinental climate with strong altitudinal gradients. Most of the fans and terraces have been modified and are now in exotic pasture with sweet briar and grey scrub communities widespread on lower slopes (McEwen, 1987).

Figure 2: Subdivision Plan



2.2 Physical parameters

The study area covers approximately 70 ha and ranges in elevation between 200 m and 417 m above sea level. The majority of the area is north facing with an annual median rainfall of 400-450 mm and has amongst the highest evapotranspiration rates found in Central Otago. The resultant moisture deficits particularly over summer leads to an environment that can be classified as semi-arid.

2.3 Geomorphology

The study area is visually dominated by schist rock outcrops and bluffs of the Rakaia terrane and locally referred to as "The Bendigo Bluffs". Early Pleistocene glacial advances descending from Wanaka/Hawea reached to adjacent or beyond the study area during the Lowburn and Lindis advances. However most notable for the study area are the terrace remnants interspersed between the rock outcrops at approx. 300 m above sea level. These were deposited as a result of the Lindis or Luggate advances several hundred thousand years ago and consist of moderately weathered schist and greywacke gravels.

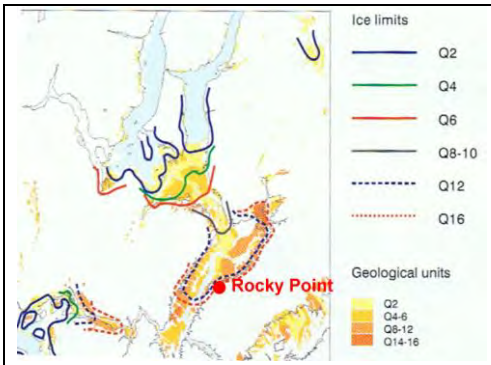


Figure 3. Glacial advances in the Upper Clutha

Pre-Pleistocene Lake Manuherikia group sediments dating back to the Miocene and buried under later glacially deposited gravels are commonly exposed in the Upper Clutha valley where either natural or anthropogenic processes have eroded the covering gravels. These are relatively common around Central Otago and are for example a feature of the landscape at Bannockburn. However none of these areas were shown on the geological maps examined and none were observed during field inspection.

2.4 Soils

Soils are mostly classed as Semiarid with RAW soils on the steep slopes and terrace risers.

Figure 4. Soil exposure on nearby terrace

RAW soils lack distinct top soils development and occur where the development of topsoil is prevented by rockiness, active erosion or deposition. (Hewitt 1993). RAW soils are found within the study area wherever steepness e.g on terrace risers or bluffs, precludes the development of soils through active movement of parent material.

Semiarid soils occur in the inland basins of Otago and southern Canterbury where precipitation is less than 500mm. They are high base status soils in which a water deficit prevails over most of the growing season. Wetting fronts fail to penetrate deeper than the base of the soil with consequent accumulation of pedogenic lime and soluble salts. The flat glacial outwash terraces found within the study area have provided a stable geological surface for several hundred thousand years allowing sustained illuviation to present a mature profile with clearly defined Bkm, Bk, and Bt horizons similar to that pictured in Figure 4. The majority of these soils will be Aged-Argillic Semiarid soils and are relatively common throughout Central Otago

2.5 Saline soils

Within the Semiarid soils of Central Otago there are areas of soil where in the absence of leaching, soluble salts have accumulated to such an extent that they present an inland saline or saline-sodic ecosystem. The source of soluble salts is from the weathering of several geological substrates: basement schist, ancient marine or lake sediments, and old alluvial gravels (Landcare Research). Recent scientific work by (Craw *et al*, 2022) shows marine aerosols have also been a source of salt in these soils. Regardless of the source, within the semi-arid climate zone wherever water moves down a slope accumulating and dissolving salt as it travels and if it eventually pools on impermeable or semi- impermeable surfaces evaporation will occur and any salt contained within the water will be left behind leading to surface accumulation of salts. The main salts are usually chorides or sulphates of sodium or calcium. Magnesium salts are also not uncommon. Elevated levels of salts overall lead to elevated levels of salinity. Where levels of sodium are significant soils are described as having elevated sodicity.

Rogers *et al*, (2000) recognise five geomorphic units where saline/sodic soils can be found in Central Otago, they are; saltpan, salt meander channel, salt plain, salt knoll and salt apron. Of these the last two are most relevant landforms for where Saline/sodic soils may been found in the study area. Salt Knolls are described as "*Patches on convex or planar eroded land surfaces"* and salt aprons as "*Patches on concave or planar land surfaces on which erosion sediments have accumulated or are accumulating generally downslope from eroding salt knolls*".

Saline/Sodic soils provide a difficult environment for plants not adapted to the challenges they present. High concentrations of any soluble salt will create an osmotic environment that will make it very difficult for plants to take up water. High levels of Sodium causes Calcium to be displaced from Clay surfaces. Calcium plays an important role in flocculating clay particles in the soil helping create structure and preventing dispersion. Sodium ions due to their larger atomic size and single charge cannot fulfil this role. As a consequence soils that have a high proportion of exchangeable Sodium

tend to be poorly structured and dispersive. Where a high pH also occurs, nutrient availability is affected, and toxicities and deficiencies may occur.

The challenges for vegetation growing in these environments is significant and generally it favours sparse, mostly herbaceous vegetation and specialised plants known as Halophytes. At the nearby Mahaka Katia Scientific reserve on the western side of the Clutha River halophytic threatened or unusual flora present include: *Atriplex buchananii*, *Craspedia* "Kaitorete", *Leptinella* "Clutha", *Lepidium sisymbrioides* subsp. *Sisymbrioides* (Allen and McIntosh 1997).

Although Inland saline soils with neutral–alkaline pH are scattered around the main basins of Central Otago, their current distribution is an estimated mere fraction (< 1%) of what is believed to have existed at the time of European settlement (Rogers *et al*. 2000). It is estimated they formerly covered more than 40 000 ha of semi-arid land in the Maniototo basin, mid-Manuherikia Valley, and upper Clutha Valley (Raeside & Cutler 1966; Leamy & Saunders 1967;). According to Allen and McIntosh (1997) mining, cultivation and irrigation have reduced the area of these soils to less than 100 ha.

Most salt pans are now surrounded by non-saline agricultural land that has little or no indigenous character and only a few are adjacent to non-saline land that still supports plant species representative of the pre-European flora. (Allen and McIntosh 1997).

3. Methods

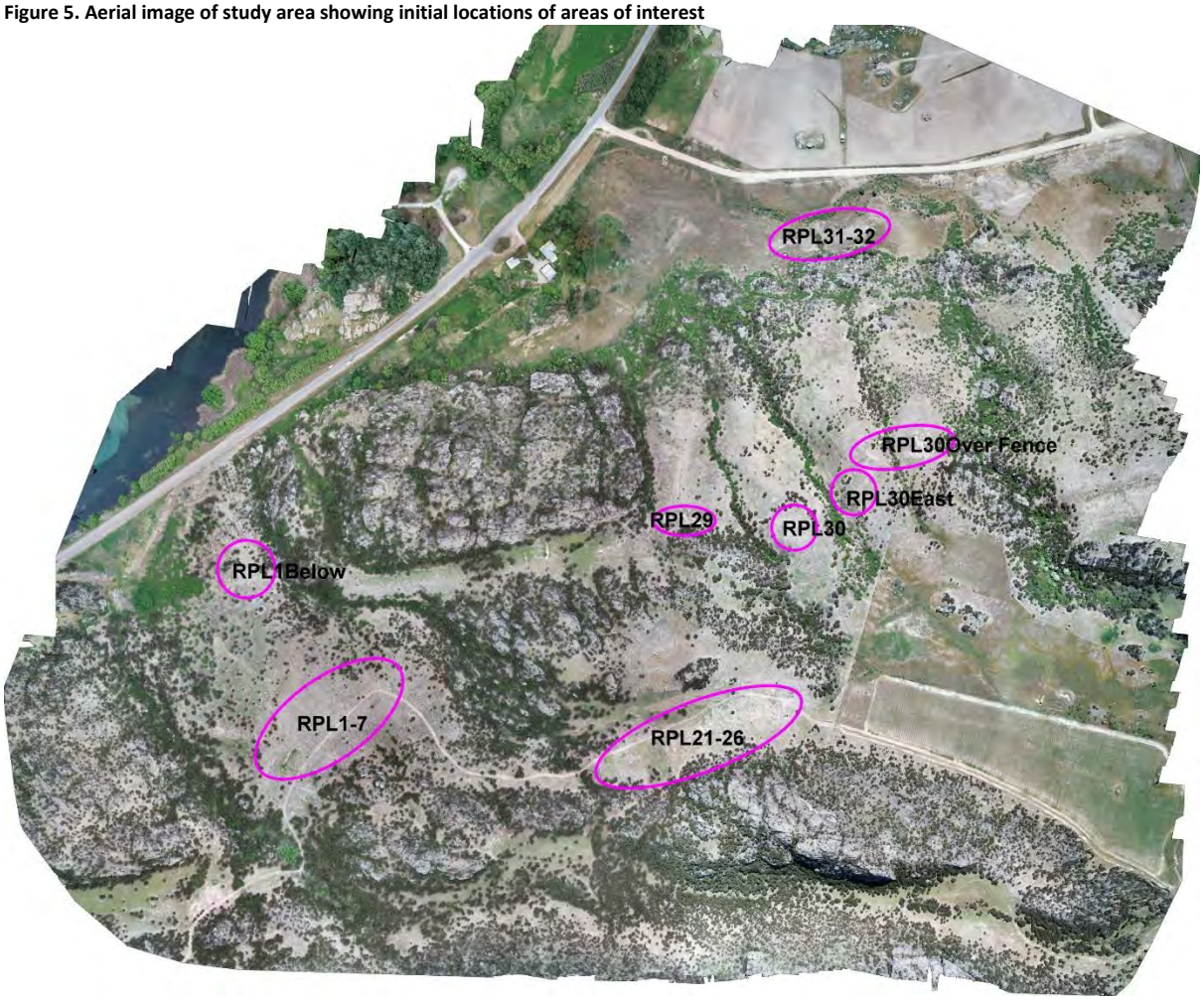
An initial assessment was made using the high resolution aerial drone photography that is available for the site. As high levels of Sodium result in low soil aggregate stability consequently the potential for wind and stormwater erosion is high. As a result areas of high salinity/sodicity are often marked by actively eroding areas, blow outs and bare patches where overall slope stability would suggest they should be stable and vegetated. These are usually fairly easily spotted on aerial photography and in extreme cases may even be accompanied by a white tinge on the surface as a result of salt encrustation. However ablation areas close to terrace risers can experience extreme winds and erosion quite independent of salinity/sodicity and so presence of erosion or blowouts is not definitive.

A lack of scrub or tree vegetation and sparse herbaceous vegetation is also indicative of potential; Saline/Sodic soils. The cushion plants Rao*ulia australis* and *R. beauverdii* also typically occurr on sites having an elevated level of salinity/sodicity and are useful for identifying sites for interest. These species however are not restricted to saline areas. Bare patches devoid of most vegetation amongst cushion fields can indicate extreme localised levels of soluble salts causing toxicity to most plants.

As neither of the above methods can provide a definitive diagnosis, following an identification of potential areas on the aerial photography a field visit was carried out, vegetation observed and soils samples taken and sent for analysis by Hill-Labs.

4. Results and Interpretation

Figure 5. Aerial image of study area showing initial locations of areas of interest



Eight areas of interest were identified from the aerial photography and visited, their soils sampled and sent for analysis. In addition one further area of interest outside of the study area was also sampled. Soil results from Hill- Labs are provided in Appendix 1. Aerial Imagery showing areas sampled is given in Appendix 2.

Figure 6. Soils with soluble salts and their categories as defined by Rogers *et al* (2000)

Saline soils	EC of 0.18 mS/cm or more, ESP less than 15% , and pH values below 8.5.
Saline-sodic soils	EC of 0.18 mS/cm or more, ESP of 15% or more, and pH values near or above 8.5.
Sodic soils	EC less than 0.18 mS/cm, ESP of 15% or more, and pH above 8.5.

We have used the categories used by Rogers *et al*, (2000) for describing the soils sampled. Rogers *et al* recognised that within the large number of soil parameters they analysed, three broad types of soil could be recognised within the saline/sodic spectrum; saline (dominated by Sodium), sodic (dominated by exchangeable Sodium) and saline-sodic (dominated by both exchangeable Sodium and Sodium as a salt. Electrical Conductivity (EC) and Exchangeable Sodium percentage (ESP) were identified as useful gradients for study. It was noted that although high pH is often associated with Sodic soils and Rogers *et al* have given accessory limits they state pH is not differentiating.

It should also be noted that surface (0-75mm) soil sampling provides a single snap shot in time of what is a fairly dynamic system. Because soluble salts dissolve in water they move easily and composition and concentration of any given horizon can vary from time to time and place to place within a saline ecosystem. A heavy rainfall event may dissolve, wash away or leach away a surface salt build up or change its composition depending on differing solubility of its components. Over time salts will accumulate again as new salt is transported in and water evaporated off. Ideally a series of analyses over time would give the most accurate picture of the soils chemistry (Raeside & Cutler 1966, Craw *et al*. 2024). Spatial variability can also exist within a saline/sodic ecosystem depending on geomorphic changes. Salt accumulation will be highest where water currently pools and evaporates from (Rogers *et al,* 2000). Our soil chemistry results are thus indicative of the presence of salt in the soil where soils were sampled. Discussion will include vegetation and geomorphology to give a fuller interpretation of where a salt influenced ecosystem may exist.

Table 1. Summary of results and observations from areas initially identified from aerial imagery

	pH	EC mS/cm	ESP %	Comment
RPL 1 – Below (approx. 0.2ha)	6.5	0.02	1.5	Not Saline, Steep slope inconsistent with salinity, RAW soil.
RPL 1-7 (approx. 1.2 ha)	6.4	0.14	9.7	Modified by water race/dam so historical water application possible; Regenerating Kanuka present is consistent with only mild salinity.
RPL 21-26 (approx. 1.2 ha)	6.6	0.26	21.2	Saline-Sodic. Visible signs of salinity/sodicity particularly on the lower flatter parts of the area. Bare areas on lower parts of slope showed possible salt crusting.
RPL 29 (approx. 0.1ha)	6.0	0.37	29.1	Saline-Sodic. Small area on knoll <0.2 Ha
RPL 30 (approx. 0.1ha)	6.7	0.03	0.6	Not Saline
RPL 30 East (approx. 0.2ha)	6.6	0.02	0.7	Not Saline
RPL 30 Over fence	6.0	0.63	28.9	Saline-Sodic. Visible signs of salinity/sodicity. Multiple areas of blow outs and erosion with small collection evaporation zones on gentle slope/apron below.
RPL 31-32 (approx. 0.2ha)	7.6	0.12	0.2	Low Sodium but High proportion Ca and Mg, Possible Dolomitic Lime application affected or possibly pedogenic lime erosion from above – mildly saline but non-Sodic. Vegetation/ grasses etc dont appear consistent with high salinity.
RP Comp East (approx. 1.3ha)	6.3	0.03	0.5	Not Saline – Bare areas at front of terrace riser elevated from areas behind and are unlikely to have received transport of salt through water movement. Bare areas are most likely result of wind ablation.

Of all the areas sampled only RPL 29, RPL 30(over the fence) and RPL21-26 have shown significant chemistry consistent within the spectrum of Saline or Saline-Sodic soils. The extent of area RPL29 is quite limited. RPL30(over the fence) is on the same position of the landscape as RPL29 but further

along the edge of the terrace and is more extensive. RPL21-26 is the most extensive area and is discussed last.

RPL1Below

A steep slow on eroding permeable gravels inconsistent with water pooling and evaporation and salinity build up. No visible sign of salt and chemistry shows no indication of salinity – conclude this is a RAW soil

RPL1-7

RPL1-7 shows elevated levels of EC (salinity) and ESP (Exchangeable Sodium) but they are less than the criteria used by Rogers *et al* and maybe best described as slightly/mildly saline. Much of this area shows regenerating seedlings of Kanuka which are unlikely to be present if salinity/sodicity was high. This area also had the remnants of an old irrigation reservoir and water race which suggest that at some stage in the past it may have already experienced water runoff and levels of leaching that may have removed accumulated salts. Within the area sampled there may be some limited patches of higher concentrations of soluble salts but overall it is not considered significantly saline or sodic.

Figure 7. Regenerating Kanuka across proposed lots 1-7

RPL29

This is a very small area of saline/sodic soil just below an eroding knoll. Cushion field and soil chemistry that confirms Saline-Sodic categorisation

RPL30

An area of what appears to be wind ablation on a mostly permeable surface. Possibly visible signs right at the western margin of a tiny area of salinity. Soil chemistry shows no indication of accumulated soluble salts,

RPL 30 East

The same situation as RPL30 except no visible signs of salinity anywhere in the sampling area

RPL 30 Over fence

This is an area similar to RPL29 in its position on the landscape but is a more extensive area of saline/sodic soil located just below an eroding knoll. Cushion field and soil chemistry confirms Saline-Sodic categorisation

Figure 8. Images taken looking uphill on the area identified as RPL30 (over the fence).

RPL31-32

RPL31-32 had slightly elevated levels of Salinity and high pH. However Sodium is at very low background levels whereas exchangeable Calcium and Magnesium are both elevated and the site has 100% Base Saturation. This area is adjacent to the Bendigo Loop road and not far from where the top dressing airstrip that once existed alongside the road was. It is possible that the area has been fertilised with Lime or possibly Dolomitic Lime. The vegetation was not consistent with Saline areas and consisted mostly of introduced grasses. Alternatively it may be affected by eroding pedogenic lime from an exposed Bk horizon eroding above it.

RPL Comp

This is an area outside of the study area that is being evaluated as a possible compensation area. Soil chemistry shows no signs of salinity/sodicity. Covered in areas of wind ablation bear the edge of the terrace riser. The area examined had no slope behind to act as source of downward moving salt and the substrate appeared to be permeable gravels without any area for water to pool and evaporate leaving salt behind to accumulate

RPL21-26

A slope with an apron area at its foot. Visible signs of salinity/sodicity particularly on the lower flatter parts of the area where areas of possible salt encrustation are showing. Mid slopes show many blowouts and eroded areas where salt is presumed to be eroding from and being transported downslope and accumulated at lower levels. Mostly covered in cushion field. The initial soils results for the sample taken from throughout the area of proposed lots 21-26 show elevated levels of soluble salts with ESP well above the 15% threshold to be considered Sodic.

It was not immediately clear for this area where the outer limits of the saline/sodic ecosystem exist and where the greatest accumulation of salt may be found. Lot 26 is mostly outside what appears to be the salt supply and accumulation zone and as it is mostly sloping permeable gravels away from the main accumulation apron it was thought that it may have no accumulated salinity nor would it

Figure 9. Image taken from western edge of Lot 24 looking towards Lots 23-21. Foreground shows possible salt accumulation. The slope behind below the Kanuka shows areas eroding and most likely source of salt.

be supplying salt. Likewise the area to the North of Lots 24 and 25 is below the accumulation apron and consists of permeable gravels with a thin layer of loess on top. It is unlikely this area has any role in the saline/sodic ecology of the area. Towards Lot 21 there also less visual evidence of an accumulation/evaporation zone for salt. Significant salinity/sodicity may still be present in small hollows and may be still part of the ecosystem.

Although vegetation and landform shape/substrate permeability gives us clues as to the limits of the salt supply and accumulation zone, detailed soils sampling of these lots was needed for greater confidence in setting these boundaries. In order to understand the soils of this area better it was therefore decided to undertake further sampling. Areas sampled is shown in Appendix C. EC, pH and ESP results from Hill-Labs analysis are shown in Table 2.

Table 2. Summary of results and observations from secondary sampling in and around Lots 21-26

	pH	EC mS/cm	ESP %	Comment
RPL21	6.1	0.07	5.8	Slightly elevated ESP
RPL22	6.8	0.03	4.4	Slightly elevated ESP
RPL23	6.1	0.28	15.9	Saline-Sodic.
RPL24 and 25 above track	6.0	0.43	31.9	Saline-Sodic. Visible signs of salinity/sodicity. Multiple areas of blow outs, erosion with small collection evaporation zones on gentle slope below leading to what is thought to be main accumulation zone below track.
RPL24 and 25 below track	6.0	0.66	21.5	Saline-Sodic. Visible signs of salinity/sodicity particularly on the lower flatter parts of the area. Bare areas showed possible salt crusting.
RPL26	7.0	0.03	0.7	Not Saline
Area North of RPL24 and 25	6.1	0.03	0.8	Not Saline

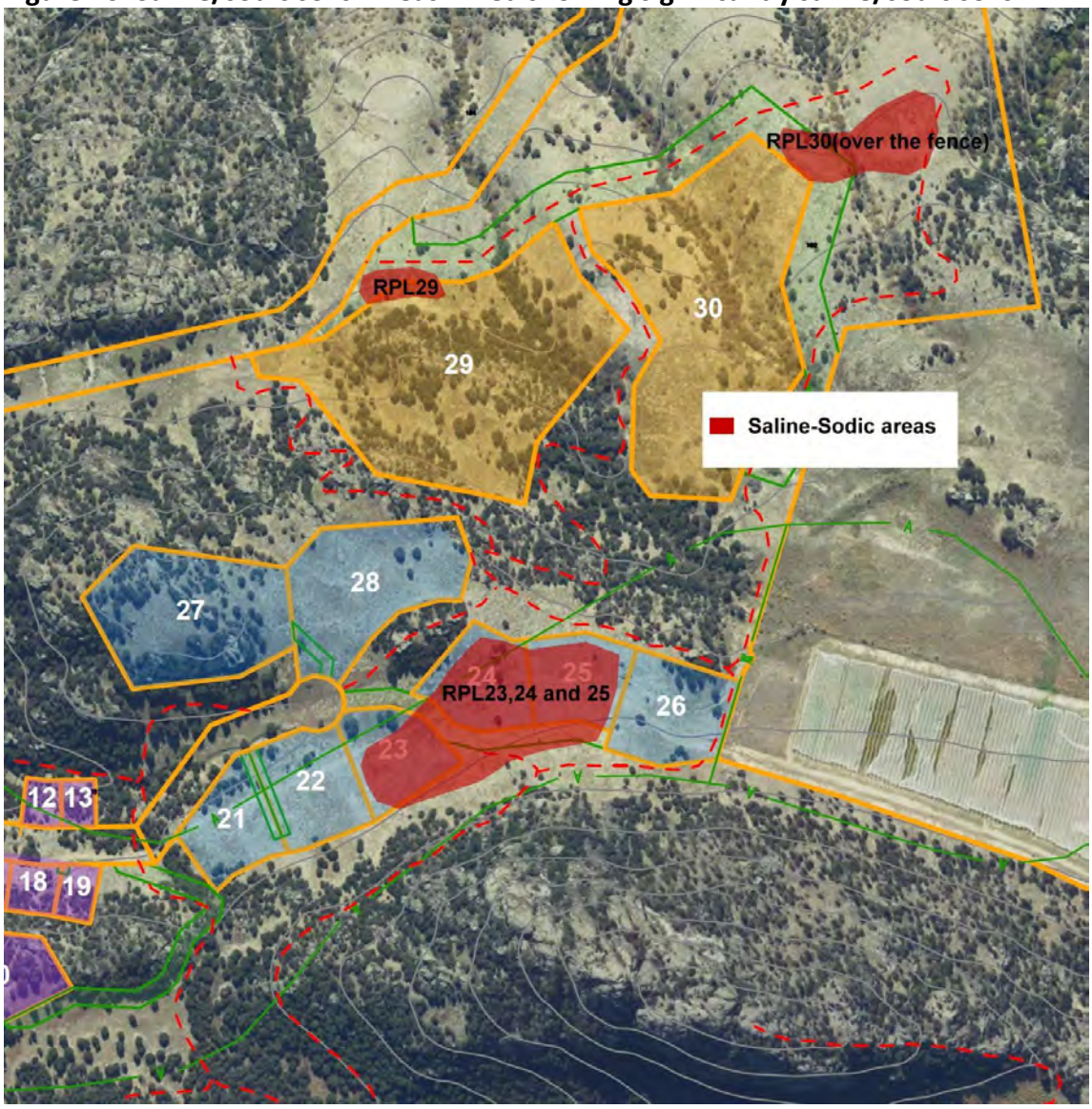
As expected there is variability of salt accumulation across the proposed lots 21-26. The main area of accumulation is on or around proposed lots 23, 24 and 25 and results from these samples show significantly raised EC and ESP consistent with classification as Saline-Sodic. The soil results for Lots

21 and 22 show slightly elevated levels of ESP but no elevation in EC. These two lots can therefore be considered to be outside the main salt accumulation zone and instead a part of the peripheral saline influenced ecological area. As was previously suspected, Lot 26 and the area to the north of Lots 24 and 25 showed no chemistry consistent with salinity. These are both just outside of the salt producing landform and accumulation zone.

5. Summary

Three areas were identified with visible signs of salinity/sodicity and with chemistry results that confirm this. These are shown in figure 9. The area RPL29 is small (<0.1ha) and on its own does not contribute significantly in terms of area although it does contribute to the overall ecological mosaic and diversity of the area. RPL30(over the fence) is a larger area (approx. 0.2ha) and more significant contributor to the diversity of the study area. Secondary sampling of Lots 21-26 showed the significantly saline/sodic soils area is centered on proposed lots 23-25. This is the largest area observed (approx. 0.8ha)

Figure 10. Saline/sodic soils. Areas in red showing significantly saline/sodic soils.



All saline areas showed evidence of an erosion or source area for salt and accumulation zone below where water accumulates in patches over less permeable layers and evaporates off leaving transported salt behind. As salt is eroded these from the slope above the accumulation zone, it will be transported with water movement to wherever water pools above the less permeable layers. Heavy rain may shift and re-dissolve and move surface salt build up or change its composition depending on differing solubility of its components. Re-dissolved salts may then be left behind again further downslope where water has pooled and evaporated. Over time salts will accumulate again as new salt is transported in and water evaporated off. So within a saline/sodic ecosystem a supply area and an accumulation area will exist within which there will be spatial and temporal variability even though it is all part of saline/sodic ecosystem.

6. References

Allen RB, McIntosh PD. 1997. Guidelines for conservation of salt pans in Central Otago. *Science for Conservation 49*. Wellington: Department of Conservation.

Craw D, Rufaut C, Pillai D 2022 Geological controls on evolution of evaporative precipitates on soil-free substrates and ecosystems, southern New Zealand. *Sci Total Environ* 849:157792

Dave Craw, Joanna Druzbicka, Shanna Law, Kat Lilly, and Cathy Rufaut 2024 *Evaporative salts in Central Otago* https://www.otago.ac.nz/geology/research/environmental-geology/geomorphology/evaporative-salts-central-otago

Grove P.B., Ward, C.M., 1994 *Lindis, Pisa and Dunstan Ecological District: A Survey Report for the Protected Natural Areas Programme.* Issue 36 of New Zealand Protected Natural Areas Programme. Department of Conservation, Otago Conservancy

Hewitt 1993 New Zealand Soil Classification, Landcare Research Ltd

Landcare Research - Inland saline (salt pans) web page. https://www.landcareresearch.co.nz/publications/naturally-uncommon-ecosystems/inland-and-alpine/inland-saline

Rufauta C, Craw D, Druzbickab J and Law S 2018 Conservation of saline patches in Central Otago needs better recognition of physical processes to secure future habitats; *New Zealand Journal Of Botany*, 2018 vol. 56, no. 1, 115–126

Raeside JD, Cutler EJB, Miller RB. 1966. Soils and related irrigation problems of part of Maniototo Plains, Otago. *New Zealand Soil Bureau Bull 23*. Wellington: Department of Scientific and Industrial Research.

Rogers GM, Walker S, Tubbs M, Henderson J. 2002. Ecology and conservation status of three "spring annual" herbs in Dryland ecosystems of New Zealand. *New Zealand Journal of Botany*. 40:649–669.

Rogers G, Hewitt A, Wilson JB. 2000. Ecosystem based conservation strategy for Central Otago's saline patches. *Science for Conservation 166.* Wellington: Department of Conservation.

Appendix A. Soils results from Hill Labs

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Certificate of Analysis

Client:	Roger Gibson	Lab No:	3540197 shvpv1
Address:	5 Elite Court RD 3 Cromwell 9383	Date Received:	12-Apr-2024
		Date Reported:	17-Apr-2024
		Quote No:	
		Order No:	
		Client Reference:	Rocky Point - TK
		Submitted By:	Roger Gibson

Soil Analysis Results

Sample Name:		RPL 1 - Below	RPL 1-7	RPL 21-26	RPL 29	RPL 30	RPL 30 East
Lab Number:		3540197.1	3540197.2	3540197.3	3540197.4	3540197.5	3540197.6
Sample Type:		SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard
Sample Type Code:		S49	S49	S49	S49	S49	S49
pH	pH Units	6.5	6.4	6.0	6.6	6.7	6.6
Olsen Phosphorus	mg/L	8	19	10	15	10	9
Potassium	me/100g	0.41	0.43	0.32	0.17	0.54	0.46
Potassium	%BS	7.7	6.9	6.8	3.3	10.1	9.0
Potassium	MAF units	10	10	8	4	12	11
Calcium	me/100g	2.2	2.6	1.6	1.9	2.6	2.4
Calcium	%BS	42	43	35	38	47	47
Calcium	MAF units	3	4	2	3	4	3
Magnesium	me/100g	0.60	0.80	0.58	0.79	0.55	0.53
Magnesium	%BS	11.4	12.8	12.1	15.4	10.2	10.3
Magnesium	MAF units	16	20	15	21	14	13
Sodium	me/100g	0.08	0.61	1.01	1.49	< 0.05	< 0.05
Sodium	%BS	1.5	9.7	21.2	29.1	0.6	0.7
Sodium	MAF units	4	31	55	82	< 2	< 2
CEC	me/100g	5	6	5	5	5	5
Total Base Saturation	%	63	72	75	85	68	67
Volume Weight	g/mL	1.14	1.10	1.18	1.20	1.12	1.12
Soluble Salts (Field)	%	< 0.05	< 0.05	0.09	0.13	< 0.05	< 0.05
EC (in 1:5 Extract)	mS/cm	0.02	0.14	0.26	0.37	0.03	0.02
Soil Sample Depth*†	mm	0-75	0-75	0-75	0-75	0-75	0-75
Soil Type*†		Sedimentary	Sedimentary	Sedimentary	Sedimentary	Sedimentary	Sedimentary

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Certificate of Analysis

Client:	Roger Gibson	**Lab No:**	3540197 shvpv1
Address:	5 Elite Court RD 3 Cromwell 9383	**Date Received:**	12-Apr-2024
		Date Reported:	17-Apr-2024
		Quote No:	
		Order No:	
		Client Reference:	Rocky Point - TK
		Submitted By:	Roger Gibson

Soil Analysis Results

Sample Name:		RPL 31-32	RP Comp East				
Lab Number:		3540197.7	3540197.8				
Sample Type:		SOIL Grape, Vineyard	SOIL Grape, Vineyard				
Sample Type Code:		S49	S49				
pH	pH Units	7.6	6.3	-	-	-	-
Olsen Phosphorus	mg/L	31	43	-	-	-	-
Potassium	me/100g	0.64	0.64	-	-	-	-
Potassium	%BS	6.4	11.1	-	-	-	-
Potassium	MAF units	14	15	-	-	-	-
Calcium	me/100g	8.2	2.2	-	-	-	-
Calcium	%BS	83	37	-	-	-	-
Calcium	MAF units	11	3	-	-	-	-
Magnesium	me/100g	1.04	0.42	-	-	-	-
Magnesium	%BS	10.6	7.3	-	-	-	-
Magnesium	MAF units	25	11	-	-	-	-
Sodium	me/100g	< 0.05	< 0.05	-	-	-	-
Sodium	%BS	0.2	0.5	-	-	-	-
Sodium	MAF units	< 2	< 2	-	-	-	-
CEC	me/100g	10	6	-	-	-	-
Total Base Saturation	%	100	56	-	-	-	-
Volume Weight	g/mL	1.07	1.13	-	-	-	-
Soluble Salts (Field)	%	< 0.05	< 0.05	-	-	-	-
EC (in 1:5 Extract)	mS/cm	0.12	0.03	-	-	-	-
Soil Sample Depth*†	mm	0-75	0-75	-	-	-	-
Soil Type*†		Sedimentary	Sedimentary	-	-	-	-

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Certificate of Analysis

Client:	Roger Gibson	**Lab No:**	3578852	shvpv1
Address:	5 Elite Court RD 3 Cromwell 9383	**Date Received:**	13-May-2024	
		Date Reported:	16-May-2024	
		Quote No:		
		Order No:		
		Client Reference:	Rocky Point TK	
		Submitted By:	Roger Gibson	

Soil Analysis Results

Sample Name:		RP Lot 21	RP Lot 22	RP Lot 23	RP 24/25 North	RP 24/25 Above	RP 24/25 BT
Lab Number:		3578852.1	3578852.2	3578852.3	3578852.4	3578852.5	3578852.6
Sample Type:		SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard
Sample Type Code:		S49	S49	S49	S49	S49	S49
pH	pH Units	6.1	6.8	6.1	6.1	6.2	6.0
Olsen Phosphorus	mg/L	5	6	6	11	7	27
Potassium	me/100g	0.40	0.51	0.28	0.52	0.25	0.51
Potassium	%BS	8.9	12.4	5.3	8.5	5.1	6.1
Potassium	MAF units	11	12	7	12	6	13
Calcium	me/100g	2.2	2.4	2.9	3.1	2.1	2.9
Calcium	%BS	49	58	54	50	43	36
Calcium	MAF units	4	4	4	4	3	5
Magnesium	me/100g	0.46	0.44	0.47	0.60	0.51	1.54
Magnesium	%BS	10.1	10.6	8.9	9.7	10.3	18.7
Magnesium	MAF units	13	11	13	14	14	43
Sodium	me/100g	0.27	0.18	0.84	< 0.05	1.57	1.77
Sodium	%BS	5.8	4.4	15.9	0.8	31.9	21.5
Sodium	MAF units	16	10	47	2	89	101
CEC	me/100g	5	4	5	6	5	8
Total Base Saturation	%	74	86	84	69	90	82
Volume Weight	g/mL	1.27	1.17	1.21	1.07	1.23	1.23
Soluble Salts (Field)	%	< 0.05	< 0.05	0.10	< 0.05	0.15	0.23
EC (in 1:5 Extract)	mS/cm	0.07	0.03	0.28	0.03	0.43	0.66
Soil Sample Depth*†	mm	0-75	0-75	0-75	0-75	0-75	0-75
Soil Type*†		Sedimentary	Sedimentary	Sedimentary	Sedimentary	Sedimentary	Sedimentary

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		Quote No:		
		Order No:		
		Client Reference:	Rocky Point TK	
		Submitted By:	Roger Gibson	

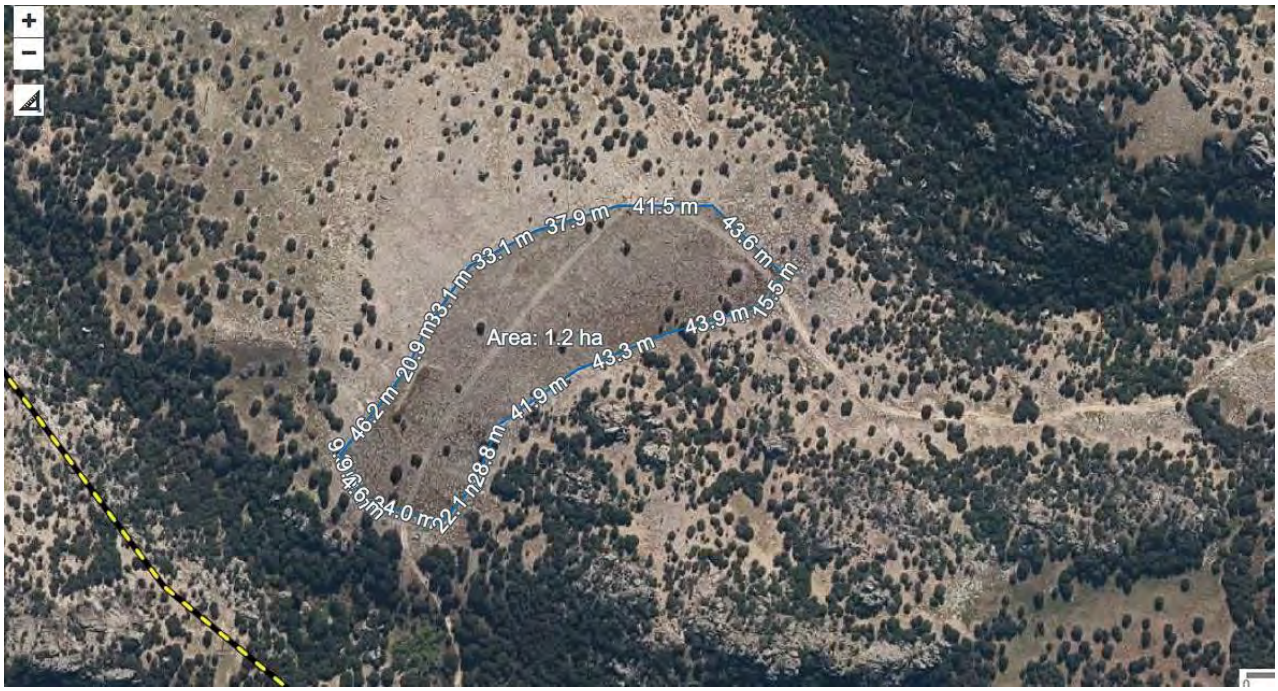
Soil Analysis Results

Sample Name:		RP Lot 26	RP 30 Over Fence				
Lab Number:		3578852.7	3578852.8				
Sample Type:		SOIL Grape, Vineyard	SOIL Grape, Vineyard				
Sample Type Code:		S49	S49				
pH	pH Units	7.0	6.0	-	-	-	-
Olsen Phosphorus	mg/L	9	10	-	-	-	-
Potassium	me/100g	0.49	0.19	-	-	-	-
Potassium	%BS	8.3	3.3	-	-	-	-
Potassium	MAF units	12	5	-	-	-	-
Calcium	me/100g	4.5	2.1	-	-	-	-
Calcium	%BS	77	36	-	-	-	-
Calcium	MAF units	7	3	-	-	-	-
Magnesium	me/100g	0.71	1.11	-	-	-	-
Magnesium	%BS	12.0	19.5	-	-	-	-
Magnesium	MAF units	18	33	-	-	-	-
Sodium	me/100g	< 0.05	1.64	-	-	-	-
Sodium	%BS	0.7	28.9	-	-	-	-
Sodium	MAF units	2	100	-	-	-	-
CEC	me/100g	6	6	-	-	-	-
Total Base Saturation	%	97	88	-	-	-	-
Volume Weight	g/mL	1.15	1.33	-	-	-	-
Soluble Salts (Field)	%	< 0.05	0.22	-	-	-	-
EC (in 1:5 Extract)	mS/cm	0.03	0.63	-	-	-	-
Soil Sample Depth*†	mm	0-75	0-75	-	-	-	-
Soil Type*†		Sedimentary	Sedimentary	-	-	-	-

Appendix B. Aerial Imagery showing boundaries of areas sampled in initial visit.

RPL1Below, Below proposed lot 1 Approx area 0.2ha

RPL1-7 – Approx area 1.2ha



RPL21-26 – Proposed lots 21-26 approx area 1.2ha

RPL29– Bottom of proposed lots 29, approx area 0.1ha

RPL30, approx area 0.2ha

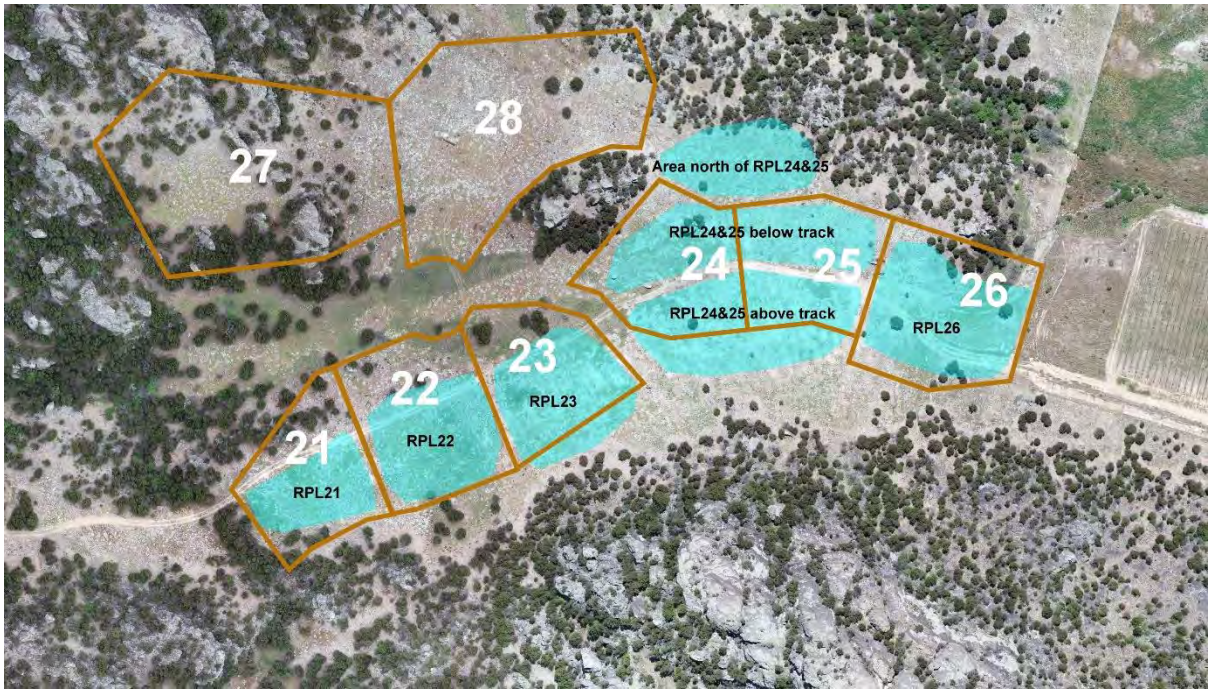
RPL30EAST, approx area 0.2ha

RPL30 Over the fence, approx area 0.4ha

RPL31-32, approx area 0.2ha

RPComp East, approx area 1.3ha

Appendix C. Aerial Image showing areas sampled in secondary survey of proposed Lots 21-21.



Appendix 6 – Vegetation Succession and Climax Communities at Rocky Point

Vegetation succession and climax communities at Rocky Point

Contract Report No. 7080a

Providing outstanding ecological services to sustain and improve our environments

Wildlands

Vegetation succession and climax communities at Rocky Point

Contract Report No. 7080a

July 2024

Project Team:

Andrew Wells – Field work and report author

Simon Beale – Field work

Kelvin Lloyd – Peer review and technical advisor

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5/07/2024
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1.0 Introduction

1.1 Background

TKO Properties Limited is proposing to subdivide a property at Rocky Point, near Bendigo in Central Otago. The 68.6-hectare property is located above the head of Lake Dunstan between the Tarras Cromwell Road and the Bendigo Scenic Reserve (Figure 1).

A resource consent application was lodged with the Central Otago District Council (CODC) in July 2023, but the proposed subdivision layout has since been revised. The revised subdivision layout has been guided in part by ecological assessments undertaken by Beale Consultants (2024), and the identification of areas of saline-sodic soils by Roger Gibson Land and Sea Services (Gibson 2024).

TKO Properties Limited has subsequently commissioned Wildland Consultants to undertake a review of vegetation succession at Rocky Point, to supplement the ecological assessments. This review will form part of the background ecological material to be submitted to CODC with the revised subdivision layout. Wildland Consultants has also been commissioned to provide an evaluation of climax vegetation communities (what would be there if humans had never colonised Aotearoa) at the Rocky Point site, and to develop offset benchmark parameters. The purpose of this is to inform a biodiversity offset accounting model for the proposed subdivision.

1.2 Project scope

The report is divided into two parts. Part 1 provides an assessment of post-human-settlement vegetation change and vegetation succession at Rocky Point and the surrounding area. The assessment utilises the following:

- Early historical accounts of European settlers and scientists
- Aerial and satellite imagery from the 1950s to the present
- Palaeoecological studies in the Central Otago region
- Field investigation of the Rocky Point site and the surrounding lower western flanks of the Dunstan Range.

Part 2 of the report provides an assessment of potential climax vegetation communities at the Rocky Point site, and provides suggested parameters for these communities to inform a biodiversity offset accounting model. This assessment utilises the following:

- Palaeoecological studies in the Central Otago region
- Field investigation of the Rocky Point site and the surrounding lower western flanks of the Dunstan Range, including RECCE plot surveys to obtain benchmark values for offset modelling.

2.0 Ecological Context

2.1 Rocky Point site

The site is located adjacent to the northern end of Lake Dunstan, and varies in elevation between 200 metres and 417 metres above sea level with a predominantly north to northwestern aspect (Figure 1). Schist rock outcrops and bluffs are a prominent feature of the site, with stony hillslopes and small gullies interspersed. Postglacial terrace remnants between rock bluffs are also present at the north of

the site. Annual rainfall is low at 400-450 millimetres, which in combination with the rocky substrates and northern aspect of the site results in Rocky Point having a very high evapotranspiration rate.

The site is currently vegetated with a mix of young kānuka (*Kunzea serotina*) scrub, cushionfield, exotic herbfield and exotic grassland. Refer to Beale Consultants (2024) for detailed site and vegetation descriptions.

2.2 Ecological district

Rocky Point is located within the Dunstan Ecological District (ED) and Central Otago Ecological Region. The Dunstan ED is characterised by a dry pseudo-subcontinental climate with strong altitudinal gradients. Most of the fans and terraces have been modified and are now in exotic pasture with sweet briar (*Rosa rubiginosa*) and grey scrub communities widespread on lower slopes outside those landforms (McEwen 1987).

The Dunstan ED is described by McEwen (1987) as: "Tilted, block-faulted schist range to 1692 m a.s.l surrounding lowlands, glacial outwash gravels, moraines: dry, subcontinental climate, snow lies for weeks in winter; shallow to moderately deep soils with variable loess cover on rolling, hilly and steep slopes, shallow to deep soils on terrace and fans in valleys; formerly mostly tussockland, no beech forest, rare small Hall's totara remnants E, extensive kānuka shrubland SW; local endemics; burnt, grazed, rabbits."

2.3 Nearby protected areas

The 627-hectare Bendigo Scenic Reserve lies to the east of Rocky Point, and occupies the lower northern and western flanks of the Dunstan Range immediately above the grape growing area of Bendigo, incorporating Chinamans Creek and west of School Creek (Figure 1). The western part of the reserve includes most of the Pigeon Creek catchment, less than one kilometre from the southern boundary of Rocky Point and adjoining the Bendigo Hills property owned by TKO Properties Limited. The area east of School Creek is contained in the 458-hectare Bendigo Historic Reserve. Together these two reserves provide legal protection to 1,085 hectares of land on the lower western and northern flanks of the Dunstan Range between 340 and 760 metres above sea level, on landforms very similar to those at Rocky Point, and preserve the largest example of successional kānuka forest in the Dunstan ED.

3.0 Methods

Published and unpublished scientific literature related to vegetation change in the wider Central Otago District and the Rocky Point/western Dunstan Range area was reviewed. Historic and recent aerial and satellite imagery was examined to understand broad changes in vegetation over the past 75 years.

A walk over of the Rocky Point site was conducted on 5 December 2023, with TKO Properties and Simon Beale (Beale Consultants), to provide familiarisation with the site and the proposed development. This was followed by a three-hour helicopter fly over of the Dunstan Ecological District (ED) and adjoining Central Otago and Pisa ED's, to assess the extent of cushionfield vegetation and kānuka succession. The focus was on the lower elevation hillslopes (200-700 metres) within comparable settings to Rocky Point, and particularly the northern and western flanks of the Dunstan Range within the Dunstan ED.

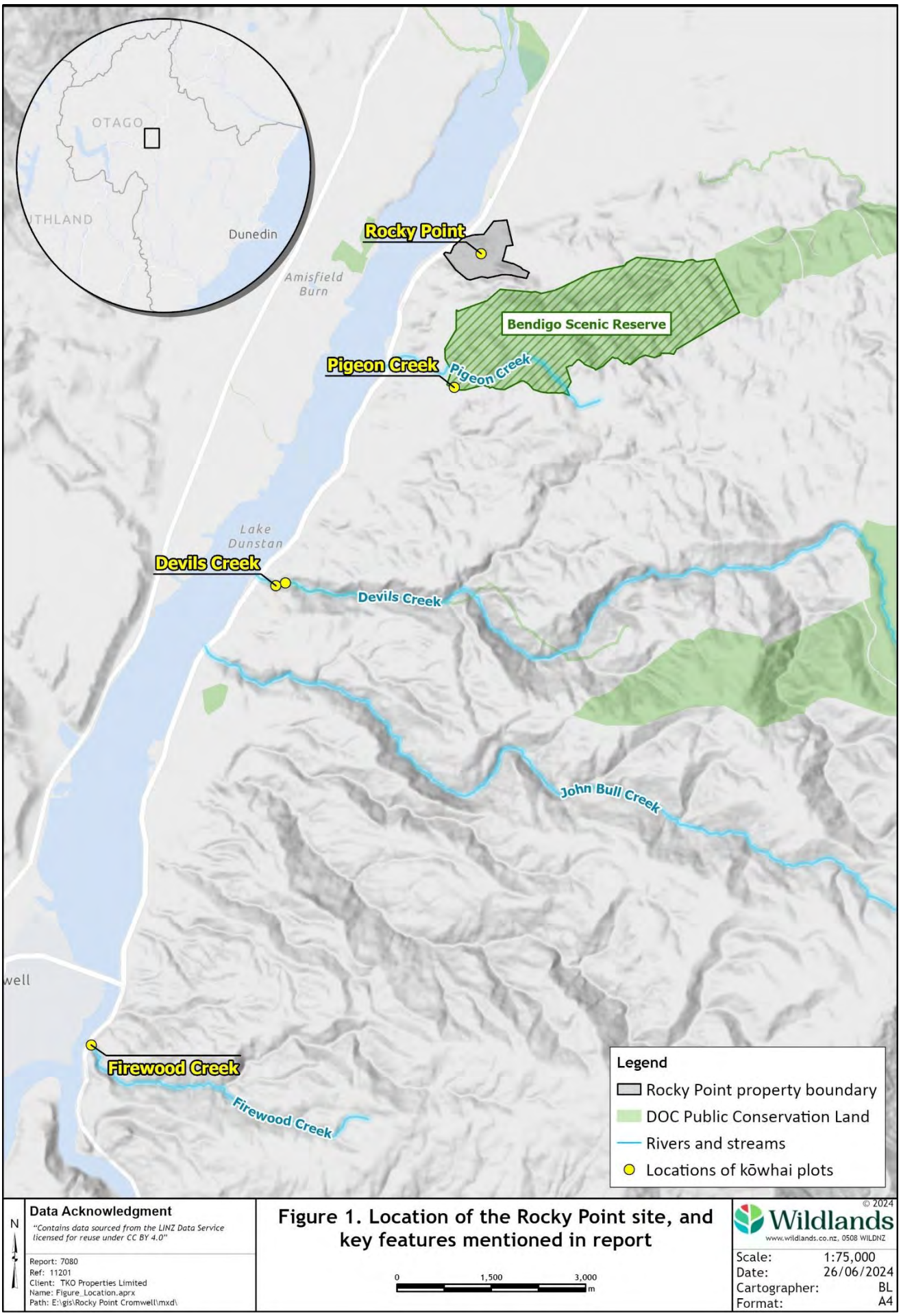

Figure 1. Location of the Rocky Point site, and key features mentioned in report

Further site inspections were carried out on 25 March and 29 April 2024 with Simon Beale, to assess potential offset and compensation sites. Walk over surveys of the entire Rocky Point site and RECCE plot surveys were conducted with Simon Beale on 10, 14, 15 and 30 May 2024. The RECCE plot surveys included cushionfield and kānuka scrub at Rocky Point, three potential offset sites in the adjacent Bendigo Hills Estate, and offset benchmark sites at Devils Creek and Firewood Creek. Additional RECCE plot surveys were undertaken on 13 May 2024, of offset benchmark sites at Rocky Point and at Pigeon Creek (Figure 1). During RECCE plot surveys of offset benchmark sites, any indigenous species that were observed outside of the plots in the nearby area but not found within the plots were also noted.

The combined information from the above sources was used to assess vegetation succession at Rocky Point, and to assess climax vegetation communities at Rocky Point. Suggested offset benchmark communities were also described, and their attributes and parameters quantified based on RECCE plot data.

4.0 Part 1 – Vegetation Succession

4.1 Overview

Vegetation in the drier parts of Central Otago has undergone rapid and profound changes since human settlement. Polynesian fires approximately 750 years BP resulted in the rapid replacement of predominantly woody forest and shrubland communities with predominantly tussock grasslands and successional shrubland assemblages (Rogers *et al.* 2007). European settlers brought further changes through the introduction of exotic plants, rabbits and stock grazing, and repeated burning for pasture development (Walker *et al.* 2009). This radically transformed the vegetation patterns of the entire region, as succinctly described by McGlone (2001): “Eight hundred years of fire and 150 years of pastoral development have obscured the original vegetation patterns of the south-eastern South Island. Over large stretches of country no vegetation associations corresponding to those of the pre-human situation remain.”

Today, woody indigenous plants in Central Otago typically remain as patches of ‘grey scrub’ (Wardle 1991), shrubland communities arising through secondary succession.

4.2 Post-European settlement vegetation change in Central Otago

4.2.1 Early history

While no recorded details are available that describe the vegetation in the district at the time of Māori arrival, there are historic accounts from European settlers. When the first European farmers arrived in Central Otago in 1857, they found an extensive tussock-covered landscape, an absence of trees, and considerable areas of shrublands. At this time inland Otago was described as “all open, well grassed and watered, with sufficient scrub for fuel for many years but no bush or timber”. By 1859 all suitable land in the district had been taken up by graziers (Hercus 1966).

Overburning and overstocking with sheep soon began to cause problems for farmers. Rabbits were first reported as a pest in the area in 1876, and by the 1880s the combination of overburning, overstocking, and rabbit invasion was having a devastating effect on farming. Sheep numbers declined and many of the early settlers were ruined. Bare ground replaced vegetation cover over large tracts of land, and where vegetation was present it often comprised low-growing inedible plants such as indigenous scabweeds (*Raoulia* spp.) and exotic herbs. Rabbits continued as a serious plague in the region from the mid-1870s to the 1950s.

As noted by Hercus (1966), it took bitter experience to learn that in this arid environment, mistakes in land management have dramatic long-term consequences. These mistakes left behind the largely human-induced 'deserts' of the Central Otago hill country from which vegetation has been slowly recovering since the 1950s.

4.2.2 Present-day indigenous vegetation

As previously mentioned, indigenous woody plants in the drier parts of Central Otago commonly remain as patches of 'grey scrub'. Stands of early successional kānuka shrubland/scrub are also present (Plate 1), such as at Rocky Point and Bendigo Scenic Reserve. Kōwhai (*Sophora microphylla*) is the most prominent large indigenous tree left at elevations below c.700 metres, and these typically occur as isolated individuals or small clusters restricted to rocky fire-protected sites. The lower western and northern flanks of the Dunstan Range (between c.200-700 metres) that are still grazed or that have continuing high rabbit numbers contain a high abundance of *Raoulia australis* within cushionfields (Plate 2), reflecting a very early successional community on semi-arid highly-degraded land. At higher altitudes (above about 750 metres), relict trees of Hall's tōtara (*Podocarpus laetus*) are present but restricted to rocky gorges or fire-protected rocky outcrops (Wells 1972).

Plate 1. A young stand of successional kānuka shrubland at Rocky Point.

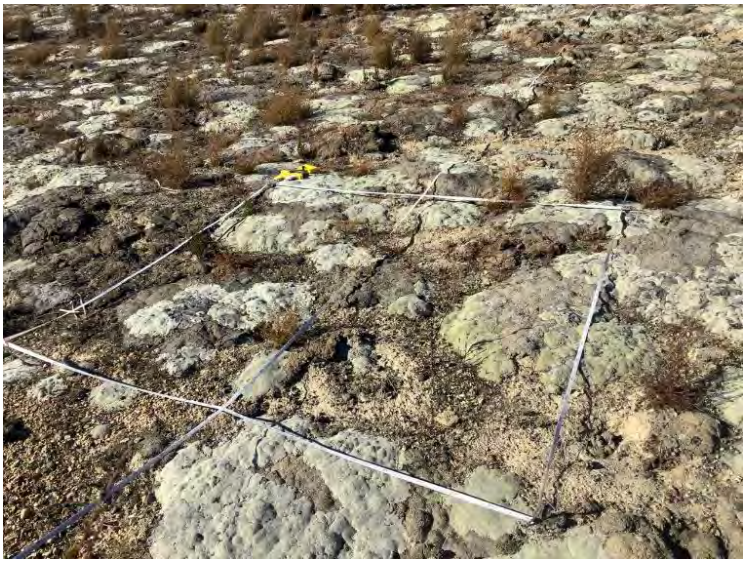

Plate 2. Cushionfield at Rocky Point, with a high cover of *Raoulia australis*.

4.2.3 Cushionfield extent from aerial fly over

The aerial fly over conducted on 5 December 2023 revealed that low-elevation cushionfields with a high proportion of indigenous *Raoulia* spp. remain extensive within the Dunstan ED. In particular, large areas of cushionfield are present between 200-700 metres elevation on the western and northern flanks of the Dunstan Range. An estimated 168.9 hectares of cushionfield was mapped within five kilometres of Rocky Point (Figure 2). Other vegetation present includes extensive successional kānuka-dominant scrub, exotic pasture, tussock grasslands and vineyards.

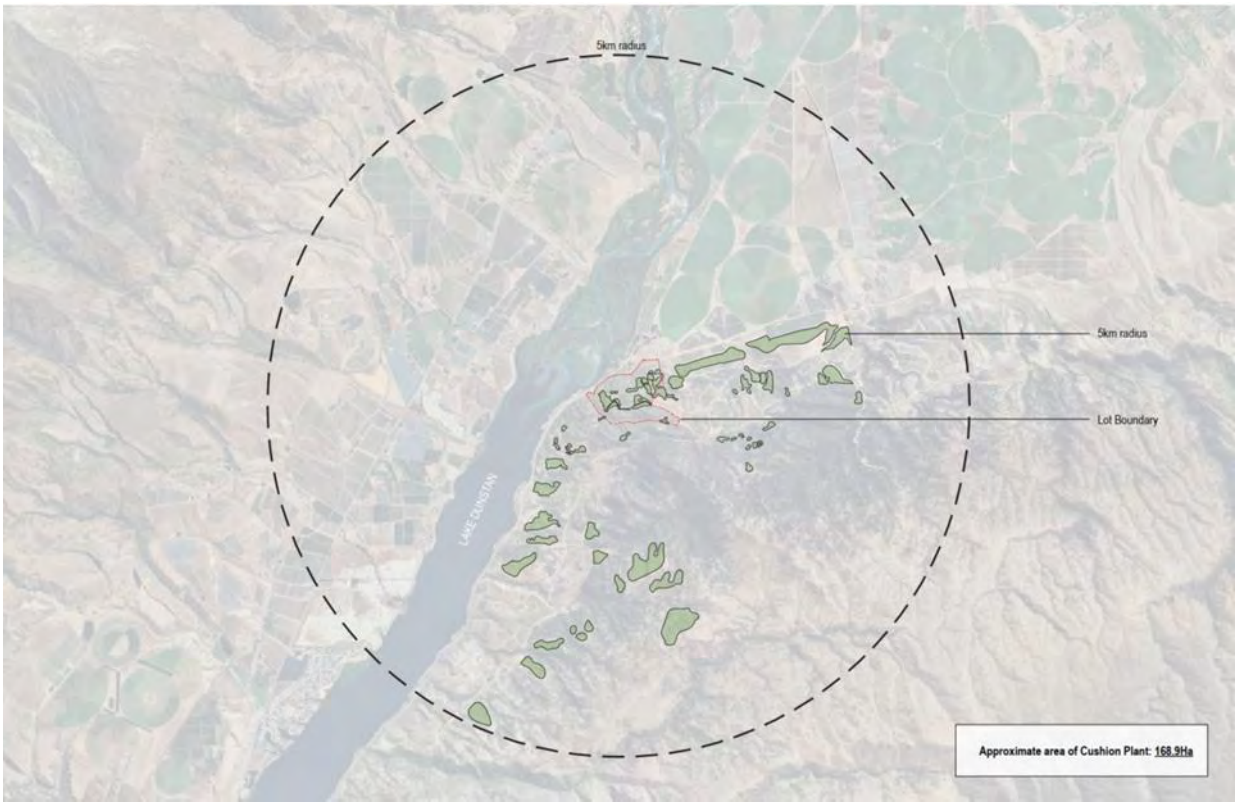

Figure 2. Indicative areas of *Raoulia australis* cushionfield on the lower western flanks of the Dunstan Range within a five-kilometre radius of the Rocky Point site, based on a fly over survey conducted on 5 December 2023. Only areas with a high density of cushion plants are mapped.

Small areas of cushionfield are also located in the adjoining ED's, but occur only as isolated patches and are not extensive. Vegetation on the lower hillslopes in the adjoining ED's is dominated by exotic pasture, tussock grasslands, and successional kānuka-dominated scrub.

The relatively large areas of cushionfield remaining in the lower northern and western flanks of the Dunstan Range, relative to other areas in Central Otago, presumably reflects the particularly harsh nature of this area resulting from low rainfall, exposed northwestern aspects and rocky/stony soils. Restoration of grassland or succession to woody vegetation following historic land degradation is therefore slower than in other environments of Central Otago, and may often require the removal of grazing and rabbits. This is discussed further below.

4.3 Vegetation change at Rocky Point from 1950s to the present day

In the early 1950s the Bendigo Station lease was suffering from all of the issues mentioned above, and was considered to be in a very run down condition. Rabbits remained a very serious problem and continued to cause widespread, extreme depletion across the entire lease area below 610 metres (Coterra 2024). Between 1953 and 1978, changes in management were reported to bring about some

vegetation improvement. The property underwent tenure review in the late 1990s, at which time Rocky Point was privatised.

4.3.1 Aerial and satellite imagery of Rocky Point – 1958 to 2024

Aerial imagery from 1958 shows the Rocky Point property overwhelmingly dominated by non-woody vegetation, and almost devoid of woody vegetation (Figure 3). A few individual shrubs are evident in the main gullies and on rocky outcrops throughout, most probably of kānuka and a few remnant kōwhai. A large crack willow (*Salix ×fragilis*) is present mid-way up the southwestern gully, and this is still present today.

Based on interpretation of the 1958 aerial imagery using present-day field observations, it is almost certain that the lighter, white areas reflect *Raoulia australis* cushionfield vegetation with a high percentage cover of cushion plants, while the slightly darker areas reflect bare gravelly ground and other low-growing vegetation (including young kānuka) with a lower abundance of cushion plants. The 1958 imagery thus indicates that well over half of the site area was likely dominated by *Raoulia australis* cushionfield with a high percentage cover of cushion plants. This is consistent with reports of severe degradation at the site at this time. Low stature kānuka shrubland occupies only a very small portion of the site.

This pattern remains essentially unchanged in 1975 imagery, with only a slight increase in woody vegetation in gullies and rocky outcrops. Between 1975 and 2001 there is a notable increase in the density and extent of woody vegetation in gullies and rock outcrops, as well as a spread of woody vegetation onto the gravelly faces and hillslopes at the site, as kānuka shrubs developed mature canopies. This trend of increasing density and extent of woody vegetation continued through the 2000's, and is obvious in the 2024 imagery (Figure 3). Site investigations verify that almost all of this colonisation comprises kānuka, with a minor component of sweet briar, and occasional korokio (*Corokia cotoneaster*) and mingimingi (*Coprosma propinqua*) in rock outcrops.

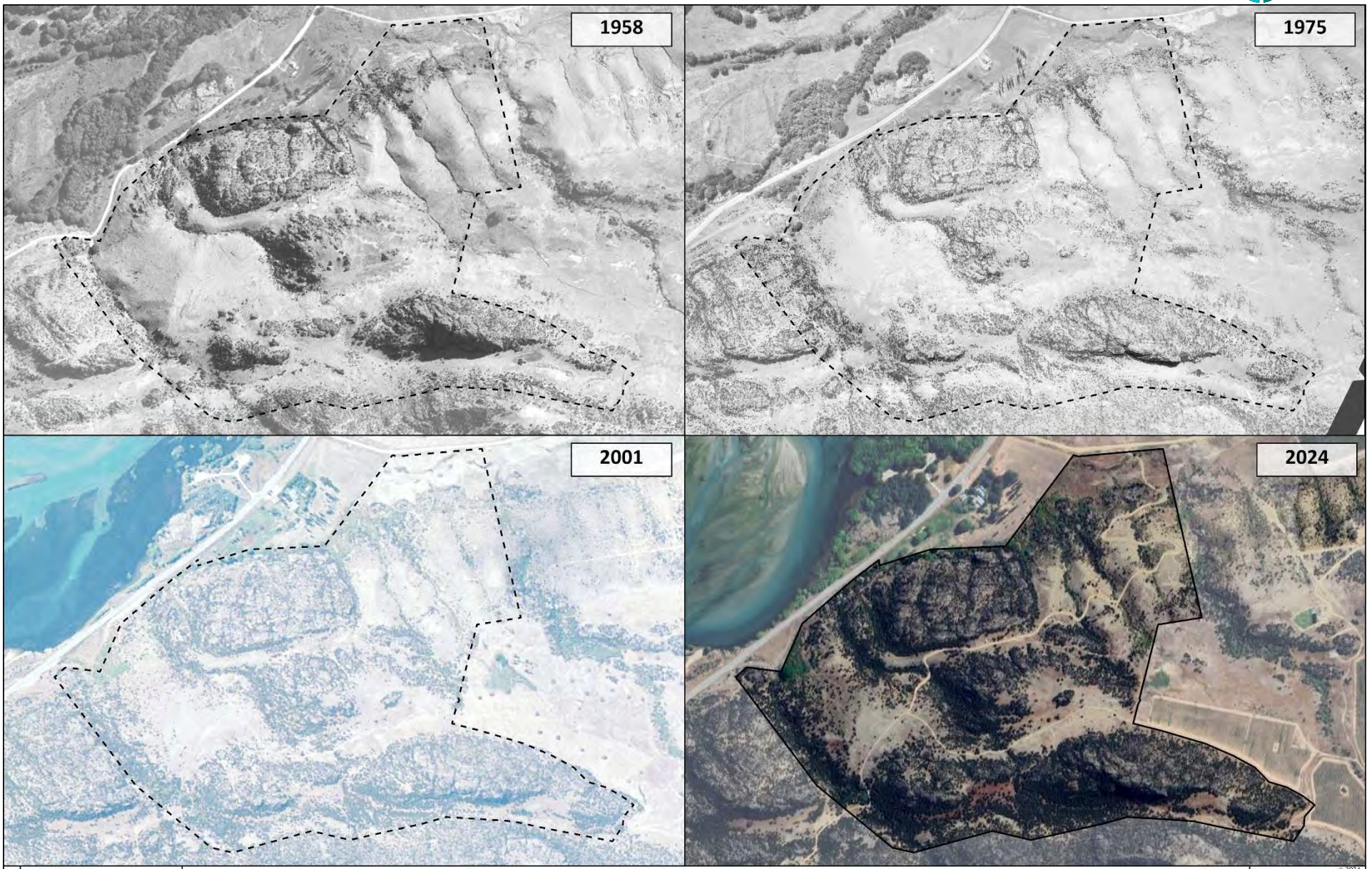

Figure 3. Retrolense imagery of Rocky Point

4.3.2 Field observations

General observations of relevance to succession made during the walk over surveys and RECCE plot surveys at the Rocky Point site are outlined here. These observations supplement the RECCE plot data provided in Beale Consultants (2024).

1. Ongoing expansion of kānuka into areas of bare ground and cushionfield, and ongoing reductions in the extent of cushionfield and bare ground and in the diversity and abundance of cushionfield plant species

Seedlings and saplings of kānuka were widely observed across the site, in almost all landform settings including rocky outcrops, hillslopes and gullies. Regeneration was more pronounced close to already-established older kānuka, indicating that kānuka is continuing to expand its range across the site as conditions are ameliorated by existing plants. This expansion is primarily into areas of cushionfield and bare ground (Plate 3). This is consistent with the successional pattern observed in aerial imagery over the past c.70 years discussed above, and reflects the gradual recovery from human-induced degradation. If this successional trend continues uninterrupted, almost all of the site will be covered in low woody vegetation dominated by kānuka within another 30-40 years.

Kānuka has been able to persist and colonise because it regenerates after fire, and is not palatable to rabbits or farm stock. Few other indigenous woody species share these traits, and thus are much more restricted in the landscape today.

Directly related to the expansion of kānuka and other woody species, the extent of bare ground and cushionfield at the site continues to reduce. This reflects the ongoing recovery of the site from the impacts of overburning, overgrazing and rabbits, all of which induced the previous dominance of bare ground and cushionfield. Current regeneration of kānuka demonstrates that climate and soils are not a limiting factor for the re-establishment of woody vegetation at the site. It is probable that over the next 30-40 years, in the absence of human disturbance, cushionfield will become restricted to small relict patches amongst woody vegetation.

Further observational evidence indicating that the cushionfield vegetation at the site is largely a human-induced early successional stage is presented in Appendix 1.

Plate 3. Young kānuka shrubland succeeding cushionfield at Rocky Point.

The notable exception to this is the localised patches of saline soil identified by Gibson (2024). No kānuka regeneration was observed on these areas, and as Gibson (2024) notes, colonisation by woody species is unlikely due to the extreme soil conditions. The natural climax vegetation in these areas is therefore indigenous cushionfield/herbfield.

2. Regeneration of kōwhai from relict trees, and development of kōwhai as a prominent component of scrub/forest vegetation

A few old mature relict kōwhai trees are present at Rocky Point (Plate 4). These trees are in rocky outcrops where they have presumably survived fires. While their age is unknown, their knarled trunks and rocky site positions (where slow growth is expected) suggest that they are well over 100 years old. Several younger trees have established within about 20 metres of these trees, and there are also several saplings and seedlings nearby and downslope. This indicates that active regeneration of kōwhai from the relict trees has been occurring for some time. Regeneration of kōwhai will continue in the absence of human disturbance, and will be hastened by the amelioration of site conditions brought about by the developing kānuka shrubland.

More advanced examples of kōwhai succession from relict trees were observed on similar landforms and elevations at several other locations in the lower western flanks of the Dunstan Range, including at Bendigo Hills (Plate 5), Bendigo Scenic Reserve, Pigeon Creek (Plate 6), Devils Creek and Firewood Creek. The closest example to Rocky Point is on north-facing rocky and gravelly hillslopes at Bendigo Hills, less than 100 metres south of the Rocky Point boundary. At this location, over 50 kōwhai ranging from small trees to young seedlings are scattered over an area of hillside, and appear to have established below a few mature relict trees near the ridgeline.

Plate 4. An old kōwhai tree (on the left) at Rocky Point, with younger regeneration surrounding it.

Plate 5. A relict kōwhai on a ridge at Bendigo Hills, with the Rocky Point site visible below.

Plate 6. Trunks of relict kōwhai at Pigeon Creek.

3. Gradual expansion and diversification of indigenous woody species within kānuka shrubland

Several woody species besides kānuka are present in low abundances at Rocky Point, notably kōwhai, *Coprosma propinqua*, korokio, porcupine shrub (*Melicytus alpinus*), mountain tauhinu (*Ozothamnus leptophylla*), *Olearia odorata* and *O. lineata* (Plates 7 and 8). These species would be expected to increase in abundance at the site amongst the kānuka shrubland, as more diverse establishment microsites and microclimates develop. Other indigenous woody species not currently found at the site but known to still be present in the lower western flanks of the Dunstan Range may also eventually self-introduce, such as poataniwha (*Melicope simplex*), *Carmichaelia* spp., *Coprosma virescens*, and *Veronica* spp.

Plate 7. Young *Olearia lineata* in the southern gully at Rocky Point. Only four individuals of this species were observed at Rocky Point

Plate 8. Korokio, mingimingi, porcupine shrub, kōwhai and kānuka in a rocky refuge at Rocky Point.

4. Expansion of exotic woody and herbaceous weeds

Several small wilding pine (*Pinus radiata* and *P. contorta*) seedlings and saplings were observed across the site. The expanding open indigenous shrubland/scrub provides ideal establishment conditions for wilding pines. Franchet's cotoneaster (*Cotoneaster franchetii*), wild plum (*Prunus* sp.), flowering currant (*Ribes sanguineum*) and stinking iris (*Iris foetidissima*) are also present in substantial numbers along the lower northeastern slopes of the site; if not controlled, these species will continue to spread up the hillslope and into the rest of the site.

Sweet briar is widespread at the site, but poses less of a long-term threat as it will be succeeded by woody indigenous vegetation. Observations at the site of indigenous woody species established underneath sweet briar suggest that sweet briar may even facilitate regeneration of indigenous woody species, by creating favourable microsite conditions for seedling establishment.

Various exotic herbs are abundant at the site within cushionfield and herbfield communities, most notably hemlock (*Conium maculatum*), stonecrop (*Sedum acre*) and scarlet pimpernel (*Anagallis arvensis*). These species pose a particular long-term threat to vegetation on saline soils, where woody vegetation is unlikely to establish.

4.4 Vegetation change at Bendigo Scenic Reserve

Successional patterns in the nearby Bendigo Scenic Reserve since the 1950s show very similar trends to Rocky Point, in which indigenous woody vegetation dominated by kānuka has been steadily replacing cushionfield, exotic herbfield and bare ground over the past 60-70 years. Aerial imagery from the 1950s shows a slightly higher abundance of woody plants in gullies than at Rocky Point, and on south facing hillslopes in the upper reaches of Pigeon Creek, but otherwise an overwhelming dominance of bare ground and cushionfield. Consequent expansion of woody vegetation in gullies and adjoining side slopes was more rapid than at Rocky Point, likely reflecting the deeper gullies and localised patches of more favourable soils. However, colonisation rates of kānuka over the remainder of the reserve have been similar to Rocky Point.

Field observations within Bendigo Scenic Reserve and Bendigo Historic Reserve (made during recreational trips by Wildlands staff) confirm very similar vegetation patterns to Rocky Point. Low kānuka shrubland and scrub with very low species diversity and remnant cushionfield amongst shrubs now covers most of the reserves (Plates 9-11), with taller kānuka forest restricted to deep gullies. Cushionfield now remains in only a few places including the lower northern slopes, the upper southern slopes (Plate 10), and the lower western slopes around Pigeon Creek (Plate 11), where it continues to be colonised by kānuka and exotic grasses. Shrublands on the northern flanks of the reserves contain scattered mingimingi and korokio, with only a few individuals of *Coprosma dumosa*, mountain tauhinu, *Olearia lineata*, *O. odorata* (mainly in the historic reserve), koromiko (*Veronica salicifolia*)and desert broom (*Carmichaelia petriei*). As at Rocky Point, a few relict kōwhai are present with regeneration nearby. Damp soils in gullies in upper Pigeon Creek are notable for locally common *Olearia lineata*. Also of note are observations of single individuals of *Veronica pimeleoides* subsp. *faucicola* (At Risk-Naturally Uncommon) and *V. pimeleoides* subsp. *pimeleoides* on hillslopes at the southwestern margin of the reserve above Pigeon Creek.

Plate 9. Looking northeast into Chinamans Creek and towards School Creek, within Bendigo Scenic Reserve.

Plate 10. The upper slopes of Chinamans Creek contain cushionfield being colonised by kānuka. Three kōwhai trees are also visible as lighter green patches, in the lower centre of the image.

Plate 11. The lower western slopes of Bendigo Scenic Reserve contain a mix of cushionfields and colonising kānuka shrubland.

4.5 Summary – vegetation succession

Rocky Point is currently in the early transitional successional stages of indigenous vegetation recovery following years of severe human-induced degradation of soils and vegetation. The first stage has involved colonisation of denuded soils by the most resilient early successional species of Central Otago – cushion plants and small herbs. Reductions in grazing pressure and fires over the past c.50 years have since enabled kānuka, a hardy, unpalatable, and prolific early colonising woody species, to progressively establish within cushionfield and bare ground at the site. Over the next 50 years (in the absence of further human disturbance) kānuka-dominated shrubland will further increase in extent at the site, and will be progressively succeeded by a low forest with a canopy of kōwhai, kānuka and *Olearia lineata*, and a diverse shrub understorey. The diversity of forest that develops in future succession will depend to a large extent on seed sources for woody indigenous species, and the virtual absence of species other than kānuka, korokio and mingimingi is likely to be a key factor. The suite of

cushionfield species at the site will continue to reduce in abundance as succession progresses. Exotic woody weeds will pose a growing threat to the ecological integrity of the developing indigenous woody vegetation communities.

Long term ecological management at Rocky Point will hasten the successional transition at the site from cushionfield to woody vegetation, as the slightly more advanced succession at Bendigo Scenic Reserve demonstrates. The persistence of cushionfield at the site (other than those in saline ecosystems) would require a continuation of the management regime that induced these communities, including a continuation of stock grazing and high rabbit numbers.

The successional trends at Rocky Point provide a good example of how communities of plants 'come and go', or at least drastically change in relative abundance, during stages of vegetation recovery from severe human-induced disturbance. These changes are particularly dramatic at Rocky Point and within the adjoining lower western and northern flanks of the Dunstan Range, because they are occurring at a landscape level. At present the decline of the formally-dominant *Raoulia australis* cushionfield community is particularly apparent, along with the associated increased extent of kānuka shrubland. Over the next 50-100 years of succession kānuka is likely to begin to decrease in abundance as it is succeeded by trees such as kōwhai and *Olearia lineata* and diverse small-leaved shrubs.

The presence and abundance of specific Threatened and At Risk plant species also varies greatly as succession proceeds. For example, species such as *Colobanthus brevisepalus* (At Risk-Declining) and At Risk-Declining species of *Raoulia* have almost certainly greatly declined in abundance at the site over the past 50 years, while other species such as dwarf mistletoe (*Korthalsella salicornioides*; Threatened-Nationally Critical), spring annuals (Threatened and At Risk) and kānuka (At Risk-Declining) have greatly increased in abundance over this time. In the future woody species such as *Olearia lineata* (At Risk-Declining), *Coprosma virescens* (At Risk-Declining) and fierce lancewood (*Pseudopanax ferox*; At Risk-Declining) may well increase in abundance or recolonise the site, as soils and establishment microsites become increasingly favourable for these species.

5.0 Part 2 – Climax Vegetation Communities at Rocky Point

The following section examines the likely pre-settlement vegetation patterns at Rocky Point, and uses this information to develop an overview of likely climax vegetation communities at the site.

5.1 Pre-settlement vegetation in Central Otago

5.1.1 Palaeoecological research

Because virtually no pre-settlement vegetation remains in Central Otago at lower elevations, palaeoecological research and modelling have provided the only means to reconstruct likely pre-settlement vegetation patterns. These studies have typically focussed on subfossil logs, palynology, and macrofossils in localised accumulation sites such as wetlands and rock overhangs. A brief summary of studies relevant to the Dunstan Range/Rocky Point area is presented here.

The first comprehensive study of subfossil wood and charcoal from the region was undertaken by Molloy et al. (1963), who concluded that forest would have covered almost all areas of Central Otago below treeline, other than sites that were too dry or prone to frequent natural disturbance. Consequent studies noted widespread subfossil logs and charcoal of Hall's tōtara in the drier Central Otago ranges including the Dunstan, Pisa and Carrick Ranges, along with some mountain toatoa (*Phyllocladus alpinus*), bog pine (*Halocarpus bidwillii*), and kānuka (Wardle 2001). Evidence of conifers was only found at altitudes from 590-1,040 metres.

Palynological studies have indicated that various associations of shrubland and forest dominated on lower hillsides and valley floors. Clark et al. (1996) concluded that late Holocene vegetation was mainly a small-leaved shrubland or woodland containing *Coprosma* spp., *Muehlenbeckia* spp., *Sophora* spp., *Plagianthus* sp. and probably kānuka, possibly with patches of taller podocarp forest. McGlone and Moar (1998) reached similar conclusions, but suggested podocarp pollen was likely sourced from higher-altitude forests. Walker et al. (2003) mapped 12 woody ecosystem types across Central Otago, and concluded that the widespread present-day associations of tūkatakuru/matagouri (*Discaria toumatou*)-mingimingi are derived from invasion of more disturbance-tolerant shrubs following destruction of the forests that used to grow in these locations. Their modelling mapped kānuka-kōwhai woodland on the lower western flanks of the Dunstan Range, and noted that other more fire-sensitive canopy species may have been under-represented in their model. Other modelling has suggested various scenarios for forests on the lower hillslopes in drier areas (such as the western Dunstan Mountains) including vegetation in which broadleaved trees and shrubs were important (e.g. kānuka, kōwhai, mānatu/lowland ribbonwood [*Plagianthus regius*], coprosma) (Walker et al 2003, 2004b; Rogers et al. 2005; Leathwick et al. 2012), and vegetation in which conifers may have been an important component (Hall and McGlone, 2006; McGlone et al., 2017).

Other studies have examined plant macrofossils (leaf, wood and seed material) dating from the mid to late Holocene preserved in rock shelters in gorges and lower hillslopes of Central Otago, including many samples from the western Dunstan Mountains. Wood and Walker (2008) concluded that broadleaved species forest with scattered Hall's tōtara occupied rocky gorges in Central Otago in the mid to late Holocene, and that lowland ribbonwood was likely to have been widely distributed on valley floors. This study included sites in the Cromwell Gorge and the western Dunstan Mountains close to Rocky Point. Kānuka and matagouri were not recorded in the sites sampled by Wood and Walker (2008), suggesting the current abundance of these species in Central Otago is due to increased fire frequency and early vegetation succession after forest clearance following the arrival of humans. This does not support the modelling of Walker et al. (2003), which suggested kānuka-dominant woodland occurred in these gorges.

A recent study by Pole (2022) investigated macrofossils from 115 rock shelters, including many in the Cromwell Gorge and lower western Dunstan Mountains near Rocky Point. Pole (2022) concluded that kōwhai was the dominant tree on the lower hillslopes and gullies, likely forming a forest with a continuous but low (perhaps 14 metre) and open canopy over the study area. Other prominent tree species were kōhūhū (*Pittosporum tenuifolium*), fierce lancewood (*Pittosporum ferox*) and lowland ribbonwood, but these species were subordinate to kōwhai. Other common plants included *Carmichaelia* spp., *Rubus* spp., and *Veronica lycopodioides,* which Pole (2022) noted to be more suggestive of lower, open vegetation but which may also have been present beneath the kōwhai canopy. Evidence of kānuka was rare, and there was no indication of a conifer component to the vegetation or of forest species typical of moister habitats such as kāpuka or beech.

5.1.2 Potential terrestrial ecosystem mapping for Rocky Point

Mapping of 'potential terrestrial ecosystems' (i.e. those ecosystems that would have occurred in Otago if humans had never colonised Aotearoa) was undertaken across Otago by Wildland Consultants (2020), based on the Singers and Rogers (2014) classification of indigenous ecosystem types. Mapping was undertaken using a range of existing layers and database information, as well as palaeoecological data and local knowledge of remnant vegetation. These provide a valuable broad-scale overview of likely vegetation. While potential ecosystem mapping necessarily results in lines determining boundaries between different ecosystem types, actual ecological boundaries are often diffuse or have significant inter-fingering.

This mapping identified three Singers and Rogers ecosystem classes at the Rocky Point site (Figure 4). Most of Rocky Point is mapped as TI2 kānuka, Olearia scrub/treeland, with the mapped area extending into the surrounding north-facing hill country up to about 800 metres elevation, south to John Bull Creek and east to Bendigo Creek. TI2 is described by Singer and Rogers (2014) as, "scrub and treeland of kānuka, and species of *Olearia*, *Carmichaelia* and *Melicytus*, with korokia, matagouri, mountain tauhinu, prostrate kōwhai and lianes (e.g. *Muehlenbeckia*), and locally *Leonohebe cupressiodes*. Early successional derivatives include short tussock grasslands of species of Poa, Festuca, Deyeuxia and Rytidosperma, with inter-tussock prostrate herbfield species." Within Otago, TI2 was also mapped on north-facing rocky slopes near Luggate, where kānuka woodland is extensive today, and near the junction of the Kawarau River and Clutha River where a smaller existing stand of kānuka remains. It was also mapped in the upper Clutha River catchment on recent alluvial soils and on the drier parts of outwash terraces. Singers and Rogers (2004) notes that drought may play an equally important role to frost in the derivation of these communities because they occur predominantly in the South Island's dry interior.

The small area of alluvial soils at the north of the Rocky Point site was mapped as CLF13 Mataī, broadleaf forest. Besides mataī (*Prumnopitys taxifolia*) and kāpuka/broadleaf (*Griselinia littoralis*), it is likely that the CLF13 ecosystem type would also have included trees such as kōwhai, lowland ribbonwood, narrow-leaved lacebark (*Hoheria angustifolia*), and fierce lancewood. However, no indigenous forest remains in the areas where CLF13 was mapped, so there is considerable uncertainty relating to the occurrence and extent of this ecosystem type.

A small area of CL8 Helichrysum, Melicytus shrubland/tussockland/rockland was mapped at the northeast of the site, in an area where postglacial terrace scarp merges with bedrock. CL8 comprises colluvial slopes with mosaics of scrub, shrub, fern and grass species.

Although not mapped at Rocky Point, Wildland Consultants (2020) also note the presence of localised saline and alkaline soils between about 200-600 metres elevation in the main basins of Otago, in which herbaceous communities form the natural vegetation.

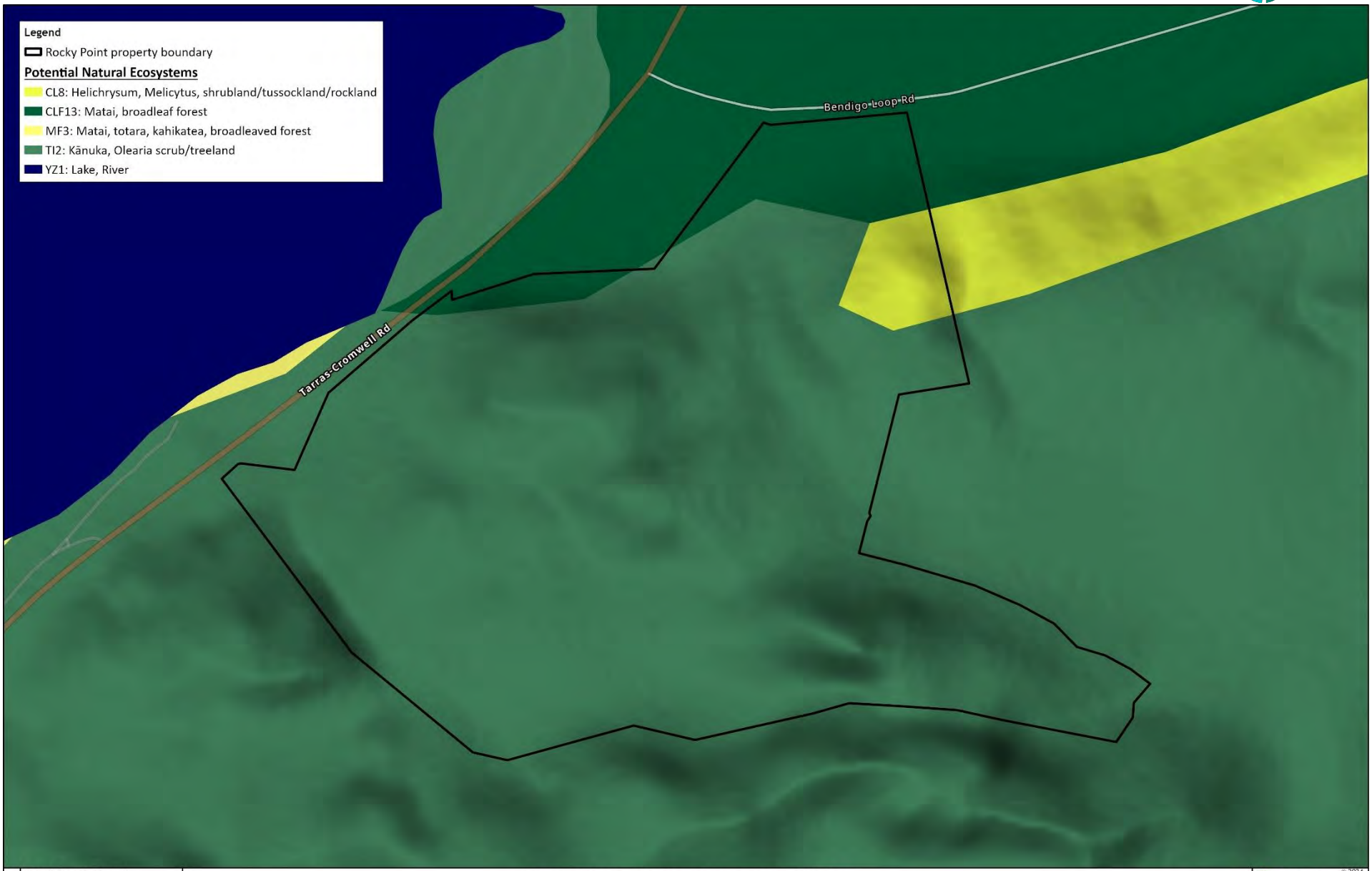

Figure 4. Potential Natural Ecosystems at Rocky Point

5.1.3 Summary

The available evidence indicates that Rocky Point would have supported forest vegetation communities across almost the entire site, with the exception of cushionfield/herbfield communities on localised areas of saline soils (Gibson 2024) and possible persistence of shrubland on postglacial terrace escarpments. The small area of alluvial deposits at the northeast of the site may have supported a podocarp-broadleaved species forest.

The remainder of the site (mapped as TI2 in Figure 4) would have likely been covered in a forest with a canopy that included kōwhai, fierce lancewood, lowland ribbonwood, *Olearia lineata* and kānuka, and an understorey of diverse shrubs including *Coprosma* spp., *Olearia* spp., *Carmichaelia* spp. and *Veronica* spp. There is significant variance in the literature regarding the relative dominance of kānuka and kōwhai, with potential ecosystem mapping suggesting a dominance of kānuka and *Olearia lineata*, and macrofossil evidence suggesting a dominance of kōwhai and broadleaved species such as lowland ribbonwood with little canopy kānuka. Recent research suggests that a high abundance and local dominance of kōwhai in the forest canopy at the site was likely. This suggested dominance of kōwhai (with a much reduced presence of kānuka) is considered most consistent with present-day observations of woody vegetation in the district, in which the only large remnant trees remaining are relict kōwhai, and in which evidence of kōwhai regeneration is present around all remaining relict trees throughout the lower western Dunstan Range. This is discussed below.

5.2 Present-day field observations and RECCE plots in regenerating remnants of indigenous woody vegetation

5.2.1 General field observations

Small relicts of indigenous vegetation preserved in the lower western flanks of the Dunstan Range provided the opportunity to investigate modern-day regenerating forest communities. These relicts are often within refuges (rocky outcrops and gorges), and typically contain one or two old kōwhai trees surrounded by regeneration of kōwhai and other woody species. They provide one of the few examples of what may naturally develop at Rocky Point in the absence of human intervention.

Relict kōwhai at Rocky Point and Bendigo Hills were described in Section 4.3.2. Other relict kōwhai observed in the lower northern and western flanks of the Dunstan Range are summarised below, with further details and representative photos contained in Appendix 2a:

- A single very large tree on a hillslope in the southwest of Bendigo Scenic Reserve at about 600 metres elevation, with three younger individuals nearby. Adjoining vegetation comprises cushionfield with kānuka.
- A single very large tree on a rocky slope on the western flanks of Bendigo Scenic Reserve in upper Pigeon Creek at about 550 metres elevation, with at least 20 younger kōwhai nearby.
- A few scattered trees on dry hillsides above Pigeon Creek on the lower western flanks of Bendigo Scenic Reserve, with recent regeneration surrounding them.
- A single large tree in the lower Pigeon Creek gorge in Bendigo Scenic Reserve, with at least 15 younger trees and saplings nearby.
- Two small patches of regenerating kōwhai in lower Devils Creek just above the highway, one patch on rocky cliffs above the creek and the other on a dry north-facing rocky slope.
- A patch of regenerating kōwhai in lower Firewood Creek just above the highway, consisting of more than 50 young trees extending from the creek up adjoining south-facing hillslopes.

5.2.2 RECCE plot surveys

Five of the small patches of vegetation developing near relict kōwhai were surveyed using RECCE plots (see Figure 1 for locations). The structure and composition of vegetation were recorded using rectangular RECCE plots of variable size, positioned subjectively so as to best capture the areas of relict/regenerating vegetation. Numbers of seedlings (<30 centimetres tall) and saplings (30-200 centimetres tall) were recorded by species. The diameter at breast height (DBH) of all trees (>2 metres tall) was recorded. Canopy cover (%), mean canopy height and top height were also recorded for each plot. Further details of the sampled sites are presented in Appendix 2b, including a summary of key measured attributes.

All plots contained regenerating kōwhai that included small seedlings, saplings and small trees. Even with the currently established kōwhai individuals, the vegetation will develop into a relatively closed-canopy forest with a kōwhai canopy in the absence of disturbance. The plots and their immediate surrounds also contained a higher diversity of woody indigenous plants than present in young kānuka regeneration at Rocky Point, likely reflecting the fact that the locations are relicts in refuges.

The most developed vegetation was at Firewood Creek. This site contains a stand of young kōwhai forest on a rocky hillslope near the base of a gorge. A closed forest canopy is present, and trees have already reached a height of 10 metres. This site provides a good example of the young forest that can develop in the current environment of the lower western flanks of the Dunstan Range. This young developing forest is consistent with Pole's (2022) suggestion of kōwhai forest with "a continuous but low (perhaps 14 metre) canopy" in the area.

5.2.3 Woody species presence and abundance

A combined total of 24 woody indigenous species were observed during field work at Rocky Point (13 species noted) and the lower western flanks of the Dunstan Range (24 species noted). An additional 10 species are likely to have been prominent in the vegetation of the lower western Dunstan Range based on palaeoecological studies (Table 1).

The likely pre-settlement and present-day abundances of these 33 key woody species in the lower western flanks of the Dunstan Range are summarised in Table 1. Rocky Point shows low species diversity relative to the present-day lower western Dunstan Range, and a very low diversity compared to the palaeoecological record.

5.3 Climax community descriptions, and benchmark parameters

5.3.1 Vegetation types

In light of the combined information discussed above, it is considered that the pre-settlement vegetation at Rocky Point most likely comprised a kōwhai-dominant forest across most of the site, characterised by a relatively continuous canopy approximately 8-14 metres tall. Lower canopy heights of around eight metres were likely on bony soils on exposed north and west facing slopes, with taller canopy heights up to 14 metres likely in gullies and more sheltered hillslopes. Other canopy trees present amongst the backbone of kōwhai would have included fierce lancewood, kōhūhū, *Olearia lineata*, lowland ribbonwood and narrow-leaved lacebark, with less frequent kānuka, weeping māpou (*Myrsine divaricata*), māpou (*Myrsine australis*) and *Coprosma virescens*, and possibly occasional Hall's tōtara and mountain toatoa in deeper soils at the southern gully. A diverse assortment of shrubs would have been present throughout the forest understorey, including the species listed in Table 1, contributing to the canopy in open areas. The most abundant shrub species are likely to have included *Coprosma* spp., *Olearia* spp., korokio, weeping māpou, *Veronica* spp., and *Carmichaelia* spp.

Table 1 – Observed abundances and inferred pre-settlement abundances of 31 key woody species in the study area. Blank cells represent absence of that species.

Species	Abundance in landscape[1]		
	Rocky Point - present-day	Lower western Dunstan Range - present-day	Lower western Dunstan Range - pre-settlement
Trees:			
Hoheria angustifolia			Locally common
Kunzea serotina	Abundant	Abundant	Occasional/locally common
Myrsine australis			Occasional
Myrsine divaricata		Very rare	Locally common
Olearia avicenniifolia		Very rare	Occasional/locally common
Olearia bullata		Occasional	Occasional/locally common
Olearia lineata	Very rare	Occasional	Locally common/frequent
Olearia odorata	Very rare	Occasional	Locally common/frequent
Phyllocladus alpinus			Rare
Pittosporum tenuifolium			Locally common
Plagianthus regius			Locally common/frequent
Podocarpus laetus			Rare
Pseudopanax crassifolius			Occasional
Pseudopanax ferox			Locally common/frequent
Sophora microphylla	Rare	Occasional	Abundant
Shrubs:			
Carmichaelia compacta		Locally common	Locally common
Carmichaelia petriei		Rare	Locally common
Coprosma crassifolia		Rare	Locally common
Coprosma dumosa	Very rare	Rare	Locally common
Coprosma propinqua	Occasional	Occasional	Locally common
Coprosma virescens		Rare	Locally common
Corokia cotoneaster	Occasional	Locally common	Locally common
Discaria toumatou	Very rare	Occasional	Occasional
Melicope simplex		Very rare	Occasional
Melicytus alpinus	Rare	Occasional	Locally common
Ozothamnus leptophyllus	Very rare	Rare	Occasional
Ozothamnus vauvilliersii	Very rare	Rare	Occasional
Veronica lycopodioides			Locally common
Veronica pimeleoides subsp. *pimeleoides*		Very rare	Locally common
Veronica pimeleoides subsp. *faucicola*		Very rare	Unknown
Veronica salicifolia		Very rare	Locally common
Vines:			
Muehlenbeckia australis		Occasional	Frequent
Muehlenbeckia complexa	Rare	Occasional	Frequent
Rubus spp.	Occasional	Occasional	Frequent

[1] Abundance classes: Very rare – <10 plants found; Rare – 10-50 plants found, not common anywhere; Occasional – scattered occurrence; Locally common – common in particular habitats, but not elsewhere; Frequent – occurring widely but not dominant; Abundant – dominants vegetation across most of area.

The postglacial terrace escarpment remnants at the northeast of the site may have been an exception to this forest pattern, and may have retained a shrub canopy on the very exposed and dry spurs and faces. However, the current vigorous regeneration of kānuka within the small gullies suggests that even these areas are likely to have had forest cover.

The small localised patches of saline soils identified at the site are most unlikely to have contained woody-dominant vegetation, due to the extreme soil conditions. These areas would most probably have comprised herbaceous cushionfield communities dominated by *Raoulia australis* in pre-settlement times, but possibly also with indigenous halophytic plants.

Idealised vegetation type descriptions for each community, using vegetation classes outlined by Atkinson (1985), are outlined below. The likely extent of each vegetation type are mapped in Figure 5.

1. (Mataī)/kāpuka-lowland ribbonwood-māpou-fierce lancewood forest

This vegetation type would have occurred on the small area of alluvial gravels at the base of the hillslopes at the north of the site. It is equivalent to the CLF13 ecosystem class. While there is no remaining CLF13 vegetation in Otago, it would likely have comprised occasional emergent mataī above a broadleaved canopy including kāpuka, lowland ribbonwood, kōwhai, narrow-leaved lacebark, māpou (*Myrsine australis*) and fierce lancewood. Species from this community would have been present on pockets of deeper moister soils on the hillslopes.

2. Kōwhai-fierce lancewood-lowland ribbonwood/Olearia lineata-kānuka forest and scrub

This vegetation type would have occurred on rocky slopes, rocky ridges and areas of shallow stoney soil, which occupy the vast majority of Rocky Point. The canopy is likely to have been dominated by kōwhai 8-10 metres tall, with common but less frequent lowland ribbonwood, narrow-leaved lacebark and fierce lancewood, and occasional kānuka, māpou, kōhūhū and *Olearia lineata*. A dense and diverse shrub layer is likely to have comprised *Coprosma* spp., porcupine shrub, *Olearia odorata, O. bullata*, *O. aviceniifolia*, korokio, weeping māpou, poataniwha and mountain tauhinu. Other species would have included *Veronica* spp. and *Carmichaelia* spp. Lianes of *Rubus* spp. and *Muehlenbeckia* spp. were likely abundant throughout. While some of the most infertile areas may have been dominated by shrubs and lacked a forest canopy, it is more probable that at least a low open tree canopy was present even in these areas; this is based on observations of kānuka colonisation over virtually all of the landscape, and observations of recent kōwhai regeneration in some of the driest and most rocky parts of the landscape.

3. Kōwhai-Olearia lineata-kōhūhū-lowland ribbonwood forest

Small areas of the site mainly within basins, gullies and small alluvial deposits contain deeper soils (Plate 12). These areas retain more moisture and have higher soil fertility than the surrounding rocky country typical of the site. A variant of Type 1 forest is likely to have occurred in these areas. The canopy is likely to have been taller, denser, and more diverse, and while likely dominated by kōwhai would have included a higher proportion of *Olearia lineata*, fierce lancewood and kōhūhū, as well as narrow-leaved lacebark and lowland ribbonwood. The forest may also possibly have had occasional Halls' tōtara, kāpuka, and mountain toatoa.

Plate 12. The southern gully at Rocky Point, showing an area of dense hemlock (*Conium maculatum*) on deeper soils.

4. Kānuka/porcupine shrub-korokio-Olearia-Coprosma-Carmicahelia scrub

Small areas of postglacial terrace escarpment at the north of the site between incised gullies and rock outcrops would have contained vegetation similar to the CL8 Singers and Rogers ecosystem class. This scrub would have been dominated by small-leaved *Olearia*, *Coprosma*, *Carmichaelia*, *Veronica*, kānuka, korokio, porcupine shrub, *O. avicenniifolia*, and kōwhai. Kānuka and *Olearia odorata* are presently replacing cushionfleld within the shallow gullies incised into the escarpment, and are indicative of the woody vegetation likely to develop on adjoining escarpments over time.

5. Raoulia australis *cushionfield*

Cushionfield would have been confined to areas of saline soils, where soil conditions restrict colonisation by woody vegetation. While it is possible that small areas of very exposed crests or hillslope with compacted soils may have retained small patches of cushionfield, this is considered unlikely as conditions would have been ameliorated by adjoining forest vegetation and higher organic carbon contents within soils. The current expansion of kānuka into cushionfields even at some of the most unfavourable microsites supports this.

5.3.2 Impacts of changed fire regimes and climate change on future vegetation development

Pole (2022) has noted, “As a vegetation type, we have no idea how all the species of the sophora [kōwhai] forest were placed in a structural sense, or how they interacted over long periods of no fire.” It is equally unknown how regenerating woody vegetation will respond to the present-day fire regime, let alone possible climate change over the long term. The uncertainties are too great to make meaningful assessments.

In light of this, a pragmatic approach is to focus efforts on ensuring a wide variety of appropriate indigenous species from the ecological district is present in plantings, and that these species are able to develop naturally at a landscape scale wherever possible. It would also be prudent to include a considerable component of species in plantings that are thriving in the present-day environment and are resilient to fire and grazing. This will foster the greatest resilience in vegetation communities, and provide a favourable environment for future adaption to changing fire and climatic regimes.

Figure 5. Climax vegetation communities at Rocky Point.

With this in mind, it is also suggested that kāpuka and tī kōuka are added to the mix of appropriate climax community species for plantings. Kāpuka is fire resistant and has wide environmental tolerance. While recent palaeoecological evidence implies kāpuka may not have been an important component of pre-settlement forest in the area (Pole 2022), kāpuka is today present on steep rocky ground in Central Otago (e.g. Mt Iron), and would be a valuable ecological addition to plantings. Tī kōuka is a prominent component of the present-day planted flora in the district, and is resistant to fire and grazing once mature.

5.3.3 Suggested benchmark communities and attributes

Objective measures of selected attributes from plot work, and suggested climax community values for some of these attributes based on plot data combined with the information from palaeoecological studies, are presented in Table 3-1 in Appendix 3 for vegetation types affected by the proposed development.

Appropriate objectives for offset plantings based on the above analysis could include:

1. To recreate plant compositions and structures that were most probably present in pre-settlement climax vegetation at the site, and that are appropriate for present-day conditions.

2. To increase plant diversity at Rocky Point and surrounding area by re-introducing a variety of species that would have formerly been key components of the vegetation, but that are now locally extinct and/or very rare. It is anticipated that these plants will provide a seed source for further spread into the Rocky Point site, and into the nearby Bendigo Scenic Reserve.

It is suggested that the backbone of the plantings comprises kōwhai and kānuka. Kānuka is important, even though likely less reflective of climax vegetation, as it is a proven successful early coloniser at the site. Other canopy species that should be included as an important component of the plantings are *Olearia lineata*, fierce lancewood, kōhūhū, lowland ribbonwood, narrow-leaved lacebark, kāpuka, tī kōuka/cabbage tree (*Cordyline australis*), and māpou. A diversity of shrubs listed in Table 1 should also be included, including *Olearia* spp., *Coprosma* spp., weeping māpou, *Carmichaelia* spp, and *Veronica* spp.

Using the above information, suggested offset benchmark community compositions and attributes were developed for offsetting impacted shrubland vegetation at Rocky Point, and for offsetting impacted cushionfield communities at Rocky Point. Common fern species found in the Dunstan ED were also included. Summaries of the benchmark communities are shown in Tables 3-2 and 3-3 of Appendix 3.

6.0 Conclusion

Human settlement of Central Otago transformed a predominantly forested lansdcape into a predominantly non-woody landscape within a few centuries, through a combination of fires, grazing and rabbits. The very dry lower areas of the western Dunstan ED were especially impacted, to the extent that even exotic grasslands were replaced by large areas of bare ground and herbfields, including cushiofields. Over the past half century, natural vegetation recovery in these areas has resulted in colonisation by predominantly kānuka and a few exotic trees and shrubs. This trend towards woody vegetation will continue in the absence of human disturbance.

Palaeoecological studies suggest that pre-settlement vegetation of the Rocky Point area would have comprised forests of broadleaved species, the canopy dominated by kōwhai with several other important accompanying species. Observations of very large, old relict kōwhai trees scattered through

the landscape support this, and kōwhai regeneration over the past century near relict trees demonstrates that kōwhai will continue to increase in abundance as succession advances. Many of the other canopy species likely to have been present with kōwhai are no longer present in the area, and their re-introduction through planting would be required if they are to be a part of future forests.

RECCE plot surveys were undertaken within five small regenerating kōwhai forest patches, to provide measures of attributes of potential climax kōwhai-dominated forest. These will assist in providing benchmark values to aid in the development of a biodiversity offset accounting model for the proposed Rocky Point subdivision.

Acknowledgments

Many thanks to Simon Beale (Beale Consultants) and Shanon Garden (TKO Properties Limited) for fieldwork, field logistics, and helpful discussions.

References

Beale Consultants (2024). Rocky Point subdivision terrestrial ecology impact vassessment. Unpublised report prepared for TKO Properties Limited. 24pp.

Clark, G.R., Petchey, P., McGlone, M.S., and Bristow, P. (1996). Faunal and floral remains from Earnscleugh Cave, Central Otago, New Zealand. Journal of the Royal Society of New Zealand, 26:363-380.

Coterra (2024). *Rocky Point – report on property and consent history*. Unpublished report prepared for TKO Properties Limited. Coterra, Wānaka. 18pp.

Gibson (2024). Rocky Point Subdivision Bendigo. Saline/sodic soils identification and location. Unpublished report prepared for TKO Properties Limited by Roger Gibson Land and Sea Services. 26pp.

Hall, G.M.J. and McGlone, M. (2006). Potential forest cover of New Zealand as determined by an ecosystem process mode. New Zealand Journal of Botany, 44:211-232.

Hercus J.M. (1966). Farming in Central Otago. Proceedings of the New Zealand Grassland Association, vol. 28. 26 pp.

Leathwick, J., McGlone, M., and Walker, S. (2012). Documentation for 'New Zealand's potential vegetation pattern'. Landcare Research.

McEwen W.M. (1987). Ecological Regions and Districts of New Zealand. Third revised edition in four 1:500,000 maps. Publication No. 5 (in four parts). Part 3. New Zealand Biological Resources Centre, Department of Conservation, Wellington. 137 pp.

McGlone, M.S. (2001). The origin of the indigenous grasslands of southeastern South Island in relation to pre-human woody ecosystems. New Zealand Journal of Ecology, 25:1-15.

McGlone, M.S. and Moar, N.T. (1998). Dryland Holocene vegetation history of Central Otago and Mackenzie Basin, South Island, New Zealand. New Zealand Journal of Botany, 36:91-111.

McGlone, M.S. and Wood, J.R. (2019). Early Holocene plant remains from the Cromwell Gorge, Central Otago, New Zealand. New Zealand Journal of Ecology, 43:3363.

McGlone, M.S., Richardson, S.J., Burge, O.R., Perry, G.L.W., and Wilmshurst, J.M. (2017). Palynology and the ecology of the New Zealand conifers. Frontiers in Earth Science, 5.

Molloy, B.P.J., Burrows, C.J., Cox, J.E., Johnston, J.A., and Wardle, P. (1963). Distribution of subfossil forest remains, eastern South Island, New Zealand. New Zealand Journal of Botany, 1:68-77.

Pole M. (2022). A vanished ecosystem- *Sophora microphylla* (kōwhai) dominated forest recorded in mid-late Holocene rock shelters in Central Otago, New Zealand. Palaeontologia Electronica https:/doi.org/10.26877/1169

Rogers G., Hewitt A., and Wilson J.B. (2000). Ecosystem-based conservation strategy for Central Otago's saline patches. Science for Conservation 166. Department of Conservation, Wellington.

Rogers, G.M., Walker, S., and Lee, W. (2005). The role of disturbance in dryland New Zealand: past and present. Science for Conservation, 258:1-122.

Singers N.J.D. and Rogers G.M. (2014). A classification of New Zealand's terrestrial ecosystems. Science for Conservation 325. Department of Conservation, Wellington.

Walker, S., King, N., Monks, A., Williams, S., Burrows, L., Cieraad, E., Meurk, C., Overton, J.M., Price, R., and Smale, M. (2009). Secondary woody vegetation patterns in New Zealand's South Island dryland zone. New Zealand Journal of Botany, 47:367-393.

Walker, S., Lee, W.G., and Rogers, G.M. (2003). The woody vegetation of Central Otago, New Zealand. Science for Conservation, 226:5-99.

Walker, S., Lee, W.G., and Rogers, G.M. (2004a). The woody vegetation of Central Otago, New Zealand. New Zealand Journal of Botany, 42:589-612.

Walker, S., Lee, W.G., and Rogers, G.M. (2004b). Pre-settlement woody vegetation of Central Otago, New Zealand. New Zealand Journal of Botany, 42:613-646.

Wardle, P. (1991). Vegetation of New Zealand. Cambridge University Press, Cambridge.

Wardle, P. (2001). Holocene forest fires in the upper Clutha district, Otago, New Zealand. New Zealand Journal of Botany, 39:523-542.

Wells, J.A. (1972). Ecology of Podocarpus hallii in Central Otago, New Zealand. New Zealand Journal of Botany, 10:399-426.

Wildland Consultants (2020). Mapping of potential natural ecosystems and current ecosystems in Otago Region. Contract Report 5015a, prepared for Otago Regional Council. 20pp.

Wood, J.R. and Walker, S. (2008). Macrofossil evidence for pre-settlement vegetation of Central Otago's basin floors and gorges. New Zealand Journal of Botany, 45:239-255.

Wood, J.R., Rawlence, N.J., Rogers, G.M., Austin, J.J., Worthy, T.H., and Cooper, A. (2008). Coprolite deposits reveal the diet and ecology of the extinct New Zealand megaherbivore moa (Aves, Dinornithiformes). Quaternary Science Reviews, 27:2593-2602.

Appendix 1

Observations of cushionfield replacement in Dunstan ED

Field observations from Rocky Point and the surrounding landscape indicate that the extensive cushionfield/bare ground communities in the lower western and northern flanks of the Dunstan Range are largely human-induced communities. Two key indicators are discussed below.

A. Ongoing regeneration of kānuka within cushionfield and bare ground across the site.

Kānuka seedlings and saplings are abundant in areas of bare soil and cushionfield in many parts of the site, and demonstrate ongoing colonisation of the site consistent with trends evident in aerial imagery over the past 50 years. This regeneration includes 'infilling' of gaps within existing open shrubland, and expansion of range into areas lacking existing kānuka shrubs. Kānuka is now actively regenerating in one of the largest remaining areas of dense cushionfield at the site, in the vicinity of Lots 1-7. Cushion plants themselves are often favoured establishment microsites for kānuka. Existing kānuka shrubs are also resulting in the decline of cushionfields, as their canopy extent increases shading out cushionfield habitat. The ongoing development of soil organic horizons and leaf litter/woody debris around kānuka is also evident, creating conditions unfavourable for cushion plants to persist or regenerate.

Representative photos are presented below.

Plate A1-1. Kānuka regeneration infilling remaining patches of cushionfield within open kānuka shrubland at Rocky Point. Location: transect line 4 (see Beale Consultants 2024).

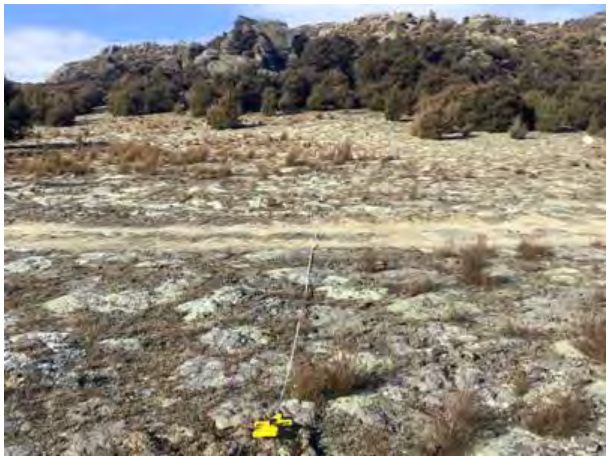

Plate A1-2. Regenerating kānuka within dense cushionfield at Rocky Point. Location: lots 1-7 (see Beale Consultants 2024).

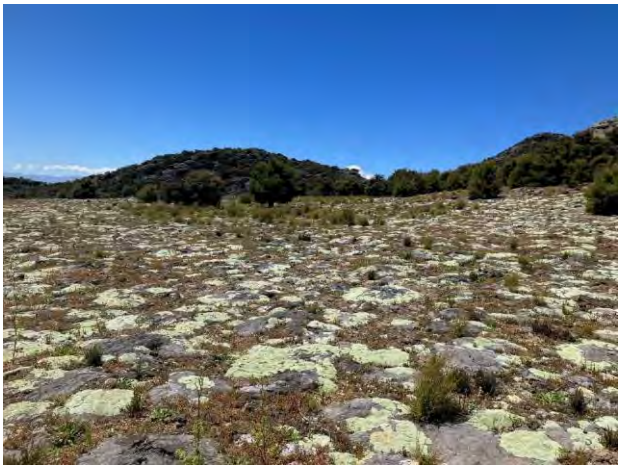

Plate A1-3. Regenerating kānuka within dense cushionfield at Rocky Point. Note the concentration of seedlings downwind of kānuka shrubs. Location: lots 1-7 (see Beale Consultants 2024).

Plate A1-4. Cushion plants can provide favourable microsites for kānuka establishment at Rocky Point.

Plate A1-5. As kānuka shrubland matures cushionfield is dying and being replaced by leaf litter and woody debris at Rocky Point. Location: transect line 5 (see Beale Consultants 2024).

Plate A1-6. Large hillslopes near the southern boundary of Bendigo Scenic Reserve formerly dominated by cushionfield are being progressively colonised by kānuka.

B. Fence lines delineating vegetation responses to differing management regimes

Further evidence that cushionfields have largely been induced by human management in the lower western flanks of the Dunstan Range is provided by vegetation on either side of fence lines that separate differing management regimes. While no such fence lines are present at Rocky Point, they are relatively common and widespread in the surrounding landscape. These generally arise when grazing has been removed and rabbits controlled on formerly-degraded land, often for the purposes of horticulture or viticulture. Three examples are provided below, from locations at 250-400 metres elevation on the lower western flanks of the Dunstan Range with landscape positions and soil conditions similar to Rocky Point . These graphically show that in the absence of stock grazing, rabbits and fire, cushionfield vegetation is colonised by exotic grasses and herbs. These would succeed to shrubland and forest, as at Rocky Point and Bendigo Scenic Reserve, if permitted.

Plate A1-7. A fence line on Devils Creek true left hillside, on public walkway just above the kōwhai plots sampled in this study (see Figure 1).

Plate A1-8. A fence line on the crest of the postglacial terrace just east of Rocky Point. The area to the left of the fence has been developed as a vineyard, and stock and rabbits have been excluded.

Plate A1-9. This fence line just south of Rocky Point separates Bendigo Scenic Reserve (to the right) from private land managed for vineyards. Grazing has ceased on both blocks, but rabbit control has also been undertaken on the private land.

Appendix 2

Details of field observations and RECCE plot surveys in relict/regenerating kōwhai forest remnants

A. Selected field observations

1. A single very large, old kōwhai tree on a hillslope in the southwest of Bendigo Scenic Reserve at about 600 metres elevation, with three younger individuals nearby. Adjoining vegetation comprises cushionfield with colonising kānuka (Plates A2-1 to A2-3).

Plate A2-1 This one large, old kōwhai measured 49 centimetres diameter, and was estimated to be 6-7 metres tall.

Plate A2-2. The large kōwhai is surrounded by cushionfield and regenerating kānuka.

Plate A 2-3. A young kōwhai growing near to the large kōwhai.

2. A single very large, old tree on a rocky slope on the western flanks of Bendigo Scenic Reserve in upper Pigeon Creek at about 550 metres elevation, with at least 20 young kōwhai nearby (Plates A2-4 to A2-6).

Plate A2-4. This very large, old kōwhai had a main stem measuring 51 centimetres in diameter with two other large stems, and was estimated to be 8-9 metres tall. This was the largest tree observed by Wildlands staff.

Plate A2-5. Over 20 kōwhai trees, saplings and seedlings were observed in the area surrounding the large, old kōwhai (upper centre of image), seven of which are visible on the hillside in this image.

Plate A2-6. This young, straight kōwhai has established c.50 metres north of the large, old kōwhai, and now has young regeneration around it.

3. A single large tree in the lower Pigeon Creek gorge in Bendigo Scenic Reserve, with at least 15 younger trees and saplings nearby (Plates A2-7 and A2-8).

Plate A2-7. This large kōwhai was estimated to be 10 metres tall, with an estimated diameter of 35 centimetres. The tree was in full flower when viewed on 29 June 2024. A group of seven tui and several bellbirds were observed feeding on the nectar of this tree and a younger flowering tree nearby, highlighting the importance of such trees for avifauna.

Plate A2-8. Over 15 small trees, saplings and seedlings were observed near to the older tree, four of which are visible in this photo.

B. RECCE plot details, representative photos, and survey data summary

Table A2-1 – Details of RECCE plots surveyed in regenerating kōwhai forest in the lower western Dunstan Range. All plots contained several older kōwhai trees with regeneration present.

Site Location	Details of plot and site		
	Site description	Plot size	Other indigenous species in plot/nearby
Rocky Point	Rocky outcrop on ridge	10x15m	Kānuka, korokio, porcupine shrub, rock fern, *Raoulia australis*
Pigeon Creek	Rocky outcrop on ridge	10x10m	Kānuka, korokio, *Veronica pimelioides* subsp. *pimelioides, Rubus schmedelioides*, rock fern
Devils Creek Upper	Rocky outcrop on north facing hillside	33x5m	Kānuka, *Olearia lineata*, korokio, porcupine shrub, mingimingi, *Coprosma virescens*, weeping māpou
Devils Creek Lower	Stony north facing hillside with rocky outcrops in gully above creek	10x10m	Kānuka, mingimingi, porcupine shrub
Firewood Creek	Rocky outcrops and stony soils on south facing hillside above creek	20x20m	Mingimingi, koromiko, *Carmichaelia compacta*, *Melicope simplex, Coprosma crassifolia*

Representative plot photographs

Plate A2-9. Rocky Point plot, southwestern corner looking northeast.

Plate A2-10. Pigeon Creek plot locality, looking west to Lake Dunstan.

Plate A2-11. Devils Creek Upper plot locality, looking east.

Plate A2-12. View from just above the northeastern corner of the Firewood Creek plot, looking southwest towards Cromwell. The kōwhai canopy visible on the centre and left of the image is within the plot.

Plate A2-13. The central area of the Firewood Creek plot.

Plate A2-14. Regenerating kōwhai on south-facing slopes above Firewood Creek, outside of the sampled plot.

Table A2-2 – Summary data from RECCE plots surveyed in regenerating kōwhai forest in the lower western Dunstan Range. All plots contained several older kōwhai trees with regeneration present.

Site	Measured and predicted Attributes								
	Stems/ha	Kōwhai BA/ha	Kānuka BA/ha	Canopy cover	Top height	Mean height	Woody indigeous species (no.)	Likely mature canopy cover	Likely mature mean height
Rocky Point	467	7.8	0.6	25%	6m	4m	4	75-100	6-8m
Pigeon Creek	1,100	8.6	0.3	20%	6m	4m	5	75-100	6-8m
Devils Creek Lower	1,000	12.9	0	45%	8m	6m	4	75-100	>8m
Devils Creek Upper	667	9.4	0.9	45%	6m	4m	8	75-100	>8m
Firewood Creek	1,050	24.5	0	85%	10m	6m	5	85-100%	>10m

Appendix 3

Selected attributes for climax communities, and suggested benchmark communities for offsetting at Rocky Point

Table A3-1 – Attributes and values for benchmark climax communities at Rocky Point.

Attribute	Measure	Attribute values for climax vegetation community			
		Kōwhai-fierce lancewood/ *Olearia lineata*-(kānuka) forest	Kōwhai-Olearia lineata-kōhūhū-lowland ribbonwood forest	Kānuka/porcupine shrub-korokio-Olearia-Coprosma-Carmichaelia scrub	Raoulia australis cushionfield
Indigenous spp. cover abundance	% cover	>75	>75	>75	>50
Woody indigenous canopy cover abundance	% cover	>75	>75	>75	<10
Woody indigenous canopy height	Average height (m)	8-12	10-14	2-4	2-3
Indigenous tree basal area	m2/ha	20-30	25-40	<10	<1
Indigenous tree density	Stems/ha	1,000	1,000	<400	<100
Structural diversity present - tree, shrub, ground cover/litter, lianes)	No. of developed layers present (0-4)	4	4	3	1-2
Indigenous species diversity (woody spp?)	No. of species	>15	>15	>10	5-10

Table A3-2 – Suggested offset benchmark community for shrublands at Rocky Point. Combined basal area is 65 m2/ha. Combined cover is 100% for ground and canopy, and 49% for shrub.

Species	Plant type	Values for shrubland offset community			
		Cover (%)	Basal area (m2/ha)	No. seedlings in 100m2 plot	No. saplings in 100m2 plot
Asplenium flabellifolium	Fern	1	0		
Polystichum neozelandicum	Fern	9	0		
Asplenium richardii	Fern	5	0		
Pellaea calidirupium	Fern	2	0		
Raoulia australis	Herb	0	0		
Bryophytes	Mosses	8.5	0		
Carmichaelia compacta	Shrub	0.5	0		
Coprosma dumosa	Shrub	0.5	0		
Coprosma crassifolia	Shrub	5	0.5		
Coprosma propinqua	Shrub	1	0		
Coprosma virescens	Shrub	20	0		
Corokia cotoneaster	Shrub	2	0		
Melicope simplex	Shrub	15	0		
Melicytus alpinus	Shrub	1	0		
Olearia odorata	Shrub	0.5	0		
Veronica salicifolia	Shrub	2	0		
Myrsine divaricata	Small tree	0.5	0.5	5	0.5
Olearia lineata	Small tree	2	2	1	0.1
Veronica pimeleoides	Subshrub	0.5	0		0
Vittadinia australis	Subshrub	0.5	0		0
Cordyline australis	Tree	2	1	1	0.1
Griselinia littoralis	Tree	15	8	25	2.5
Hoheria angustifolia	Tree	10	8	5	0.5
Kunzea serotina	Tree	15	8	5	0.5
Myrsine australis	Tree	2	5	5	0.5
Pittosporum tenuifolium	Tree	2	5	15	1.5
Plagianthus regius	Tree	20	10	5	0.5
Pseudopanax ferox	Tree	0.5	2	10	1
Sophora microphylla	Tree	30	15	15	1.5
Muehlenbeckia australis	Vine	1	0		
Muehlenbeckia complexa	Vine	0.5	0		
Rubus schmidelioides	Vine	1	0		
Bare ground, litter, rocks etc	n/a	65	0		

Table A3-3 – Suggested offset benchmark community for cushionfield at Rocky Point. Combined basal area is 18.5 m2/ha. Combined cover is 98% for ground, 41.5% for canopy, and 58% for shrub cover.

Species	Plant type	Values for cushionfield offset community			
		Cover (%)	Basal area (m2/ha)	No. seedlings in 4m2 plot	No. saplings in 4m2 plot
Asplenium flabellifolium	Fern	1	0		
Cheilanthes sieberi	Fern	1	0		
Polystichum neozelandicum	Fern	0.5	0		
Asplenium richardii	Fern	1	0		
Pellaea calidirupium	Fern	1	0		
Raoulia australis	Herb	1	0		
Bryophytes	Mosses	2	0		
Carmichaelia compacta	Shrub	2	0		
Coprosma dumosa	Shrub	1	0		
Coprosma crassifolia	Shrub	15	1		
Coprosma propinqua	Shrub	5	0		
Coprosma virescens	Shrub	10	0		
Corokia cotoneaster	Shrub	5	0		
Melicope simplex	Shrub	0.5	0		
Melicytus alpinus	Shrub	10	0		
Olearia odorata	Shrub	1	0		
Veronica salicifolia	Shrub	1	0		
Myrsine divaricata	Small tree	5	1	5	0.5
Olearia lineata	Small tree	5	2	5	0.5
Veronica pimeleoides	Subshrub	0.5	0	0	0
Vittadinia australis	Subshrub	0.5	0	0	0
Cordyline australis	Tree	1	0.5	5	0.5
Griselinia littoralis	Tree	5	0.5	5	0.5
Kunzea serotina	Tree	25	10	15	1.5
Pittosporum tenuifolium	Tree	1	1	5	0.5
Pseudopanax ferox	Tree	1	1	5	0.5
Sophora microphylla	Tree	5	1.5	5	0.5
Muehlenbeckia australis	Vine	2	0		
Muehlenbeckia complexa	Vine	2	0		
Rubus schmidelioides	Vine	2	0		
Bare ground, litter, rocks etc	n/a	85	0		

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Appendix 7 – Summary of Offsetting Approach

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R7080b

9 July 2024

TKO Properties Limited
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Dear Shanon,

SUMMARY OF OFFSETTING APPROACH – ROCKY POINT PROPOSED SUBDIVISION

OFFSETTING APPROACH

The offsetting approach used as a guide to the sufficiency of effects management actions was based on the offset calculator (an excel spreadsheet) published by the Department of Conservation. This is a condition:area offsetting model that can potentially exchange biodiversity condition with the area of offsetting activities. The model has disaggregated components, each component assessing progress toward no net loss.

Two offset models were used, one based on effects on kānuka (*Kunzea serotina*) shrubland, and one based on effects on cushionfield dominated by *Raoulia australis*. The two models had different benchmarks, with the shrubland model incorporating an indigenous forest benchmark on deeper, moister soils, and the cushionfield model incorporating a shrubland benchmark on thinner, drier soil. In addition, different plot sizes were used to gain data for the offsetting models, with 10 metre × 10 metre ($100m^2$) plots used to generate information for the shrubland offset and 2 metre × 2 metre ($4m^2$) plots used to generate information for the cushionfield offset.

BIODIVERSITY INFORMATION

Vegetation plots were established to measure the condition of the impacted vegetation and habitat, and also used to sample remnants of kōwhai (*Sophora microphylla*) woodland in the landscape to assist compiling benchmarks, and planted vegetation of known age in Wānaka to assist the rate of biodiversity improvement at the offset sites. Benchmarks were partly formed subjectively by adding in indigenous tree species that are no longer naturally present in the area.

COMPONENTS AND ATTRIBUTES

Components in each model were constructed for indigenous cover, species richness, basal area, number of indigenous seedlings, and number of indigenous saplings. Basal area is a key component because at a plot level it increases continuously, whereas aspects of cover, species richness, and numbers of seedlings and saplings can increase or decrease depending on the stage of succession.

For each component, several attributes were used (Table 1). Importantly, there can be trade-offs between the condition of attributes within a component. For example, one species might increase condition more rapidly than others, and hence have a greater effect on the offset outcome.

Summaries of the benchmark community parameters and the predicted offset community parameters at the end of the offset are included in Tables 3 and 4, at the end of this letter.

Table 1 – Summary of components and attributes used for the shrubland and cushionfield offsets at Rocky Point.

Component	Attributes	Measurement unit (shrubland offect)	Measurement unit (cushionfield offset)
Indigenous cover	*Raoulia australis* Indigenous woody cover Rocks, litter etc Vine cover	% cover	% cover
Indigenous species richness	Indigenous species Indigenous woody species Indigenous vine species Indigenous ground cover species	Count in 100m2 plot	Count in 4m2 plot
Basal area	Kānuka Kōwhai *Olearia lineata* Lowland ribbonwood Kōhūhū Kāpuka	m2/ha	m2/ha
Number of seedlings	Kānuka Kōwhai *Olearia lineata* Lowland ribbonwood Kōhūhū Kāpuka	Count in 100m2 plot	Count in 4m2 plot
Number of saplings	Kānuka Kōwhai *Olearia lineata* Lowland ribbonwood Kōhūhū Kāpuka	Count in 100m2 plot	Count in 4m2 plot

Table 2 – Summary of components and offset model outcomes for the shrubland and cushionfield offsets at Rocky Point.

Components	NPBV outcome	Notes
Shrubland offset		
Indigenous cover	-0.15	A positive outcome for woody cover was achieved in ten years, while vine cover was achieved in 20 years. Ground cover was negative at 30 years, reflecting that a 30-year old forest would cast deep shade, and colonisation by indigenous ground cover species will be slow.
Indigenous species richness	0.06	Total indigenous species was negative but indigenous woody, vine, and ground cover species were positive. The endpoint was 30 years for each attribute.
Basal area	0.04	Kānuka basal area was negative, but positive outcomes from the other six species outweighed this. The endpoint was 30 years for each attribute.
Number of seedlings	-0.06	Kānuka cannot regenerate in deep shade, so had a negative NPBV outcome, which was not outweighed by positive NPBV outcomes from the other six species. The endpoint was 30 years for each attribute.
Number of saplings	-0.10	Kānuka cannot regenerate in deep shade, so had a negative NPBV outcome, which was not outweighed by positive NPBV outcomes from the other six species. The endpoint was 30 years for each attribute.
Cushionfield offset		
Indigenous cover	-2.06	While indigenous woody cover was positive at 20 years, the cover of indigenous ground cover species, and rock and litter cover, were both negative at 30 years. This is because on thinner, drier soils growth rates of indigenous vegetation and ecological processes will be slower, and exotic ground cover will persist for longer.
Indigenous species richness	-1.12	While indigenous woody and vine species had positive NPBV at 20 years, total species richness, and indigenous ground cover species richness, were both negative at 30 years, and these negative results outweighed the positive contributions.
Basal area	0.03	All five species, including kānuka, had small positive NPBV values at 30 years resulting in a positive NPBV at the component level.
Number of seedlings	-0.35	The negative value for kānuka was not outweighed by the positive contribution of the other six species at 30 years.
Number of saplings	-0.54	The negative value for kānuka was not outweighed by the positive contribution of the other six species at 30 years.

GENERATING THE BIODIVERSITY OUTCOMES

The offsetting outcome (net present biodiversity value of each component or NPBV) is derived by averaging the condition of the attributes within the component. The Department of Conservation offsetting calculator only has room for five attributes per component. In the shrubland offset there were seven key species selected as attributes for basal area and seedlings/saplings: kānuka, kōwhai, *Olearia lineata*, mānatu/lowland ribbonwood

(*Plagianthus regius*), narrow-leaved lacebark (*Hoheria angustifolia*), kōhūhū (*Pittosporum tenuifolium*) and kāpuka/broadleaf (*Griselinia littoralis*). In these cases, the average condition was done manually over the seven species attributes.

OFFSETTING OUTCOMES

Offsetting outcomes for most components were negative, reflecting successional processes or the 'dilution' of kānuka by other indigenous woody species (Table 2). If only kānuka was planted, the offsetting outcomes for seedlings and saplings would be positive. Importantly, the key basal area component achieved a positive NPBV outcome in both shrubland and cushionfield offsetting models. This outcome is very confidently predicted as it is based on known basal area accumulation of planted woody vegetation in Wānaka. The deep, moist soils at the site where the shrubland offset outcome will take place will not limit basal area accumulation.

APPROPRIATENESS OF CUSHIONFIELD OFFSETTING MODEL

The cushionfield offsetting model anticipates replacement of *Raoulia australis* cushionfield with indigenous woodland. This is based on research undertaken by Wildlands[1] and potential ecosystem mapping which shows woody vegetation would have dominated the site, except on steep terrace risers and saline/sodic soils, which would have supported shrubs and cushion plants[2].

Yours sincerely

Kelvin Lloyd

Kelvin Lloyd
Senior Principal Ecologist
Wildland Consultants Ltd

[1] Wildland Consultants (2024): *Vegetation succession and climax communities at Rocky Point.* Wildland Consultants Contract Report No. 7080a. Prepared for TKO Properties Limited. 42pp.

[2] Wildland Consultants (2020). *Mapping of potential natural ecosystems and current ecosystems in Otago Region.* Contract Report 5015a, prepared for Otago Regional Council. 20pp.

Table 3 – Summary of predicted component values at offset end point (30 years) for the shrubland offset plantings at Rocky Point.

Species	Benchmark values		Predicted values at offset completion			
	Cover %	Basal area m2/ha	Predicted cover %	Predicted basal area m2/ha	Predicted seedlings per plot	Predicted saplings per plot
Asplenium flabellifolium	1	0	0.5	0	0	0
Cheilanthes sieberi	0	0	0	0	0	0
Polystichum neozelandicum	9	0	0.5	0	0	0
Polystichum vestitum	7	0	5	0	0	0
Asplenium richardii	5	0	1	0	0	0
Pellaea calidirupium	2	0	0	0	0	0
Raoulia australis	0	0	0	0	0	0
Carmichaelia compacta	0.5	0	0.1	0	0	0
Coprosma dumosa	0.5	0	0.5	0	5	0.5
Coprosma crassifolia	5	0.5	10	0.5	5	0.5
Coprosma propinqua	1	0	1	0.1	5	0.5
Coprosma virescens	20	0	0.5	0	1	0.1
Corokia cotoneaster	2	0	0.5	0	0	0
Melicope simplex	15	0	0.5	0	0	0
Melicytus alpinus	1	0	0.1	0	2	0.2
Olearia odorata	0.5	0	0.1	0	0	0
Veronica salicifolia	2	0	0.2	0	1	0.1
Myrsine divaricata	0.5	0.5	0.5	0.5	1	0.1
Olearia lineata	3	2	0.5	0.5	3	0.3
Veronica pimeleoides	0.5	0	0.1	0	0	0
Vittadinia australis	0.5	0	0	0	0	0
Cordyline australis	0.5	0.5	10	1	2	0.2
Griselinia littoralis	15	8	5	1	20	2
Hoheria angustifolia	10	8	2	1	2	0.2
Kunzea serotina	15	8	35	5	15	1.5
Myrsine australis	2	5	1	0.2	0	0
Pittosporum tenuifolium	2	5	20	2	25	2.5
Plagianthus regius	20	10	5	3	0	0
Pseudopanax ferox	0.5	2	1	0.5	0	0
Sophora microphylla	30	15	20	1	5	0.5
Muehlenbeckia australis	1	0	0.5	0	0	0
Muehlenbeckia complexa	0.5	0	0.1	0	0	0
Rubus schmidelioides	1	0	0.5	0	0	0
Rocks, litter etc	65	0	55	0	0	0
TOTALS	238.5	64.5	176.7	16.3	92	9.2

Table 4 – Summary of predicted component values at offset end point (30 years) for the cushionfield offset plantings at Rocky Point.

Species	Benchmark values		Predicted values at offset completion			
	Cover %	Basal area m2/ha	Predicted cover %	Predicted basal area m2/ha	Predicted seedlings per plot	Predicted saplings per plot
Asplenium flabellifolium	1	0	0.1	0	0	0
Cheilanthes sieberi	0	0	1	0	0	0
Polystichum neozelandicum	9	0	0.5	0	0	0
Polystichum vestitum	7	0	0.5	0	0	0
Asplenium richardii	5	0	1	0	0	0
Pellaea calidirupium	2	0	0	0	0	0
Raoulia australis	0	0	0	0	0	0
Carmichaelia compacta	0.5	0	1	0	0	0
Coprosma dumosa	0.5	0	1	0	0	0
Coprosma crassifolia	5	0.5	25	0.3	3	0.3
Coprosma propinqua	1	0	1	0.1	0	0
Coprosma virescens	20	0	0.5	0	0	0
Corokia cotoneaster	2	0	2	0	1	0.1
Melicope simplex	15	0	0.1	0	0	0
Melicytus alpinus	1	0	10	0	1	0.1
Olearia odorata	0.5	0	0.5	0	0	0
Veronica salicifolia	2	0	0.5	0	0	0
Myrsine divaricata	0.5	0.5	0.5	0.1	1	0.1
Olearia lineata	3	2	1	0.3	0.5	0.05
Veronica pimeleoides	0.5	0	0.1	0	0	0
Vittadinia australis	0.5	0	0.1	0	0	0
Cordyline australis	0.5	0.5	1	0.1	0.1	0.01
Griselinia littoralis	15	8	0.5	0.1	0.1	0.01
Hoheria angustifolia	10	8	0	0	0	0
Kunzea serotina	15	8	40	1	5	0.5
Myrsine australis	2	5	0	0	0	0
Pittosporum tenuifolium	2	5	0.5	0.5	2	0.2
Plagianthus regius	20	10	0	0	0	0
Pseudopanax ferox	0.5	2	0.5	0.1	1	0.1
Sophora microphylla	30	15	1	0.5	1	0.1
Muehlenbeckia australis	1	0	1	0	0	0
Muehlenbeckia complexa	0.5	0	0.1	0	0	0
Rubus schmidelioides	1	0	0.5	0	0	0
Rocks, litter etc	65	0	35	0	0	0
TOTALS	238.5	64.5	126.5	3.1	15.7	1.57

Appendix 8 – Ecological Enhancement and Monitoring Plan

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Rocky Point Ecological Enhancement and Monitoring Plan

Prepared for Rocky Point Services Limited
July 2024

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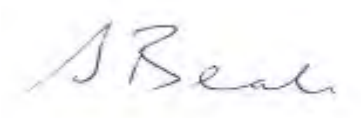

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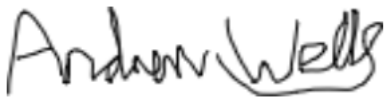

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Appendix 1: Modified McLean Scale of Rabbit Infestation

1. Introduction

TKO Properties Limited (TKO) are proposing biodiversity offset and compensation plantings at Rocky Point. The biodiversity offset addresses the residual adverse ecological effects of a proposed subdivision development. The residual adverse effects are the permanent loss of 37,633 m^2 (3.76 ha) of cushionfield and 12,802 m^2 (1.28 ha) of kanuka shrubland/scrub within the development (impact) site at Rocky Point and effects on indigenous flora and fauna that inhabit these plant communities.

The biodiversity offset comprising forest and shrubland plantings including species of high value over 5.0 hectares at Bendigo Hills Estate (Bendigo Hills). The biodiversity offset accounting model implemented by Wildlands shows the proposed offset will achieve in a net gain in biodiversity.

The compensation plantings comprise forest and shrub plantings, including high value species at four designated enrichment planting sites at Rocky Point. These plantings represent an additional positive ecological effect.

TKO propose to undertake property weed control and rabbit and goat control at Rocky Point, including most of the property that will be subject to formal protection through a covenant requiring the maintenance of this land for conservation purposes in perpetuity.

The Ecological Enhancement and Monitoring Plan (EEMP) sets out the actions required to achieve the objectives of the offset and compensation plantings and weed and pest control measures.

2. Objectives of the Offset Plantings and Compensation (Enrichment) Plantings

The objectives of the plantings are as follows:

1. To recreate plant compositions and structures that were most probably present in pre-settlement climax vegetation at the site, and that are appropriate for present-day conditions.

2. To increase plant diversity at Rocky Point and Bendigo Hills and surrounding areas by re-introducing a variety of species that would have formerly been key components of the pre-settlement vegetation, but that are now locally extinct and/or very rare. It is anticipated that these plants will provide a seed source for further spread into Rocky Point, and the nearby Bendigo Scenic Reserve.

3. Description of Offset Sites

Three offset sites have been identified on Bendigo Hills that are considered favourable for planting due to their south/south-westerly aspect, favourable soils, dominance of exotic grasses and forbs, and close proximity to Bendigo Scenic Reserve and Mt Koinga Track. The location and extent of the sites are shown on Figure 3-1. The total area of the proposed offset sites is c.5.0 hectares.

3.1. Hemlock Gully

Hemlock Gully as the same suggests is dominated by hemlock that has colonised a shallow gully representing part of an ephemeral seepage. The percentage cover of hemlock including associated litter recorded in RECCE plots sampled along a transect down gradient of a group of mature *Olearia lineata* was between 60 to 90%. The Mt Koinga Track passes through the middle of the site. Total area is c.1.8 hectares.

Figure 3-1: Proposed offset sites.

3.2. Panorama Rise

This site covers hillslopes of a moderate gradient situated between a metalled road and kānuka shrubland. The site is covered mostly in exotic grassland and incorporates small stands of kānuka and scattered shrubs of sweet briar. RECCE plots placed in the site show that exotic grasses occupy between 60-90% of the cover within the plots, exotic forbs up to 25% and the balance is mossfield, loose mats of lichen and bare ground. Total area is c. 1.2 hectares.

3.3. Pylon Flat

Pylon Flat forms part of an extensive gently-sloping terrace that abuts the Bendigo Scenic Reserve and is bisected by the Clyde-Twizel transmission line. The Mt Koinga Track enters the Bendigo Scenic Reserve at the lower end of the site. The vegetation cover is a mosaic of cushionfield, exotic grassland and exotic herbfield and large patches of bare ground. RECCE plot data shows that the cushion plant *Raoulia australis* occupied about 5% of the plots, exotic forbs up to 30%, exotic grasses between 10-30 % and bare ground was variable between 20 to 80%. Total area is c.2.7 hectares.

4. Enrichment Plantings

TKO are proposing to undertake enrichment plantings at four sites in Rocky Point beyond the development area as shown on Figure 4-1, and plantings around the perimeter of the building platforms. The former will comprise a mix of tree and shrub species and the latter solely shrub species.

Planting site 1 (*c.* 4,000 m^2) is in an area of exotic grassland, sweet briar and scattered *Coprosma propinqua* near SH 8. Planting sites 2-4, each *c.* 400 m^2 are in kānuka scrub filled gullies where favourable soils exist, positioned within existing canopy gaps and areas where exotic species (hemlock, sweet briar and crack willow) currently dominate.

The enrichment planting at these sites will comprise species identified by Wildlands as likely components of the pre-settlement vegetation types that occurred on the alluvial gravels at the base of the hillslopes at the north of Rocky Point and within the gullies and basins in Rocky Point. The vegetation across the alluvial gravels such as beside SH 8 would have likely comprised a forest with the occasional emergent mataī above a broadleaf canopy of kāpuka, ribbonwood, kōwhai, narrow-leaved lacebark, māpou and fierce lancewood. Within the gullies a variant to the (*Mataī)/kāpuka-ribbonwood-māpou-fierce lancewood* forest would have existed dominated by kōwhai, lowland ribbonwood, kōhūhū, fierce lancewood, narrow-leaved lacebark with a lesser abundance of shrubs such poataniwha (*Melicope simplex*), *Coprosma virescens*, *Copromsa crassifolia*, *Olearia lineata, Olearia odorata,* and *Myrsine divaricata.*

The shrub plantings proposed around the building platforms would comprise a mix of *Olearia* and *Coprosma* species, porcupine shrub, korokio and mountain cottonwood and the low growing shrub *Muehlenbeckia axillaris*.

Figure 4-1: Indicative location of enrichment planting sites.

5. Offset Plantings

5.1. Species Composition

In accordance with the objectives, species outlined in Table 5-1 that represent the pre-settlement forest and shrubland vegetation at Rocky Point will be utilised in plantings.

Two slightly different offset plantings have been developed and modelled; one to offset the loss of kanuka shrubland (shrubland offset) and one to offset the loss of cushionfield (cushionfield offset). The plantings and densities for each offset are set in Table 5-1.

Table 5-1: Shrubland and Cushionfield Offset Plantings.

		Shrubland offset plantings	Cushionfield offset plantings
Climax community species	**Plant type**	**Planting density (plants/ha)**	**Planting density (plants/ha)**
Asplenium flabellifolium	Fern	**0**	**0**
Cheilanthes sieberi	Fern	**0**	**20**
Polystichum neozelandicum	Fern	**20**	**0**
Polystichum vestitum	Fern	**30**	**0**
Asplenium richardii	Fern	**0**	**20**
Pellaea calidirupium	Fern	**0**	**0**
Raoulia australis	Herb	**0**	**0**
Carmichaelia compacta	Shrub	**50**	**200**
Coprosma dumosa	Shrub	**100**	**100**
Coprosma crassifolia	Shrub	**650**	**1600**
Coprosma propinqua	Shrub	**200**	**600**
Coprosma virescens	Shrub	**250**	**300**
Corokia cotoneaster	Shrub	**250**	**600**
Melicope simplex	Shrub	**250**	**60**
Melicytus alpinus	Shrub	**100**	**1150**
Olearia odorata	Shrub	**100**	**110**
Veronica salicifolia	Shrub	**250**	**100**
Myrsine divaricata	Small tree	**100**	**110**
Olearia lineata	Small tree	**100**	**200**
Veronica pimeleoides	Subshrub	**0**	**50**
Vittadinia australis	Subshrub	**0**	**50**
Cordyline australis	Tree	**400**	**80**
Griselinia littoralis	Tree	**400**	**50**
Hoheria angustifolia	Tree	**200**	**0**
Kunzea serotina	Tree	**2500**	**1600**
Myrsine australis	Tree	**150**	**0**
Pittosporum tenuifolium	Tree	**500**	**200**
Plagianthus regius	Tree	**300**	**0**
Pseudopanax ferox	Tree	**200**	**100**
Sophora microphylla	Tree	**400**	**200**
Muehlenbeckia australis	Vine	**0**	**0**
Muehlenbeckia complexa	Vine	**0**	**0**
Rubus schmidelioides	Vine	**0**	**0**
Rocks, litter etc			**0**
		Total 7500/ha	**Total 7500/ha**
		7500	**7500**

5.2. Performance Metrics

The plantings will be subject to the following performance indices:

- achieving at least 80% survival within the planting areas within five years of planting;
- achieving a measurable increase in vegetation cover and stature in the revegetation areas on an annual basis.

5.3. Staging of Planting

Planting shall occur on an annual basis and staged over a five-year period. Further details are set out on the programme chart (see Section 10).

5.4. Plant Grade

Nursery reared eco-sourced[1] PB2 grade seedlings are recommended for planting. Plants of this size have a good ratio of root bed to foliage that favours early establishment and high survival rates.

5.5. Planting Configuration

Trees will be spaced 2-2.5 metres apart and shrubs 1.5 m.

The plant density is considered appropriate to provide a sufficient future seed source for natural regenerative processes to occur in tandem with pest and weed control measures.

5.6. Nutrient Management

To maximise early establishment, it is recommended that granular fertiliser is placed in each planting hole prior to plant placement and backfilling.

5.7. Browse Protection

To protect against rabbit browse, 600 mm high plant tri-guard protectors are recommended for each plant. These should be double staked in each protector to ensure they are wind resistant. Recognised suppliers such as Advance Landscape Systems and Egmont Commercial provide plant protector/stake/weed mat combos.

5.8. Grass and Weed Suppression

Placement of weed mats around each plant at time of planting is recommended to suppress exotic grass and broadleaved weed growth.

5.9. Irrigation

Irrigation is to be applied to each of the planted areas through gravity (tank) fed reticulation systems and strategically placed elevated sprinkler heads. Irrigated water will be supplied to the plantings for a period of 5 years.

5.10. Aftercare Management

5.10.1. Replacement Plantings

Plants that do not survive within the first 6 to 12 months of planting as informed by walk over inspections will be replaced in the following autumn or spring, depending on the timing of the plantings. It is expected that up to 10% of the plantings will perish during this period.

Replacement of plantings will occur once per annum over a period of three years following initial planting (see Section 10).

5.10.2. Weed Control

Any grass and/or broadleaved weeds that manage to establish within the plant protectors should be removed by hand pulling.

[1] Plants propagated from seed sourced from trees and shrubs that occur locally in the Central Otago Ecological Region.

6. Property Wide Weed Control

Control of exotic weeds will be implemented on an annual basis during early to mid-spring to halt exotic weed spread, stop new weeds from establishing and reduce competition to the plantings to facilitate indigenous plant regeneration across Rocky Point.

Parts of Rocky Point is affected by the spread of exotic herbaceous weeds such as hemlock, stonecrop, Californian thistle and scarlet pimpernel. These species are a particular threat to the ecological integrity of cushionfield communities, and especially within saline ecosystems where succession to indigenous woody vegetation is unlikely. Control of these weeds across the cushionfields in the saline ecosystems will be undertaken using a wand to ensure targeted application of herbicide with proven performance in eliminating problem exotic herbaceous plants.

Parts of Rocky Point are also affected by infestations of exotic woody weeds. Species that will be targeted are: radiata pine, lodgepole pine, hawthorn, elderberry, Buddleia, sycamore, crack willow, wild cherry, wild plum, broom, *Cotoneaster franchetti* and blackberry. Control of these plants is essential to ensure that the objectives of the enhancement project are achieved.

Control measures will entail:

- Felling of conifers and large diameter woody flowering pest plants;
- Removal of smaller diameter woody pest plants with a scrub cutter;
- Spot spraying of exotic broadleaved plants using a proprietary herbicide such as Versatill.

These control measures will generally take place twice yearly in autumn and spring on an ongoing basis with frequency informed from walk over surveillance surveys by a suitably qualified expert.

Objectives for weed control are:

- To maintain the dominance of cushionfield communities within saline ecosystems
- To maintain weed species at relatively low abundances.
- To eradicate any conifers and problem woody weed species that establish at Rocky Point.

7. Rabbit and Goat Control

The objective of the pest control programme at Rocky Point will be to maintain rabbit and hare numbers at the McLean Scale of infestation of 3 or less (refer Appendix 1).

Rabbits and hares will be controlled on an ongoing basis across Rocky Point through a combination of measures such as night shooting, pindone poisoning and gassing of rabbit burrows to achieve sustainable pest numbers.

Goats will be controlled through daytime shooting operations. These are typically undertaken with a helicopter.

Programming of the control measures will be informed by walk over inspections by a suitably qualified expert with the intensity of operations determined from twice yearly monitoring rounds.

Only professional rabbit and goat control contractors shall be used in this role as recreational shooters tend to spook the animals and reduce the effectiveness of shooting and poisoning operations.

8. Monitoring

8.1. Walk Over Inspections of planting sites

Walk over inspections will be undertaken initially as a baseline prior to implementing the management measures and then on an annual basis to assess:

- The number of plants of each species that have died;
- Evidence of self-seeded plants; and
- Woody and non-woody weed incursions.

8.2. RECCE Plots

RECCE plots (2 x 2 m) will be established in the saline ecosystems to measure weed coverage, to assess the performance of the control measures and gauge trends over time.

RECCE plots (10 x 10 m) will be established in the planting areas to measure canopy cover, basal area, mean height, mean top height, and seedling and sapling counts.

8.3. Photo points

Fixed photo points will be established within and adjacent to each offset and enrichment planting area.

The photo points will consist of marker posts labelled with a number and arrows to indicate camera directions to ensure the same views can be taken each time.

The photographs will be taken on an annual basis at the same time as the walk over inspections.

The photographs will be used to assess plant coverage and growth using a graduated pole placed at a fixed distance from the camera.

8.4. Pest monitoring

Monitoring of rabbits will take place on separate occasions on a three-monthly basis, using the Modified McLean Scale of rabbit infestation.

Monitoring of goats will take place on Rocky Point and adjacent parts of Bendigo Hills Estate on an annual basis by way of walkovers.

9. Annual Reporting

An annual report will be prepared and submitted to Council. The report will document the walk over and RECCE plot survey records, photo point records and assess survival rates and percentage vegetation coverage against the performance indices set out in Section 7.2.

The reports will include a comparative assessment of the vegetation cover from the previous year.

10. Programme 2025 - 2029

An indicative programme is set out below.

	2025				2026				2027				2028				2029			
	S	A	W	S	S	A	W	S	S	A	W	S	S	A	W	S	S	A	W	S
Plantings																				
Offset SIte																				
Enrichment Sites																				
Replacement Plantings																				
Weed control																				
Pest control																				

11. Anticipated Outcomes

The proposed plantings in combination with ongoing pest and weed control measures will yield the following long-term outcomes that align with the objectives of the proposed enhancement measures:

- Replacement of indigenous vegetation lost through development with a larger overall area of indigenous vegetation;
- Progressive increase in extent of indigenous vegetation within the Rocky Point covenant area;
- Improved habitat quality for indigenous avifauna, lizards and invertebrates;
- Re-introduction of locally extinct plant species that would have been an important component of the pre-settlement vegetation;
- Improved health and diversity of the kānuka shrubland/scrub, and of climax cushionfield communities within saline ecosystems;
- Enhanced regenerative capacity of naturally occurring areas of kānuka shrubland; and
- Improved connectivity/linkages between the planting sites, Rocky Point and the Bendigo Scenic Reserve;
- Increased indigenous vegetation cover adjoining the upper sections of the Mt Koinga Track.

Appendix 1: Modified McLean Scale of Rabbit Infestation

Scale (Maximum Allowable Limit)	Rabbit Infestation
1	No sign seen. No rabbits seen.
2	Very infrequent sign present. Unlikely to see rabbits.
3	Sign infrequent with faecal pellet heaps more than 10 metres apart. Odd rabbits may be seen.
4	Sign frequent with some faecal pellet heaps more than 5 metres but less than 10 metres apart. Groups of rabbits may be seen.
5	Sign very frequent with faecal pellet heaps less than 5 metres apart in pockets. Rabbits spreading.
6	Sign very frequent with faecal pellet heaps often less than 5 metres apart over the whole area. Rabbits may be seen over the whole area.
7	Sign very frequent with 2–3 faecal pellet heaps often less than 5 metres apart over the whole area. Rabbits may be seen in large numbers over the whole area.
8	Sign very frequent with 3 or more faecal pellet heaps often less than 5 metres apart over the whole area. Rabbits likely to be seen in large numbers over the whole area.

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Rocky Point Ecological Enhancement and Monitoring Plan

Prepared for Rocky Point Services Limited
July 2024

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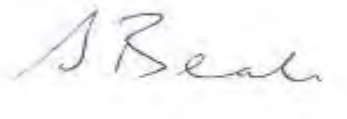

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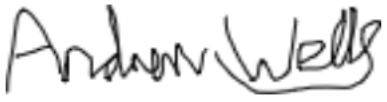

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Appendix 1: Modified McLean Scale of Rabbit Infestation

1. Introduction

TKO Properties Limited (TKO) are proposing biodiversity offset and compensation plantings at Rocky Point. The biodiversity offset addresses the residual adverse ecological effects of a proposed subdivision development. The residual adverse effects are the permanent loss of 37,633 m^2 (3.76 ha) of cushionfield and 12,802 m^2 (1.28 ha) of kanuka shrubland/scrub within the development (impact) site at Rocky Point and effects on indigenous flora and fauna that inhabit these plant communities.

The biodiversity offset comprising forest and shrubland plantings including species of high value over 5.0 hectares at Bendigo Hills Estate (Bendigo Hills). The biodiversity offset accounting model implemented by Wildlands shows the proposed offset will achieve in a net gain in biodiversity.

The compensation plantings comprise forest and shrub plantings, including high value species at four designated enrichment planting sites at Rocky Point. These plantings represent an additional positive ecological effect.

TKO propose to undertake property weed control and rabbit and goat control at Rocky Point, including most of the property that will be subject to formal protection through a covenant requiring the maintenance of this land for conservation purposes in perpetuity.

The Ecological Enhancement and Monitoring Plan (EEMP) sets out the actions required to achieve the objectives of the offset and compensation plantings and weed and pest control measures.

2. Objectives of the Offset Plantings and Compensation (Enrichment) Plantings

The objectives of the plantings are as follows:

1. To recreate plant compositions and structures that were most probably present in pre-settlement climax vegetation at the site, and that are appropriate for present-day conditions.

2. To increase plant diversity at Rocky Point and Bendigo Hills and surrounding areas by re-introducing a variety of species that would have formerly been key components of the pre-settlement vegetation, but that are now locally extinct and/or very rare. It is anticipated that these plants will provide a seed source for further spread into Rocky Point, and the nearby Bendigo Scenic Reserve.

3. Description of Offset Sites

Three offset sites have been identified on Bendigo Hills that are considered favourable for planting due to their south/south-westerly aspect, favourable soils, dominance of exotic grasses and forbs, and close proximity to Bendigo Scenic Reserve and Mt Koinga Track. The location and extent of the sites are shown on Figure 3-1. The total area of the proposed offset sites is c.5.0 hectares.

3.1. Hemlock Gully

Hemlock Gully as the same suggests is dominated by hemlock that has colonised a shallow gully representing part of an ephemeral seepage. The percentage cover of hemlock including associated litter recorded in RECCE plots sampled along a transect down gradient of a group of mature *Olearia lineata* was between 60 to 90%. The Mt Koinga Track passes through the middle of the site. Total area is c.1.8 hectares.

Figure 3-1: Proposed offset sites.

3.2. Panorama Rise

This site covers hillslopes of a moderate gradient situated between a metalled road and kānuka shrubland. The site is covered mostly in exotic grassland and incorporates small stands of kānuka and scattered shrubs of sweet briar. RECCE plots placed in the site show that exotic grasses occupy between 60-90% of the cover within the plots, exotic forbs up to 25% and the balance is mossfield, loose mats of lichen and bare ground. Total area is c. 1.2 hectares.

3.3. Pylon Flat

Pylon Flat forms part of an extensive gently-sloping terrace that abuts the Bendigo Scenic Reserve and is bisected by the Clyde-Twizel transmission line. The Mt Koinga Track enters the Bendigo Scenic Reserve at the lower end of the site. The vegetation cover is a mosaic of cushionfield, exotic grassland and exotic herbfield and large patches of bare ground. RECCE plot data shows that the cushion plant *Raoulia australis* occupied about 5% of the plots, exotic forbs up to 30%, exotic grasses between 10-30 % and bare ground was variable between 20 to 80%. Total area is c.2.7 hectares.

4. Enrichment Plantings

TKO are proposing to undertake enrichment plantings at four sites in Rocky Point beyond the development area as shown on Figure 4-1, and plantings around the perimeter of the building platforms. The former will comprise a mix of tree and shrub species and the latter solely shrub species.

Planting site 1 (*c.* 4,000 m^2) is in an area of exotic grassland, sweet briar and scattered *Coprosma propinqua* near SH 8. Planting sites 2-4, each *c.* 400 m^2 are in kānuka scrub filled gullies where favourable soils exist, positioned within existing canopy gaps and areas where exotic species (hemlock, sweet briar and crack willow) currently dominate.

The enrichment planting at these sites will comprise species identified by Wildlands as likely components of the pre-settlement vegetation types that occurred on the alluvial gravels at the base of the hillslopes at the north of Rocky Point and within the gullies and basins in Rocky Point. The vegetation across the alluvial gravels such as beside SH 8 would have likely comprised a forest with the occasional emergent mataī above a broadleaf canopy of kāpuka, ribbonwood, kōwhai, narrow-leaved lacebark, māpou and fierce lancewood. Within the gullies a variant to the (*Mataī)/kāpuka-ribbonwood-māpou-fierce lancewood* forest would have existed dominated by kōwhai, lowland ribbonwood, kōhūhū, fierce lancewood, narrow-leaved lacebark with a lesser abundance of shrubs such poataniwha (*Melicope simplex*), *Coprosma virescens*, *Copromsa crassifolia*, *Olearia lineata, Olearia odorata,* and *Myrsine divaricata.*

The shrub plantings proposed around the building platforms would comprise a mix of *Olearia* and *Coprosma* species, porcupine shrub, korokio and mountain cottonwood and the low growing shrub *Muehlenbeckia axillaris*.

Figure 4-1: Indicative location of enrichment planting sites.

5. Offset Plantings

5.1. Species Composition

In accordance with the objectives, species outlined in Table 5-1 that represent the pre-settlement forest and shrubland vegetation at Rocky Point will be utilised in plantings.

Two slightly different offset plantings have been developed and modelled; one to offset the loss of kanuka shrubland (shrubland offset) and one to offset the loss of cushionfield (cushionfield offset). The plantings and densities for each offset are set on Table 11-1.

Table 11-1: Shrubland and Cushionfield Offset Plantings.

		Shrubland offset plantings	Cushionfield offset plantings
Climax community species	**Plant type**	**Planting density (plants/ha)**	**Planting density (plants/ha)**
Asplenium flabellifolium	Fern	**0**	**0**
Cheilanthes sieberi	Fern	**0**	**20**
Polystichum neozelandicum	Fern	**20**	**0**
Polystichum vestitum	Fern	**30**	**0**
Asplenium richardii	Fern	**0**	**20**
Pellaea calidirupium	Fern	**0**	**0**
Raoulia australis	Herb	**0**	**0**
Carmichaelia compacta	Shrub	**50**	**200**
Coprosma dumosa	Shrub	**100**	**100**
Coprosma crassifolia	Shrub	**650**	**1600**
Coprosma propinqua	Shrub	**200**	**600**
Coprosma virescens	Shrub	**250**	**300**
Corokia cotoneaster	Shrub	**250**	**600**
Melicope simplex	Shrub	**250**	**60**
Melicytus alpinus	Shrub	**100**	**1150**
Olearia odorata	Shrub	**100**	**110**
Veronica salicifolia	Shrub	**250**	**100**
Myrsine divaricata	Small tree	**100**	**110**
Olearia lineata	Small tree	**100**	**200**
Veronica pimeleoides	Subshrub	**0**	**50**
Vittadinia australis	Subshrub	**0**	**50**
Cordyline australis	Tree	**400**	**80**
Griselinia littoralis	Tree	**400**	**50**
Hoheria angustifolia	Tree	**200**	**0**
Kunzea serotina	Tree	**2500**	**1600**
Myrsine australis	Tree	**150**	**0**
Pittosporum tenuifolium	Tree	**500**	**200**
Plagianthus regius	Tree	**300**	**0**
Pseudopanax ferox	Tree	**200**	**100**
Sophora microphylla	Tree	**400**	**200**
Muehlenbeckia australis	Vine	**0**	**0**
Muehlenbeckia complexa	Vine	**0**	**0**
Rubus schmidelioides	Vine	**0**	**0**
Rocks, litter etc			**0**
		Total 7500/ha	**Total 7500/ha**
		7500	**7500**

5.2. Performance Metrics

The plantings will be subject to the following performance indices:

- achieving at least 80% survival within the planting areas within five years of planting;
- achieving a measurable increase in vegetation cover and stature in the revegetation areas on an annual basis.

5.3. Staging of Planting

Planting shall occur on an annual basis and staged over a five-year period. Further details are set out on the programme chart (see Section 11).

5.4. Plant Grade

Nursery reared eco-sourced[1] PB2 grade seedlings are recommended for planting. Plants of this size have a good ratio of root bed to foliage that favours early establishment and high survival rates.

5.5. Planting Configuration

Trees will be spaced 2-2.5 metres apart and shrubs 1.5 m.

The plant density is considered appropriate to provide a sufficient future seed source for natural regenerative processes to occur in tandem with pest and weed control measures.

5.6. Nutrient Management

To maximise early establishment, it is recommended that granular fertiliser is placed in each planting hole prior to plant placement and backfilling.

5.7. Browse Protection

To protect against rabbit browse, 600 mm high plant tri-guard protectors are recommended for each plant. These should be double staked in each protector to ensure they are wind resistant. Recognised suppliers such as Advance Landscape Systems and Egmont Commercial provide plant protector/stake/weed mat combos.

5.8. Grass and Weed Suppression

Placement of weed mats around each plant at time of planting is recommended to suppress exotic grass and broadleaved weed growth.

5.9. Irrigation

Irrigation is to be applied to each of the planted areas through gravity (tank) fed reticulation systems and strategically placed elevated sprinkler heads. Irrigated water will be supplies to the plantings for a period of 5 years.

5.10. Aftercare Management

5.10.1. Replacement Plantings

Plants that do not survive within the first 6 to 12 months of planting as informed by walk over inspections will be replaced in the following autumn or spring, depending on the timing of the plantings. It is expected that up to 10% of the plantings will perish during this period.

Replacement of plantings will occur once per annum over a period of three years following initial planting.

5.10.2. Weed Control

Any grass and/or broadleaved weeds that manage to establish within the plant protectors should be removed by hand pulling.

[1] Plants propagated from seed sourced from trees and shrubs that occur locally in the Central Otago Ecological Region.

6. Property Wide Weed Control

Control of exotic weeds will be implemented on an annual basis during early to mid-spring to halt exotic weed spread, stop new weeds from establishing and reduce competition to the plantings to facilitate indigenous plant regeneration across Rocky Point.

Parts of Rocky Point is affected by the spread of exotic herbaceous weeds such as hemlock, stonecrop, Californian thistle and scarlet pimpernel. These species are a particular threat to the ecological integrity of cushionfield communities, and especially within saline ecosystems where succession to indigenous woody vegetation is unlikely. Control of these weeds will be targeted to the saline ecosystems using a wand to ensure targeted application of herbicide with proven performance in eliminating problem exotic herbaceous plants.

Parts of Rocky Point are also affected by infestations of exotic woody weeds in the form of conifers such as the lodgepole pine and the flowering plants, hawthorn, elderberry, sycamore, crack willow, broom and blackberry. Control of these plants is essential to ensure that the objectives of the enhancement project are achieved.

Control measures will entail:

- Felling of conifers and large diameter woody flowering pest plants;
- Removal of smaller diameter woody pest plants with a scrub cutter;
- Spot spraying of exotic broadleaved plants using a proprietary herbicide such as Versatill.

These control measures will generally take place twice yearly in autumn and spring on an ongoing basis with frequency informed from walk over surveys.

Objectives for weed control are:

- To control and maintain the indigenous dominance of cushionfield communities within saline ecosystems
- To control and maintain weed species at relatively low abundances.
- To eradicate any conifers and problem woody weed species that establish at Rocky Point.

7. Rabbit and Goat Control

The objective of the pest control programme at Rocky Point will be to maintain rabbit and hare numbers at the McLean Scale of infestation of 3 or less (refer Appendix 1).

Rabbits will be controlled on an ongoing basis across Rocky Point through a combination of measures such as night shooting, pindone poisoning and gassing of burrows to achieve sustainable pest numbers.

Goats will be controlled through daytime shooting operations. These are typically undertaken with a helicopter.

Programming of the control measures will be informed by walk over inspections by a suitably qualified expert with the intensity of operations determined from twice yearly monitoring rounds.

Only professional rabbit and goat control contractors shall be used in this role as recreational shooters tend to spook the animals and reduce the effectiveness of shooting and poisoning operations.

8. Monitoring

8.1. Walk Over Inspections of planting sites

Walk over inspections will be undertaken initially as a baseline prior to implementing the management measures and then on an annual basis to assess:

- The number of plants of each species that have died;
- Evidence of self-seeded plants; and
- Woody and non-woody weed incursions.

8.2. RECCE Plots

RECCE plots (2 x 2 m) will be established in the saline ecosystems to measure weed coverage, to assess the performance of the control measures and gauge trends over time.

RECCE plots (10 x 10 m) will be established in the planting areas to measure canopy cover, basal area, mean height, mean top height, and seedling and sapling counts.

8.3. Photo points

Fixed photo points will be established within and adjacent to each offset and enrichment planting area.

The photo points will consist of marker posts labelled with a number and arrows to indicate camera directions to ensure the same views can be taken each time.

The photographs will be taken on an annual basis at the same time as the walk over inspections.

The photographs will be used to assess plant coverage and growth using a graduated pole placed at a fixed distance from the camera.

8.4. Pest monitoring

Monitoring of rabbits will take place on separate occasions on a three-monthly basis, using the Modified McLean Scale of rabbit infestation.

Monitoring of goats will take place on Rocky Point and adjacent parts of Bendigo Hills Estate on an annual basis by way of walkovers.

9. Annual Reporting

An annual report will be prepared and submitted to Council. The report will document the walk over and RECCE plot survey records, photo point records and assess survival rates and percentage vegetation coverage against the performance indices set out in Section 7.2.

The reports will include a comparative assessment of the vegetation cover from the previous year.

10. Programme 2025 - 2029

An indicative programme is set out below.

	2025				2026				2027				2028				2029			
	S	A	W	S	S	A	W	S	S	A	W	S	S	A	W	S	S	A	W	S
Plantings																				
Offset SItes																				
Enrichment Sites																				
Replacement Plantings																				
Weed control																				
Pest control																				

11. Anticipated Outcomes

The proposed plantings in combination with ongoing pest and weed control measures will yield the following long-term outcomes that align with the objectives of the proposed enhancement measures:

- Replacement of indigenous vegetation lost through development with a larger overall area of indigenous vegetation;
- Progressive increase in extent of indigenous vegetation within the Rocky Point covenant area;
- Improved habitat quality for indigenous avifauna, lizards and invertebrates;
- Re-introduction of locally extinct plant species that would have been an important component of the pre-settlement vegetation;
- Improved health and diversity of the kānuka shrubland/scrub, and of climax cushionfield communities within saline ecosystems;
- Enhanced regenerative capacity of naturally occurring areas of kānuka shrubland; and
- Improved connectivity/linkages between the planting sites, Rocky Point and the Bendigo Scenic Reserve;
- Increased indigenous vegetation cover adjoining the upper sections of the Mt Koinga Track.

Appendix 1: Modified McLean Scale of Rabbit Infestation

Scale (Maximum Allowable Limit)	Rabbit Infestation
1	No sign seen. No rabbits seen.
2	Very infrequent sign present. Unlikely to see rabbits.
3	Sign infrequent with faecal pellet heaps more than 10 metres apart. Odd rabbits may be seen.
4	Sign frequent with some faecal pellet heaps more than 5 metres but less than 10 metres apart. Groups of rabbits may be seen.
5	Sign very frequent with faecal pellet heaps less than 5 metres apart in pockets. Rabbits spreading.
6	Sign very frequent with faecal pellet heaps often less than 5 metres apart over the whole area. Rabbits may be seen over the whole area.
7	Sign very frequent with 2–3 faecal pellet heaps often less than 5 metres apart over the whole area. Rabbits may be seen in large numbers over the whole area.
8	Sign very frequent with 3 or more faecal pellet heaps often less than 5 metres apart over the whole area. Rabbits likely to be seen in large numbers over the whole area.

North

LEGEND		
	Areas of existing Kanuka	343,942 m^2
	Proposed areas of Kanuka removal	13,539 m^2
	Areas of existing Cushionplant	139,649 m^2
	Proposed areas of Cushionplant removal	39,880 m^2
	Areas of Saline Soils	10,700 m^2
LOCATIONS OF		
	Myosurus minimus subsp. novae-zelandiae	
	Myosotis brevis	
	Colobanthus brevisepalus	

NOTE: for each of the points identifying a threatened species, these points generally represent more than one specimen, sometimes groups of plants.

baxter design

0 20 40 70 100m
SCALE = 1:2000 AT A1

REFERENCE **4371-SK127** - SCALE = 1:2000 AT A1 - 1:4000 AT A3 - **08 Jul 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION
j:\4371 - infracon bendigo\cad\xref - 4371 - masterplan 10.dwg - Ecology Map

DRAFT

ECOLOGY MAPPING
INFRACON - BENDIGO

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Report no. 7211

5 July 2024

TKO Properties Ltd
82 Centennial Avenue
Alexandra 9370

Dear Tim

ROCKY POINT SUBDIVISION – MEMORANDUM REGARDING LIZARD MANAGEMENT

BACKGROUND

TKO Properties Limitied (TKO) is proposing to subdivide a property at Rocky Point which was formerly part of Bendigo Station, Central Otago. The property is located above the head of Lake Dunstan between the Tarras Cromwell Road (SH8) and the Bendigo Scenic Reserve. The property covers an area of 68.6 ha.

An initial lizard survey was carried out across the entire Bendigo Estate site (Bendigo Hills Estate and Rocky Point properties) by Dr Mandy Tocher (Lizard Expert NZ; LENZ), under Wildlife Act Authority 62386-FAU, in March 2023[1]. Two lizard species were commonly found and widespread over the site: Kawarau gecko (*Woodworthia* "Cromwell"; At Risk – Declining) and McCann's skink (*Oligosoma maccanni*; Not Threatened).

All native lizard species are protected by the Wildlife Act (1953, s63 (1) (c)), which is administered by the Department of Conservation (DOC). Under the Act lizards must not be harmed, disturbed or killed without a Wildlife Act Authority (WAA) from DOC. It is standard practice for a Lizard Management Plan (LMP) to be prepared and provided with a WAA application.

TKO have engaged Wildland Consultants Ltd (Wildlands) to prepare the LMP and WAA application for the Rocky Point subdivision. This memo outlines examples of lizard management that are likely to be included in the LMP.

LIZARD SURVEY

Lizard survey methods

A three-day visual encounter survey/walk through survey was carried out over the Bendigo Estate site by Dr Mandy Tocher (LENZ) from 17 to 19 March, 2023, under WAA 62386-FAU. The surveys were carried out in weather conditions suitable for lizard activity in Central Otago. Where possible, lizards detected were captured and identified prior to release. In addition to Dr Tocher's survey in 2023, the Bendigo Estate site was also visited by Wildlands

[1] Tocher M. 2023. *Lizard Survey Report: Proposed Bendigo Hills Estate Subdivision.* Lizard Expert NZ Contract Report. Prepared for TKO Properties Ltd. 18 pp

herpetologist, Samantha King, on 17 April 2024, whereby a walk over assessment and opportunistic manual searches were undertaken (under WAA 96003-FAU).

Lizard survey results

Dr Tocher found that Kawarau gecko and McCann's skink were common and widespread over the Rocky Point site. Kawarau gecko were found so commonly across the property that they (or their sloughed skinks) were predictably present under most loose slabs on the property. Although McCann's skink were not observed as frequently as Kawarau gecko, they were still commonly observed foraging and taking refuge under living and dead scab weeds and using them as basking platforms.

The findings of the Wildlands survey undertaken in April concurred with the LENZ survey results. Both species of lizards were detected across the site. In addition, Kawarau gecko were also detected in crevices and underneath loose bark of kānuka.

Lizard habitat

Seven vegetation types occur over the site[2], including:

- Kānuka scrub and shrubland
- Cushion field (native herbfield)
- Grey shrubland
- Silver tussock grassland
- Exotic herbfield
- Exotic grassland
- Rocky substrates

Throughout each of the identified vegetation types, loose rock slabs and/or outcropping are present, which provide habitat for the two lizard species identified within the site. The surveys by LENZ and Wildlands confirmed that in areas where rocks and outcrops are less abundant, lizards of both species were found using scab weeds for cover. In addition, Kawarau gecko was observed occupying kānuka tree trunks, under loose bark and within crevices. Therefore, lizards are widespread through all of the vegetation types, in moderate-high densities across the Rocky Point subdivision site.

SIGNIFICANCE

The lizard habitats identified throughout the site meet the ecological significance criteria for rarity/distinctiveness and ecological context in the Otago Regional Policy Statement (ORPS) and the National Policy Statement for Indigenous Biodiversity (NPS-IB) because of the presence of an At Risk – Declining species, endemic to the Otago region; Kawarau gecko.

LIZARD MANAGEMENT PLAN

Due to the presence of indigenous lizards, the proposed subdivision requires a WAA under the Wildlife Act. A LMP is required to accompany the WAA application and must be submitted to DOC and approved prior to undertaking any activities that may potentially impact lizard populations, and any lizard management proposed to mitigate these effects.

Wildlands considers that it is entirely feasible that the LMP will be able to demonstrate "overall protective benefit" to local McCann's skink and Kawarau gecko populations at this site. Protective benefit ensures that lizards and their habitats are better off following the activity than they were before. The LMP will follow the principles outlined by the

[2] Beale Consultants 2023: Bendigo Hills Estate & Rocky Hills Subdivisions Terrestrial Ecology Impact Assessment.

Department of Conservation in their guidelines[3]. These principles describe steps to take and enable the outcome of successful lizard management (including salvage, if determined to be the right mitigation option). The LMP will include the following requirements:

Minimisation

- Where possible, key lizard habitats will be avoided by any development works, and additional works will be completed to enable avoidance, such as:
    - Building platform design
    - Curtilage area design and construction
    - Restrictions to gardening/resident landscaping – following the Landscape and Vegetation Protection Area.
    - Vehicle movements minimised
    - Services to be provided in a minimal way that prevents additional earthworks (such as installing cables underneath road ways).

Remediation

- Enrichment planting of lizard friendly plants to improve the naturalness of the existing lizard habitat; and to increase both plant and lizard diversity. This will include low flammable lizard friendly plants.
- Retain and place back into existing habitats rocks which are removed during earthworks.
- Rocky habitat creation to improve lizard habitat at a local scale and replace rocky habitats lost.

Mitigation

- Undertake lizard salvage and relocation, where and if required, if key lizard habitats (such as rocky outcrops or kānuka shrubland) cannot be avoided.
- Placing restrictions on the use of herbicides and pesticides within and outside of the curtilage areas.
- Provide landowners with information in order to encourage biodiversity.
- Hedgehog control if and where practical.
- Incidental Discovery Protocols for any lizard encounters during earthworks, post-salvage.

Offset

It is acknowledged that calculating offsets for lizards is difficult, owing to the cryptic nature of the species and the inability to determine species abundance or density without repeat and intensive surveys. An offset package has been prepared as part of the EcIA, which is likely to benefit lizards.

Compensation

Compensation options, if required, will be sought in collaboration with DOC. Supporting wider lizard conservation or research focused on threatened species is likely to be a better use of funding than investing in further mitigation of high numbers of McCann's skink (e.g., supporting intensive pest management and post-release monitoring programmes, that are likely to be unnecessary with no tangible outcomes realised).

[3] Department of Conservation 2019: Key Principles for lizard salvage and transfer in New Zealand. Lizard Technical Advisory Group. Department of Conservation, Wellington. Available online: https://www.doc.govt.nz/contentassets/02b1a908bcb34ff1a37652 ad357d3e2c/lizard-salvage-and-transfer-nz.pdf

SUMMARY

McCann's skink and Kawarau gecko were found at high densities throughout the entirety of the proposed Rocky Point subdivision site. Because all native lizard species are protected by the Wildlife Act and the habitats within the site meet the significance criteria under the ORPS and NPS-IB, a LMP and WAA are required before further works take place.

Wildlands are currently preparing the LMP to address any effects the subdivision works may have on lizards and ways to manage them. We consider that the LMP will sufficiently address and provide appropriate effects management, and that protective benefit can be achieved for indigenous lizards at Rocky Point. The LMP will be submitted to DOC, by Wildlands, as a part of the WAA application, on behalf of TKO.

Yours sincerely

Samantha King
Senior Herpetologist and Ecologist
Wildland Consultants Ltd

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Our Ref: 7080c

4 July 2024

Simon Beale
Beale Consultants Ltd
Alexandra

Dear Simon

TERRESTRIAL INVERTEBRATE DESKTOP ASSESSMENT OF A PROPOSED SUBDIVISION AT ROCKY POINT, CENTRAL OTAGO

Beale Consultants Ltd approached Wildland Consultants Ltd (Wildlands) on behalf of TKO Properties to undertake an invertebrate desktop assessment for a five-hectare housing development at Rocky Point, Central Otago. Previous ecological surveys have examined other ecological values, including the vegetation and habitats available.

METHODS

The terrestrial invertebrate desktop survey involved searching the Global Biodiversity Information Facility (GBIF.org 2024[1]) for species records. To filter the data, a polygon was drawn encompassing the site plus the area within five kilometres of the site perimeter. The Scientific Name filter was also applied, using the terms Arachnida, Athoracophoridae, Rhytididae, Insecta, and Onychophora to represent spiders, leaf-veined slugs, indigenous giant land snails, insects, and velvet worms respectively.

From the records retrieved by the GBIF search, freshwater invertebrates were removed. Observations that were not identified further than order, or were marked as doubtful, were deleted. This dataset was used to characterise the fauna based on the most commonly-represented orders. Of the remaining records, those identified to a useful level (usually genus or species) were scanned for notable species[2]. These were compared with vegetation and habitat on-site to judge the likelihood of each notable species occurring within the project area.

[1] GBIF.org (17 April 2024) GBIF Occurrence Download https://doi.org/10.15468/dl.2st5by

[2] Notable species are locally endemic, known or suspected to be declining, particularly sensitive to habitat loss or predation by introduced mammals, or listed as Threatened or At Risk.

SURVEY RESULTS

The GBIF search retrieved records of 78 terrestrial invertebrates that met the search terms. The invertebrate fauna was characterised mainly by beetles, and wasps, bees and ants. Of these, 70 had been identified to a level at which they could be assessed. The invertebrate fauna was predominately indigenous, with several exotic species recorded. Notable species are presented in Table 1.

Table 1: Notable invertebrates recorded within five kilometres of the site.

Species name	Common name	Threat Classification	Notability	Likelihood of being on-site
Cerius otagensis	Cromwell	Threatened – Nationally Critical (Leschen et al. 2020)	Only four specimens ever found; sensitive to habitat loss; locally endemic	Low
Holcaspis ovatella	Ground beetle	Not assessed	Locally endemic – only found in Otago	High
Hypsithocus hudsonae	Alpine shield bug	At Risk – Naturally Uncommon (Stringer et al. 2012)	May be sensitive to habitat loss; Locally endemic	High
Mecodema tibiale	Ground beetle	Not assessed	Locally endemic – only found in Otago	High
Orthodera novaezealandiae	New Zealand praying mantis	At Risk – Declining (Buckley et al. 2012)	Declining due to competition from South African mantis (*Miomantis caffra*)	High
Paranotoreas fulva	Looper moth	At Risk – Relict (Hoare et al. 2017)	Declining due to habitat loss	High
Phaulacridium otagoense	Otago short-horned grasshopper	At Risk – Declining (Trewick et al. 2022)	Declining due to habitat loss and possibly predation	High
Vanessa gonerilla	New Zealand red admiral	Not assessed	Declining due to habitat loss	Medium
Zizina oxleyi	New Zealand blue butterfly	Not Threatened (Hoare et al. 2017)	Declining due to competition from common blue (*Zizina otis labradus*)	High

Amateur and expert observations alike are stored in GBIF, and though some data standards are applied, a desktop survey is no substitute for a field survey by a qualified entomologist. However, Wildlands is confident that the desktop and on-site vegetation surveys conducted so far have provided sufficient information for the following assessment and recommendations.

INVERTEBRATE HABITAT VALUES

The cushionfield and exotic herbfield, rocky substrates, and tussock grassland are likely to be important for notable moths, beetles, and grasshoppers, some of which are At Risk or Threatened (Table 1). We note that the cushionfield, which is the most valuable invertebrate habitat at the site, is a transitional (c.f. climax) community. It is likely reverting to kānuka scrub

and then mixed scrub and forest. Nevertheless, it is probably of importance to invertebrate biodiversity. The values that remain in this habitat need to be conserved.

Since the kānuka scrub is likely to be young (mostly <30 years old), it is unlikely to be harbouring high indigenous invertebrate biodiversity (Dugdale and Hutcheson 1997) and likely has low to moderate value to indigenous invertebrate biodiversity. As it ages, its habitat values will increase. Kānuka scrub is currently likely to be of little value to notable species other than New Zealand praying mantis, which may be around the edges and in more open areas of shrubland.

POTENTIAL EFFECTS OF THE PROPOSED DEVELOPMENT ON INVERTEBRATES

Discussed in this section are potential effects that may impact invertebrates **if no effects management is applied.** All estimated impacts are conservative, as the species listed in Table 1 may not be on-site.

Permanent effects

The effects below are likely to impact invertebrates for at least 35 years.

Habitat loss
The development is likely to degrade and destroy indigenous invertebrate habitat, including cushionfield and kānuka scrub. Abrupt removal of the cushionfield will reduce available habitat for all notable species in Table 1, except for New Zealand praying mantis, which inhabits taller upright vegetation such as shrubs.

Habitat fragmentation
Patches of habitat will be removed during development, leaving fragmented habitat with reduced connectivity. Habitat fragmentation will result in further isolation of populations that are already limited in their ability to move between patches of habitat in different areas. Edge effects will also become an issue, particularly in the kānuka scrub, as the edges of habitat have different properties from the interior. Edge effects in this case will most likely be limited to reduced humidity around the edges of the scrub, leading to increased risk of desiccation for indigenous invertebrates such as molluscs, and increased access to the habitat by introduced predators.

Increased predation
Human activity attracts introduced pests, including vespid wasps (genus *Vespula*), sparrows (*Passer domesticus*) and other introduced birds, and mammals such as rats (*Rattus* spp.). Humans may also allow pet cats to roam outside. Many pests associated with humans are detrimental to invertebrate populations.

Collateral damage from domestic pesticide use
Humans living in the proposed housing development may use pesticides around the outside of their houses and gardens, which will impact pollinators and potentially the species listed in Table 1.

Disruption to nocturnal flying insects from lighting
Lighting from houses, street lamps, and other artificial sources is likely to alter the behaviour of flying insects, which are attracted to light and can become trapped around the light sources.

Temporary effects

The effects below are likely to impact invertebrates during the construction period only.

Disturbance from dust and vibration
The roots of vegetation on-site hold soil in place; their removal will increase dust mobility. Vehicles on-site will likely disturb dust and also cause vibration. Dust may impact invertebrates by blocking spiracles, irritating the cuticle, affecting access to food, and increasing desiccation of soft-bodied and mucous-coated species. Vibrations are a crucial part of the way some invertebrates perceive their world, and vibrations and noise from machinery may interfere with many aspects of their physiology and behaviour (Raboin & Elias, 2019).

Direct injury and mortality
When their habitat is removed, some individual invertebrates will be killed. Others may be squashed or struck by vehicles during construction. Mulching cleared vegetation is likely to kill invertebrates dwelling therein.

APPROPRIACY OF PROPOSED EFFECTS MANAGEMENT FOR INVERTEBRATES

Preliminary effects management has been proposed as part of the offset-compensation package and Assessment of Ecological Effects. Table 2 outlines the proposed effects management and its efficacy in addressing effects on invertebrates.

Other effects management outlined in the Ecological Impact Assessment that will benefit invertebrate biodiversity and some of the notable species in Table 1 includes:

- Creating rocky habitat ahead of the development works through stacking slab rocks across areas naturally impoverished of rock, on open and sunny sites.
- Limiting the extent of construction areas including laydowns and construction related parking.
- Prohibiting moving or using rock slabs for construction purposes.
- Avoiding rock habitat and having set-backs or no disturbance zones around rock outcrops.

While these actions are listed as lizard management, they should also be considered invertebrate management.

ADDITIONAL EFFECTS MANAGEMENT SUGGESTED FOR INVERTEBRATES

The following recommendations should be followed to manage all effects for invertebrates to achieve no net loss of indigenous invertebrate biodiversity.

Habitat loss
To address the loss of invertebrate habitat, the offset and compensation planting areas need to be of sufficient size to take account of the lost habitat and the time delay to restore replacement habitat. This may require a larger area of habitat to be restored than the area lost, and this will need to be assessed by way of an offset model.

Table 2 – Analysis of proposed effects management for invertebrates.

Community/ habitat affected	Effects to be addressed	Effects management proposed	Additional effects management needed?
Kānuka scrub	Habitat loss	Planting kānuka and other late successional indigenous plant species, to cover an area larger than that which has been removed.	**Yes:** the plants replacing the lost habitat will take at least 10 years before they present habitat of equal or better quality.
	Habitat fragmentation	Strategic planting and weed control to encourage spread of indigenous shrub developing into forest.	
Cushionfield	Habitat loss	Enhancement of remaining cushionfields in saline ecosystems by removing tall exotic herbs.	**No:** this management will ensure permanent habitat availability for cushionfield invertebrates which would otherwise disappear as it is a transitional (c.f. climax) habitat. Enhancement will also increase the carrying capacity of the permanent cushionfield so that invertebrate abundance and possibly diversity can increase there.
	Habitat fragmentation		
All habitats	Increased predation	Prohibiting outdoor cats as pets.	**Yes:** introduced species, particularly rats, mice, hedgehogs, and wasps, will still present a threat to invertebrates.
	Habitat loss/fragmentation	Vegetation clearance will avoid damage to vegetation beyond the defined construction sites. The clearance of mature *Olearia lineata*, matagouri, mingimingi, and Corokia should be avoided.	**Yes** for kānuka scrub (see above)
	Collateral damage from domestic pesticide use	Placing restrictions on the use of herbicides and pest control within and outside of curtilage areas	**Unknown:** the restrictions are not specified.
	Disturbance from dust and vibration	All machinery movements shall be limited to the construction sites and defined accessways at all times.	**Yes:** invertebrates, including notable species, may still be adversely impacted by dust and vibration.
	Direct injury and mortality	All machinery movements shall be limited to within the construction sites and defined accessways at all times.	**Yes:** invertebrates, including notable species, may still be adversely impacted by direct injury and mortality.
	Disruption to nocturnal flying insects from lighting	None	**Yes**: insects, including notable species, may be adversely impacted by artificial lighting.

Cleared coarse woody vegetation should be stacked around the edges of the replacement habitat, or in open spaces within the habitat, to provide additional habitat for invertebrates. Large logs should be cut to lengths approximately 50 cm long and stacked in the replacement habitat.

Habitat fragmentation
Connectivity loss can be remedied by planting indigenous shrubs in and around the site when construction is complete. The shrubs should aim to connect patches of habitat.

Increased predation
Hedgehogs, mustelids, and rats should be controlled in the compensation area and the enhanced cushionfield. Vespid wasps should be controlled throughout the site by destroying nests and encouraging residents to report wasp nests.

Collateral damage from domestic pesticide use
Restrictions on pesticide use should include a ban on insecticide spray and generalised non-targeted treatments designed to kill invertebrates within the curtilage areas. Targeted (species-specific) control of pest ants, wasps, aphids, and other household and garden pests should remain permitted, though sprays that may drift and kill non-target species should be discouraged.

Disturbance from dust and vibration
The impacts of dust should be minimised by implementing a Dust Management Plan (DMP). The DMP could include actions such as watering surfaces when they become dusty and limiting dust-producing activities on days when dust is most likely to be spread (such as during warm, dry weather). The effects of vibration on indigenous invertebrates can be minimised by limiting high-vibration activities (such as pneumatic drilling and driving heavy machinery) at peak activity times for invertebrates, such as above 13^{o}C on a sunny day between October and March.

Direct injury and mortality
Direct injury and mortality should be minimised by limiting activity after dark on warm summer nights, and avoiding vehicle movement around cushionfields at peak activity times for invertebrates, such as above 13^{o}C on a sunny day between October and March.

Instead of mulching cleared vegetation, it should be stacked in the restored habitat to allow invertebrates living therein to move gradually into the shrubland.

Disruption to insects from artificial lighting
Using lamps that emit light towards the red end of the electromagnetic spectrum will reduce their attractiveness to insects. Lamps should be shaded where possible. Placing lamps in areas where their light will not reach far, such as behind vegetation, will further minimise their impact on insects.

CONCLUSIONS

The proposed development has potential impacts of detriment to terrestrial indigenous invertebrates, but these will be mitigated using the protocols outlined in this document. If

these measures are implemented, effects of the proposed development on invertebrates will be adequately addressed. Much of the effects management for invertebrates is similar to effects management for other taxa, particularly for lizards, so that actions taken to manage effects for one taxon will also help another.

Yours sincerely

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REFERENCES

Buckley T.R., Palma R.L., Johns P.M., Gleeson D.M., Heath A.C.G., Hitchmough R.A., Stringer I.A.N. 2012: The conservation status of small or less well known groups of New Zealand terrestrial invertebrates. New Zealand Entomologist 35(2): 137-143. DOI: 10.1080/00779962.2012.686319.

Dugdale, J., & Hutcheson, J. 1997: Invertebrate values of kanuka [sic] (*Kunzea ericoides*) stands, Gisborne Region. *Science for Conservation series.* ISBN 0-478-01921-1. Department of Conservation, Wellington.

Hoare, R.J.B.; Dugdale, J.S.; Edwards, E.D.; Gibbs, G.W.; Patrick, B.H.; Hitchmough, R.A.; Rolfe, J.R. 2017: Conservation status of New Zealand butterflies and moths (Lepidoptera). New Zealand Threat Classification Series 20. Department of Conservation, Wellington. 13 p.

Leschen, R. A. B.; Marris, J. W. M.; Emberson, R. M.; Nunn, J.; Hitchmough, R. A.; Stringer, I. A. N. 2012: The conservation status of New Zealand Coleoptera. New Zealand entomologist 35(2): 91–98.

Stringer IAN.; Hitchmough RA.; Lariviere M.-C.; Eyles AC; Teulon DAJ.; Dale PJ.; Henderson RC. 2012: The conservation status of New Zealand Hemiptera. New Zealand Entomologist 35(2): 110–115.

Trewick S., Hegg D., Morgan-Richards M., Murray T., Watts C., Johns P., and Michel P. 2022. Conservation status of Orthoptera (wētā, crickets and grasshoppers) in Aotearoa New Zealand, 2022. New Zealand Threat Classification Series 39. Department of Conservation, Wellington.

Ward D, Early J, Schnitzler F-R, Hitchmough, R, Rolfe, J, and Stringer, I. 2017. Conservation status of New Zealand Hymenoptera. New Zealand Threat Classification Series 18. 14 p.

ROCKY POINT SUBDIVISION

Bendigo

SALINE/SODIC SOILS Identification and Location

May 29th 2024

Roger Gibson Land and Sea Services

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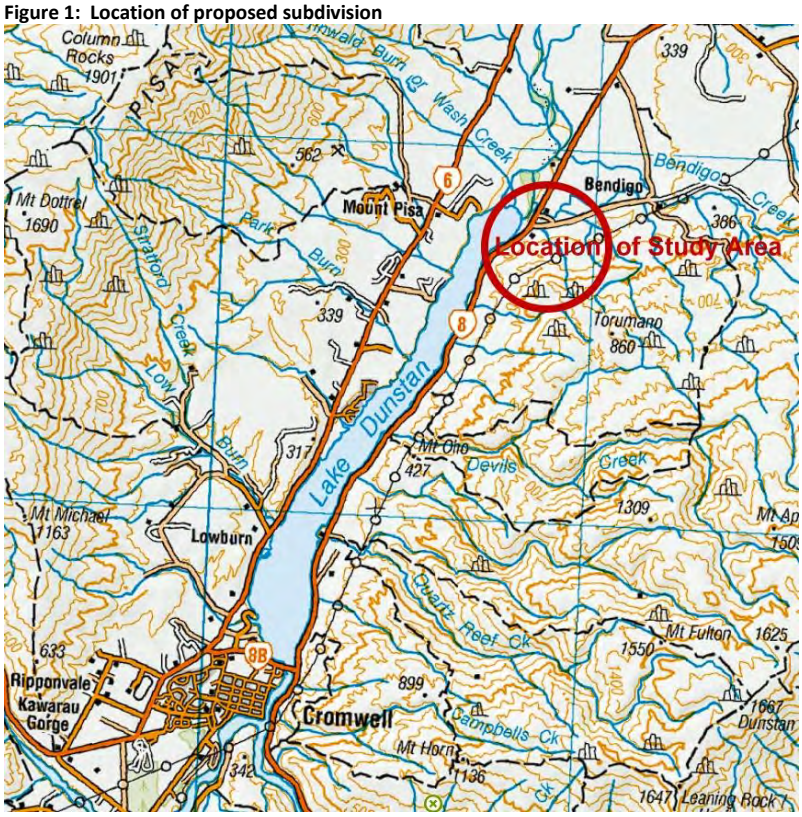
1 Introduction

1.1 Overview

TKO Properties LTD has applied for Resource Consent from the Central Otago District Council to undertake a subdivision at Rocky Point, Bendigo. During the consent process it was identified that information was lacking on the presence of Saline/Sodic soils within the subdivision area. Gibson Land and Sea services (GLS) has been commissioned by TKO Properties to identify areas of interest for saline/sodic soils. This report presents the findings using aerial imagery, a site visit and chemical analysis of surface soil samples.

Figure 1: Location of proposed subdivision



1.2 Limitations

GLS has exercised the normal level of care and expertise expected by members of the environmental science profession. No warranties, express or implied, are made. The confidence in the findings is limited by the Scope of Work, and by limited data due to the size of the area and time available and the visit being at one time of year. No systematic survey to cover the entire area and all its variations in time or space has been undertaken and a full range of soils that are present at the location may not have been seen or recorded.

The results of this assessment are based upon an inspection of aerial photography, site inspection of areas identified of interest by GLS, and chemical analysis of soil samples undertaken by Hill-Labs. All conclusions and recommendations regarding the property are the professional opinions of GLS, subject to the qualifications made above.

While normal assessments of data reliability have been made, GLS assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside GLS, or developments resulting from situations outside the scope of this project.

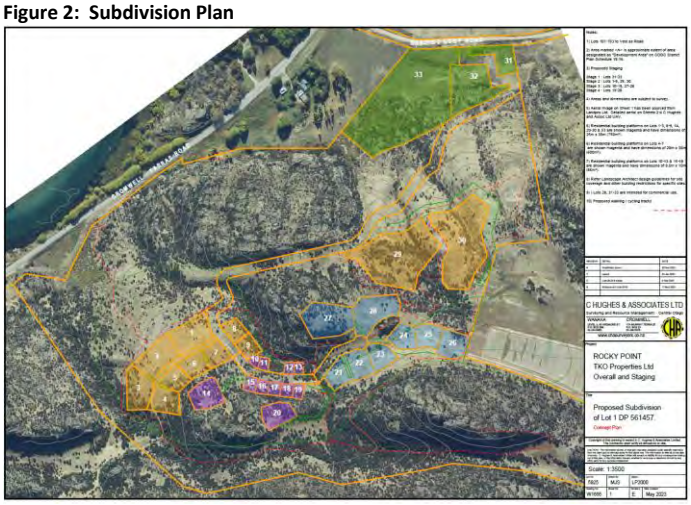
2 Environment

2.1 Environment

The study area is located adjacent to the northern end of Lake Dunstan (Figure 1) and its western boundary extends along approximately 1.5km of State Highway 8 and rises towards the east to an altitude of approximately 217 metres.

The study area straddles the boundary of the Dunstan and the Pisa Ecological District of the Central Otago Ecological Region (Grove and Ward, 1994). These ecological districts can be generalised as having a dry pseudo-subcontinental climate with strong altitudinal gradients. Most of the fans and terraces have been modified and are now in exotic pasture with sweet briar and grey scrub communities widespread on lower slopes (McEwen, 1987).

Figure 2: Subdivision Plan



2.2 Physical parameters

The study area covers approximately 70 ha and ranges in elevation between 200 m and 417 m above sea level. The majority of the area is north facing with an annual median rainfall of 400-450 mm and has amongst the highest evapotranspiration rates found in Central Otago. The resultant moisture deficits particularly over summer leads to an environment that can be classified as semi-arid.

2.3 Geomorphology

The study area is visually dominated by schist rock outcrops and bluffs of the Rakaia terrane and locally referred to as "The Bendigo Bluffs". Early Pleistocene glacial advances descending from Wanaka/Hawea reached to adjacent or beyond the study area during the Lowburn and Lindis advances. However most notable for the study area are the terrace remnants interspersed between the rock outcrops at approx. 300 m above sea level. These were deposited as a result of the Lindis or Luggate advances several hundred thousand years ago and consist of moderately weathered schist and greywacke gravels.

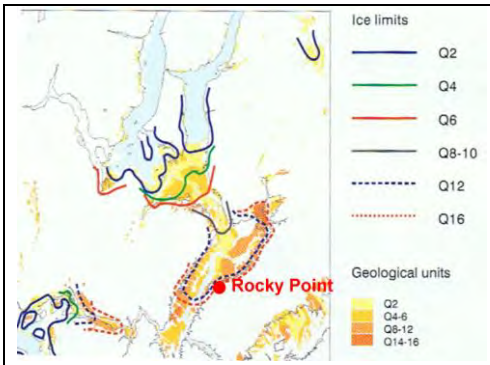


Figure 3. Glacial advances in the Upper Clutha

Pre-Pleistocene Lake Manuherikia group sediments dating back to the Miocene and buried under later glacially deposited gravels are commonly exposed in the Upper Clutha valley where either natural or anthropogenic processes have eroded the covering gravels. These are relatively common around Central Otago and are for example a feature of the landscape at Bannockburn. However none of these areas were shown on the geological maps examined and none were observed during field inspection.

2.4 Soils

Soils are mostly classed as Semiarid with RAW soils on the steep slopes and terrace risers.

Figure 4. Soil exposure on nearby terrace

RAW soils lack distinct top soils development and occur where the development of topsoil is prevented by rockiness, active erosion or deposition. (Hewitt 1993). RAW soils are found within the study area wherever steepness e.g on terrace risers or bluffs, precludes the development of soils through active movement of parent material.

Semiarid soils occur in the inland basins of Otago and southern Canterbury where precipitation is less than 500mm. They are high base status soils in which a water deficit prevails over most of the growing season. Wetting fronts fail to penetrate deeper than the base of the soil with consequent accumulation of pedogenic lime and soluble salts. The flat glacial outwash terraces found within the study area have provided a stable geological surface for several hundred thousand years allowing sustained illuviation to present a mature profile with clearly defined Bkm, Bk, and Bt horizons similar to that pictured in Figure 4. The majority of these soils will be Aged-Argillic Semiarid soils and are relatively common throughout Central Otago

2.5 Saline soils

Within the Semiarid soils of Central Otago there are areas of soil where in the absence of leaching, soluble salts have accumulated to such an extent that they present an inland saline or saline-sodic ecosystem. The source of soluble salts is from the weathering of several geological substrates: basement schist, ancient marine or lake sediments, and old alluvial gravels (Landcare Research). Recent scientific work by (Craw *et al*, 2022) shows marine aerosols have also been a source of salt in these soils. Regardless of the source, within the semi-arid climate zone wherever water moves down a slope accumulating and dissolving salt as it travels and if it eventually pools on impermeable or semi- impermeable surfaces evaporation will occur and any salt contained within the water will be left behind leading to surface accumulation of salts. The main salts are usually chorides or sulphates of sodium or calcium. Magnesium salts are also not uncommon. Elevated levels of salts overall lead to elevated levels of salinity. Where levels of sodium are significant soils are described as having elevated sodicity.

Rogers *et al*, (2000) recognise five geomorphic units where saline/sodic soils can be found in Central Otago, they are; saltpan, salt meander channel, salt plain, salt knoll and salt apron. Of these the last two are most relevant landforms for where Saline/sodic soils may been found in the study area. Salt Knolls are described as "*Patches on convex or planar eroded land surfaces"* and salt aprons as "*Patches on concave or planar land surfaces on which erosion sediments have accumulated or are accumulating generally downslope from eroding salt knolls*".

Saline/Sodic soils provide a difficult environment for plants not adapted to the challenges they present. High concentrations of any soluble salt will create an osmotic environment that will make it very difficult for plants to take up water. High levels of Sodium causes Calcium to be displaced from Clay surfaces. Calcium plays an important role in flocculating clay particles in the soil helping create structure and preventing dispersion. Sodium ions due to their larger atomic size and single charge cannot fulfil this role. As a consequence soils that have a high proportion of exchangeable Sodium

tend to be poorly structured and dispersive. Where a high pH also occurs, nutrient availability is affected, and toxicities and deficiencies may occur.

The challenges for vegetation growing in these environments is significant and generally it favours sparse, mostly herbaceous vegetation and specialised plants known as Halophytes. At the nearby Mahaka Katia Scientific reserve on the western side of the Clutha River halophytic threatened or unusual flora present include: *Atriplex buchananii*, *Craspedia* "Kaitorete", *Leptinella* "Clutha", *Lepidium sisymbrioides* subsp. *Sisymbrioides* (Allen and McIntosh 1997).

Although Inland saline soils with neutral–alkaline pH are scattered around the main basins of Central Otago, their current distribution is an estimated mere fraction (< 1%) of what is believed to have existed at the time of European settlement (Rogers *et al*. 2000). It is estimated they formerly covered more than 40 000 ha of semi-arid land in the Maniototo basin, mid-Manuherikia Valley, and upper Clutha Valley (Raeside & Cutler 1966; Leamy & Saunders 1967;). According to Allen and McIntosh (1997) mining, cultivation and irrigation have reduced the area of these soils to less than 100 ha.

Most salt pans are now surrounded by non-saline agricultural land that has little or no indigenous character and only a few are adjacent to non-saline land that still supports plant species representative of the pre-European flora. (Allen and McIntosh 1997).

3. Methods

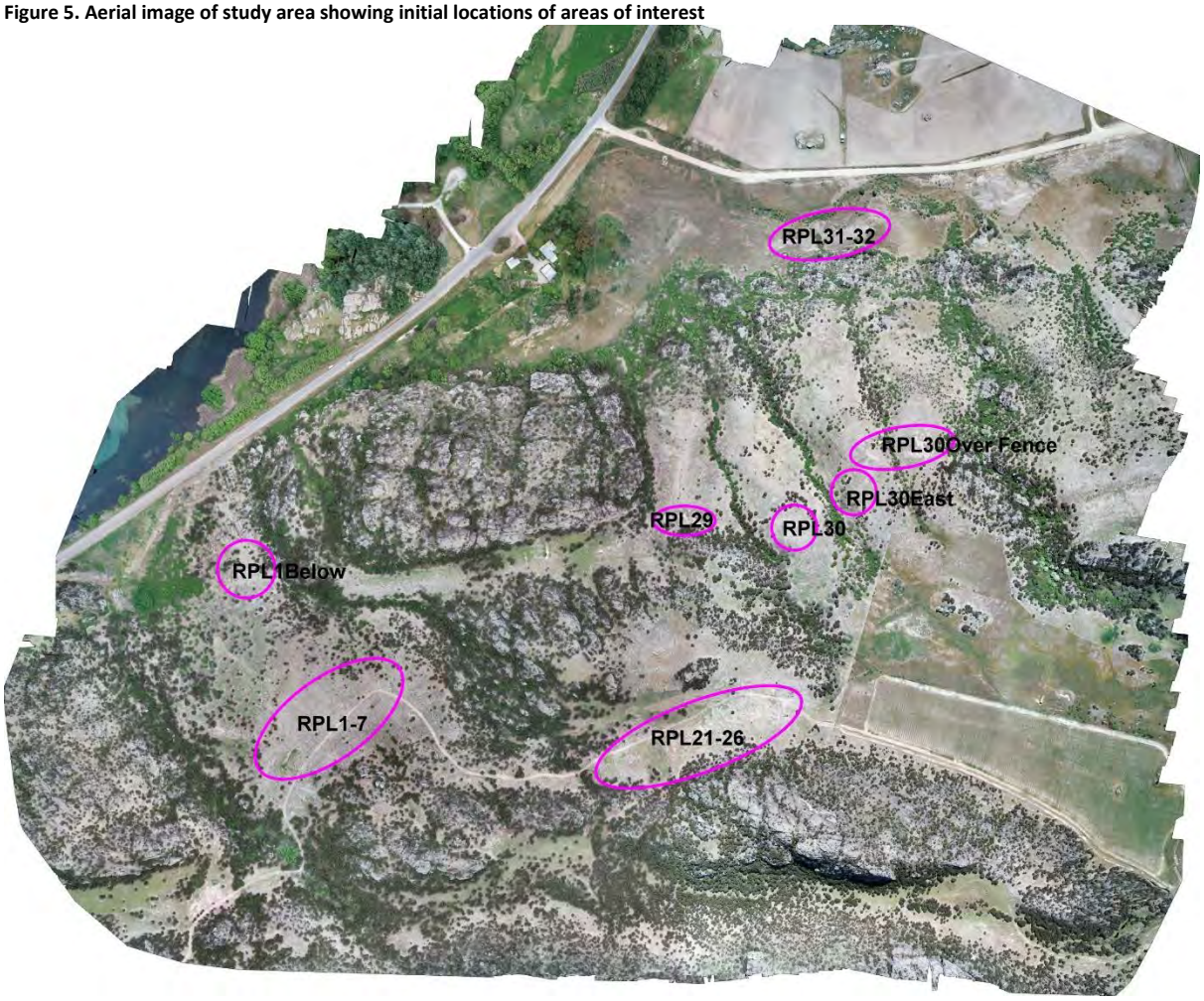
An initial assessment was made using the high resolution aerial drone photography that is available for the site. As high levels of Sodium result in low soil aggregate stability consequently the potential for wind and stormwater erosion is high. As a result areas of high salinity/sodicity are often marked by actively eroding areas, blow outs and bare patches where overall slope stability would suggest they should be stable and vegetated. These are usually fairly easily spotted on aerial photography and in extreme cases may even be accompanied by a white tinge on the surface as a result of salt encrustation. However ablation areas close to terrace risers can experience extreme winds and erosion quite independent of salinity/sodicity and so presence of erosion or blowouts is not definitive.

A lack of scrub or tree vegetation and sparse herbaceous vegetation is also indicative of potential; Saline/Sodic soils. The cushion plants Rao*ulia australis* and *R. beauverdii* also typically occurr on sites having an elevated level of salinity/sodicity and are useful for identifying sites for interest. These species however are not restricted to saline areas. Bare patches devoid of most vegetation amongst cushion fields can indicate extreme localised levels of soluble salts causing toxicity to most plants.

As neither of the above methods can provide a definitive diagnosis, following an identification of potential areas on the aerial photography a field visit was carried out, vegetation observed and soils samples taken and sent for analysis by Hill-Labs.

4. Results and Interpretation

Figure 5. Aerial image of study area showing initial locations of areas of interest



Eight areas of interest were identified from the aerial photography and visited, their soils sampled and sent for analysis. In addition one further area of interest outside of the study area was also sampled. Soil results from Hill- Labs are provided in Appendix 1. Aerial Imagery showing areas sampled is given in Appendix 2.

Figure 6. Soils with soluble salts and their categories as defined by Rogers *et al* (2000)

Saline soils	EC of 0.18 mS/cm or more, ESP less than 15% , and pH values below 8.5.
Saline-sodic soils	EC of 0.18 mS/cm or more, ESP of 15% or more, and pH values near or above 8.5.
Sodic soils	EC less than 0.18 mS/cm, ESP of 15% or more, and pH above 8.5.

We have used the categories used by Rogers *et al*, (2000) for describing the soils sampled. Rogers *et al* recognised that within the large number of soil parameters they analysed, three broad types of soil could be recognised within the saline/sodic spectrum; saline (dominated by Sodium), sodic (dominated by exchangeable Sodium) and saline-sodic (dominated by both exchangeable Sodium and Sodium as a salt. Electrical Conductivity (EC) and Exchangeable Sodium percentage (ESP) were identified as useful gradients for study. It was noted that although high pH is often associated with Sodic soils and Rogers *et al* have given accessory limits they state pH is not differentiating.

It should also be noted that surface (0-75mm) soil sampling provides a single snap shot in time of what is a fairly dynamic system. Because soluble salts dissolve in water they move easily and composition and concentration of any given horizon can vary from time to time and place to place within a saline ecosystem. A heavy rainfall event may dissolve, wash away or leach away a surface salt build up or change its composition depending on differing solubility of its components. Over time salts will accumulate again as new salt is transported in and water evaporated off. Ideally a series of analyses over time would give the most accurate picture of the soils chemistry (Raeside & Cutler 1966, Craw *et al*. 2024). Spatial variability can also exist within a saline/sodic ecosystem depending on geomorphic changes. Salt accumulation will be highest where water currently pools and evaporates from (Rogers *et al,* 2000). Our soil chemistry results are thus indicative of the presence of salt in the soil where soils were sampled. Discussion will include vegetation and geomorphology to give a fuller interpretation of where a salt influenced ecosystem may exist.

Table 1. Summary of results and observations from areas initially identified from aerial imagery

	pH	EC mS/cm	ESP %	Comment
RPL 1 – Below (approx. 0.2ha)	6.5	0.02	1.5	Not Saline, Steep slope inconsistent with salinity, RAW soil.
RPL 1-7 (approx. 1.2 ha)	6.4	0.14	9.7	Modified by water race/dam so historical water application possible; Regenerating Kanuka present is consistent with only mild salinity.
RPL 21-26 (approx. 1.2 ha)	6.6	0.26	21.2	Saline-Sodic. Visible signs of salinity/sodicity particularly on the lower flatter parts of the area. Bare areas on lower parts of slope showed possible salt crusting.
RPL 29 (approx. 0.1ha)	6.0	0.37	29.1	Saline-Sodic. Small area on knoll <0.2 Ha
RPL 30 (approx. 0.1ha)	6.7	0.03	0.6	Not Saline
RPL 30 East (approx. 0.2ha)	6.6	0.02	0.7	Not Saline
RPL 30 Over fence	6.0	0.63	28.9	Saline-Sodic. Visible signs of salinity/sodicity. Multiple areas of blow outs and erosion with small collection evaporation zones on gentle slope/apron below.
RPL 31-32 (approx. 0.2ha)	7.6	0.12	0.2	Low Sodium but High proportion Ca and Mg, Possible Dolomitic Lime application affected or possibly pedogenic lime erosion from above – mildly saline but non-Sodic. Vegetation/ grasses etc dont appear consistent with high salinity.
RP Comp East (approx. 1.3ha)	6.3	0.03	0.5	Not Saline – Bare areas at front of terrace riser elevated from areas behind and are unlikely to have received transport of salt through water movement. Bare areas are most likely result of wind ablation.

Of all the areas sampled only RPL 29, RPL 30(over the fence) and RPL21-26 have shown significant chemistry consistent within the spectrum of Saline or Saline-Sodic soils. The extent of area RPL29 is quite limited. RPL30(over the fence) is on the same position of the landscape as RPL29 but further

along the edge of the terrace and is more extensive. RPL21-26 is the most extensive area and is discussed last.

RPL1Below

A steep slow on eroding permeable gravels inconsistent with water pooling and evaporation and salinity build up. No visible sign of salt and chemistry shows no indication of salinity – conclude this is a RAW soil

RPL1-7

RPL1-7 shows elevated levels of EC (salinity) and ESP (Exchangeable Sodium) but they are less than the criteria used by Rogers *et al* and maybe best described as slightly/mildly saline. Much of this area shows regenerating seedlings of Kanuka which are unlikely to be present if salinity/sodicity was high. This area also had the remnants of an old irrigation reservoir and water race which suggest that at some stage in the past it may have already experienced water runoff and levels of leaching that may have removed accumulated salts. Within the area sampled there may be some limited patches of higher concentrations of soluble salts but overall it is not considered significantly saline or sodic.

Figure 7. Regenerating Kanuka across proposed lots 1-7

RPL29

This is a very small area of saline/sodic soil just below an eroding knoll. Cushion field and soil chemistry that confirms Saline-Sodic categorisation

RPL30

An area of what appears to be wind ablation on a mostly permeable surface. Possibly visible signs right at the western margin of a tiny area of salinity. Soil chemistry shows no indication of accumulated soluble salts,

RPL 30 East

The same situation as RPL30 except no visible signs of salinity anywhere in the sampling area

RPL 30 Over fence

This is an area similar to RPL29 in its position on the landscape but is a more extensive area of saline/sodic soil located just below an eroding knoll. Cushion field and soil chemistry confirms Saline-Sodic categorisation

Figure 8. Images taken looking uphill on the area identified as RPL30 (over the fence).

RPL31-32

RPL31-32 had slightly elevated levels of Salinity and high pH. However Sodium is at very low background levels whereas exchangeable Calcium and Magnesium are both elevated and the site has 100% Base Saturation. This area is adjacent to the Bendigo Loop road and not far from where the top dressing airstrip that once existed alongside the road was. It is possible that the area has been fertilised with Lime or possibly Dolomitic Lime. The vegetation was not consistent with Saline areas and consisted mostly of introduced grasses. Alternatively it may be affected by eroding pedogenic lime from an exposed Bk horizon eroding above it.

RPL Comp

This is an area outside of the study area that is being evaluated as a possible compensation area. Soil chemistry shows no signs of salinity/sodicity. Covered in areas of wind ablation bear the edge of the terrace riser. The area examined had no slope behind to act as source of downward moving salt and the substrate appeared to be permeable gravels without any area for water to pool and evaporate leaving salt behind to accumulate

RPL21-26

A slope with an apron area at its foot. Visible signs of salinity/sodicity particularly on the lower flatter parts of the area where areas of possible salt encrustation are showing. Mid slopes show many blowouts and eroded areas where salt is presumed to be eroding from and being transported downslope and accumulated at lower levels. Mostly covered in cushion field. The initial soils results for the sample taken from throughout the area of proposed lots 21-26 show elevated levels of soluble salts with ESP well above the 15% threshold to be considered Sodic.

It was not immediately clear for this area where the outer limits of the saline/sodic ecosystem exist and where the greatest accumulation of salt may be found. Lot 26 is mostly outside what appears to be the salt supply and accumulation zone and as it is mostly sloping permeable gravels away from the main accumulation apron it was thought that it may have no accumulated salinity nor would it

Figure 9. Image taken from western edge of Lot 24 looking towards Lots 23-21. Foreground shows possible salt accumulation. The slope behind below the Kanuka shows areas eroding and most likely source of salt.

be supplying salt. Likewise the area to the North of Lots 24 and 25 is below the accumulation apron and consists of permeable gravels with a thin layer of loess on top. It is unlikely this area has any role in the saline/sodic ecology of the area. Towards Lot 21 there also less visual evidence of an accumulation/evaporation zone for salt. Significant salinity/sodicity may still be present in small hollows and may be still part of the ecosystem.

Although vegetation and landform shape/substrate permeability gives us clues as to the limits of the salt supply and accumulation zone, detailed soils sampling of these lots was needed for greater confidence in setting these boundaries. In order to understand the soils of this area better it was therefore decided to undertake further sampling. Areas sampled is shown in Appendix C. EC, pH and ESP results from Hill-Labs analysis are shown in Table 2.

Table 2. Summary of results and observations from secondary sampling in and around Lots 21-26

	pH	EC mS/cm	ESP %	Comment
RPL21	6.1	0.07	5.8	Slightly elevated ESP
RPL22	6.8	0.03	4.4	Slightly elevated ESP
RPL23	6.1	0.28	15.9	Saline-Sodic.
RPL24 and 25 above track	6.0	0.43	31.9	Saline-Sodic. Visible signs of salinity/sodicity. Multiple areas of blow outs, erosion with small collection evaporation zones on gentle slope below leading to what is thought to be main accumulation zone below track.
RPL24 and 25 below track	6.0	0.66	21.5	Saline-Sodic. Visible signs of salinity/sodicity particularly on the lower flatter parts of the area. Bare areas showed possible salt crusting.
RPL26	7.0	0.03	0.7	Not Saline
Area North of RPL24 and 25	6.1	0.03	0.8	Not Saline

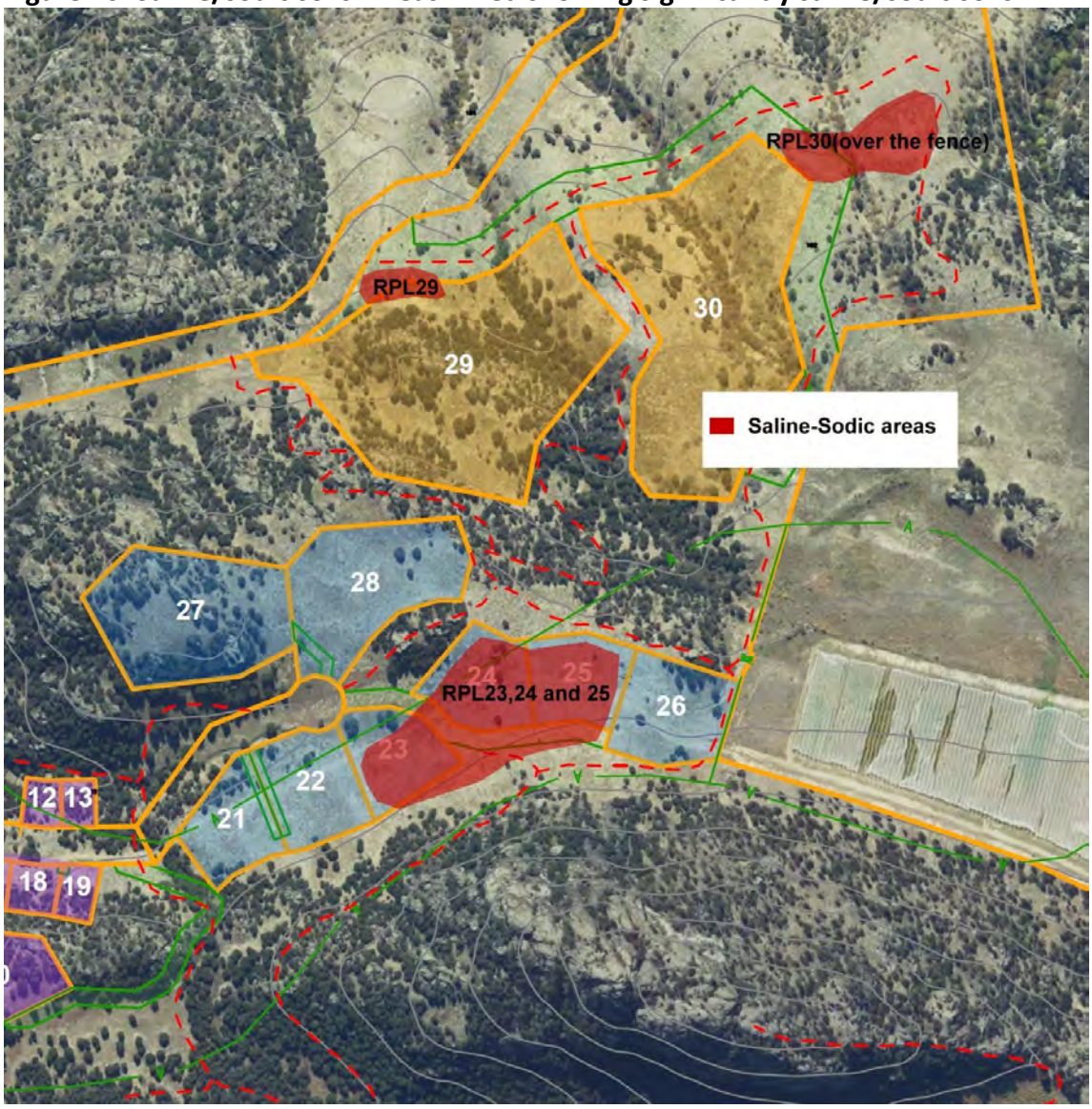
As expected there is variability of salt accumulation across the proposed lots 21-26. The main area of accumulation is on or around proposed lots 23, 24 and 25 and results from these samples show significantly raised EC and ESP consistent with classification as Saline-Sodic. The soil results for Lots

21 and 22 show slightly elevated levels of ESP but no elevation in EC. These two lots can therefore be considered to be outside the main salt accumulation zone and instead a part of the peripheral saline influenced ecological area. As was previously suspected, Lot 26 and the area to the north of Lots 24 and 25 showed no chemistry consistent with salinity. These are both just outside of the salt producing landform and accumulation zone.

5. Summary

Three areas were identified with visible signs of salinity/sodicity and with chemistry results that confirm this. These are shown in figure 9. The area RPL29 is small (<0.1ha) and on its own does not contribute significantly in terms of area although it does contribute to the overall ecological mosaic and diversity of the area. RPL30(over the fence) is a larger area (approx. 0.2ha) and more significant contributor to the diversity of the study area. Secondary sampling of Lots 21-26 showed the significantly saline/sodic soils area is centered on proposed lots 23-25. This is the largest area observed (approx. 0.8ha)

Figure 10. Saline/sodic soils. Areas in red showing significantly saline/sodic soils.



All saline areas showed evidence of an erosion or source area for salt and accumulation zone below where water accumulates in patches over less permeable layers and evaporates off leaving transported salt behind. As salt is eroded these from the slope above the accumulation zone, it will be transported with water movement to wherever water pools above the less permeable layers. Heavy rain may shift and re-dissolve and move surface salt build up or change its composition depending on differing solubility of its components. Re-dissolved salts may then be left behind again further downslope where water has pooled and evaporated. Over time salts will accumulate again as new salt is transported in and water evaporated off. So within a saline/sodic ecosystem a supply area and an accumulation area will exist within which there will be spatial and temporal variability even though it is all part of saline/sodic ecosystem.

6. References

Allen RB, McIntosh PD. 1997. Guidelines for conservation of salt pans in Central Otago. *Science for Conservation 49*. Wellington: Department of Conservation.

Craw D, Rufaut C, Pillai D 2022 Geological controls on evolution of evaporative precipitates on soil-free substrates and ecosystems, southern New Zealand. *Sci Total Environ* 849:157792

Dave Craw, Joanna Druzbicka, Shanna Law, Kat Lilly, and Cathy Rufaut 2024 *Evaporative salts in Central Otago* https://www.otago.ac.nz/geology/research/environmental-geology/geomorphology/evaporative-salts-central-otago

Grove P.B., Ward, C.M., 1994 *Lindis, Pisa and Dunstan Ecological District: A Survey Report for the Protected Natural Areas Programme.* Issue 36 of New Zealand Protected Natural Areas Programme. Department of Conservation, Otago Conservancy

Hewitt 1993 New Zealand Soil Classification, Landcare Research Ltd

Landcare Research - Inland saline (salt pans) web page. https://www.landcareresearch.co.nz/publications/naturally-uncommon-ecosystems/inland-and-alpine/inland-saline

Rufauta C, Craw D, Druzbickab J and Law S 2018 Conservation of saline patches in Central Otago needs better recognition of physical processes to secure future habitats; *New Zealand Journal Of Botany*, 2018 vol. 56, no. 1, 115–126

Raeside JD, Cutler EJB, Miller RB. 1966. Soils and related irrigation problems of part of Maniototo Plains, Otago. *New Zealand Soil Bureau Bull 23*. Wellington: Department of Scientific and Industrial Research.

Rogers GM, Walker S, Tubbs M, Henderson J. 2002. Ecology and conservation status of three "spring annual" herbs in Dryland ecosystems of New Zealand. *New Zealand Journal of Botany*. 40:649–669.

Rogers G, Hewitt A, Wilson JB. 2000. Ecosystem based conservation strategy for Central Otago's saline patches. *Science for Conservation 166.* Wellington: Department of Conservation.

Appendix A. Soils results from Hill Labs

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Certificate of Analysis

Client:	Roger Gibson	Lab No:	3540197	shvpv1
Address:	5 Elite Court RD 3 Cromwell 9383	Date Received:	12-Apr-2024	
		Date Reported:	17-Apr-2024	
		Quote No:		
		Order No:		
		Client Reference:	Rocky Point - TK	
		Submitted By:	Roger Gibson	

Soil Analysis Results

Sample Name:		RPL 1 - Below	RPL 1-7	RPL 21-26	RPL 29	RPL 30	RPL 30 East
Lab Number:		3540197.1	3540197.2	3540197.3	3540197.4	3540197.5	3540197.6
Sample Type:		SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard
Sample Type Code:		S49	S49	S49	S49	S49	S49
pH	pH Units	6.5	6.4	6.0	6.6	6.7	6.6
Olsen Phosphorus	mg/L	8	19	10	15	10	9
Potassium	me/100g	0.41	0.43	0.32	0.17	0.54	0.46
Potassium	%BS	7.7	6.9	6.8	3.3	10.1	9.0
Potassium	MAF units	10	10	8	4	12	11
Calcium	me/100g	2.2	2.6	1.6	1.9	2.6	2.4
Calcium	%BS	42	43	35	38	47	47
Calcium	MAF units	3	4	2	3	4	3
Magnesium	me/100g	0.60	0.80	0.58	0.79	0.55	0.53
Magnesium	%BS	11.4	12.8	12.1	15.4	10.2	10.3
Magnesium	MAF units	16	20	15	21	14	13
Sodium	me/100g	0.08	0.61	1.01	1.49	< 0.05	< 0.05
Sodium	%BS	1.5	9.7	21.2	29.1	0.6	0.7
Sodium	MAF units	4	31	55	82	< 2	< 2
CEC	me/100g	5	6	5	5	5	5
Total Base Saturation	%	63	72	75	85	68	67
Volume Weight	g/mL	1.14	1.10	1.18	1.20	1.12	1.12
Soluble Salts (Field)	%	< 0.05	< 0.05	0.09	0.13	< 0.05	< 0.05
EC (in 1:5 Extract)	mS/cm	0.02	0.14	0.26	0.37	0.03	0.02
Soil Sample Depth*†	mm	0-75	0-75	0-75	0-75	0-75	0-75
Soil Type*†		Sedimentary	Sedimentary	Sedimentary	Sedimentary	Sedimentary	Sedimentary

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Certificate of Analysis

Client:	Roger Gibson	**Lab No:**	3540197 shvpv1
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		Date Reported:	17-Apr-2024
		Quote No:	
		Order No:	
		Client Reference:	Rocky Point - TK
		Submitted By:	Roger Gibson

Soil Analysis Results

Sample Name:		RPL 31-32	RP Comp East				
Lab Number:		3540197.7	3540197.8				
Sample Type:		SOIL Grape, Vineyard	SOIL Grape, Vineyard				
Sample Type Code:		S49	S49				
pH	pH Units	7.6	6.3	-	-	-	-
Olsen Phosphorus	mg/L	31	43	-	-	-	-
Potassium	me/100g	0.64	0.64	-	-	-	-
Potassium	%BS	6.4	11.1	-	-	-	-
Potassium	MAF units	14	15	-	-	-	-
Calcium	me/100g	8.2	2.2	-	-	-	-
Calcium	%BS	83	37	-	-	-	-
Calcium	MAF units	11	3	-	-	-	-
Magnesium	me/100g	1.04	0.42	-	-	-	-
Magnesium	%BS	10.6	7.3	-	-	-	-
Magnesium	MAF units	25	11	-	-	-	-
Sodium	me/100g	< 0.05	< 0.05	-	-	-	-
Sodium	%BS	0.2	0.5	-	-	-	-
Sodium	MAF units	< 2	< 2	-	-	-	-
CEC	me/100g	10	6	-	-	-	-
Total Base Saturation	%	100	56	-	-	-	-
Volume Weight	g/mL	1.07	1.13	-	-	-	-
Soluble Salts (Field)	%	< 0.05	< 0.05	-	-	-	-
EC (in 1:5 Extract)	mS/cm	0.12	0.03	-	-	-	-
Soil Sample Depth*†	mm	0-75	0-75	-	-	-	-
Soil Type*†		Sedimentary	Sedimentary	-	-	-	-

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Client:	Roger Gibson	**Lab No:**	3578852	shvpv1
Address:	5 Elite Court RD 3 Cromwell 9383	**Date Received:**	13-May-2024	
		Date Reported:	16-May-2024	
		Quote No:		
		Order No:		
		Client Reference:	Rocky Point TK	
		Submitted By:	Roger Gibson	

Soil Analysis Results

Sample Name:		RP Lot 21	RP Lot 22	RP Lot 23	RP 24/25 North	RP 24/25 Above	RP 24/25 BT
Lab Number:		3578852.1	3578852.2	3578852.3	3578852.4	3578852.5	3578852.6
Sample Type:		SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard	SOIL Grape, Vineyard
Sample Type Code:		S49	S49	S49	S49	S49	S49
pH	pH Units	6.1	6.8	6.1	6.1	6.2	6.0
Olsen Phosphorus	mg/L	5	6	6	11	7	27
Potassium	me/100g	0.40	0.51	0.28	0.52	0.25	0.51
Potassium	%BS	8.9	12.4	5.3	8.5	5.1	6.1
Potassium	MAF units	11	12	7	12	6	13
Calcium	me/100g	2.2	2.4	2.9	3.1	2.1	2.9
Calcium	%BS	49	58	54	50	43	36
Calcium	MAF units	4	4	4	4	3	5
Magnesium	me/100g	0.46	0.44	0.47	0.60	0.51	1.54
Magnesium	%BS	10.1	10.6	8.9	9.7	10.3	18.7
Magnesium	MAF units	13	11	13	14	14	43
Sodium	me/100g	0.27	0.18	0.84	< 0.05	1.57	1.77
Sodium	%BS	5.8	4.4	15.9	0.8	31.9	21.5
Sodium	MAF units	16	10	47	2	89	101
CEC	me/100g	5	4	5	6	5	8
Total Base Saturation	%	74	86	84	69	90	82
Volume Weight	g/mL	1.27	1.17	1.21	1.07	1.23	1.23
Soluble Salts (Field)	%	< 0.05	< 0.05	0.10	< 0.05	0.15	0.23
EC (in 1:5 Extract)	mS/cm	0.07	0.03	0.28	0.03	0.43	0.66
Soil Sample Depth*†	mm	0-75	0-75	0-75	0-75	0-75	0-75
Soil Type*†		Sedimentary	Sedimentary	Sedimentary	Sedimentary	Sedimentary	Sedimentary

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		Date Reported:	16-May-2024
		Quote No:	
		Order No:	
		Client Reference:	Rocky Point TK
		Submitted By:	Roger Gibson

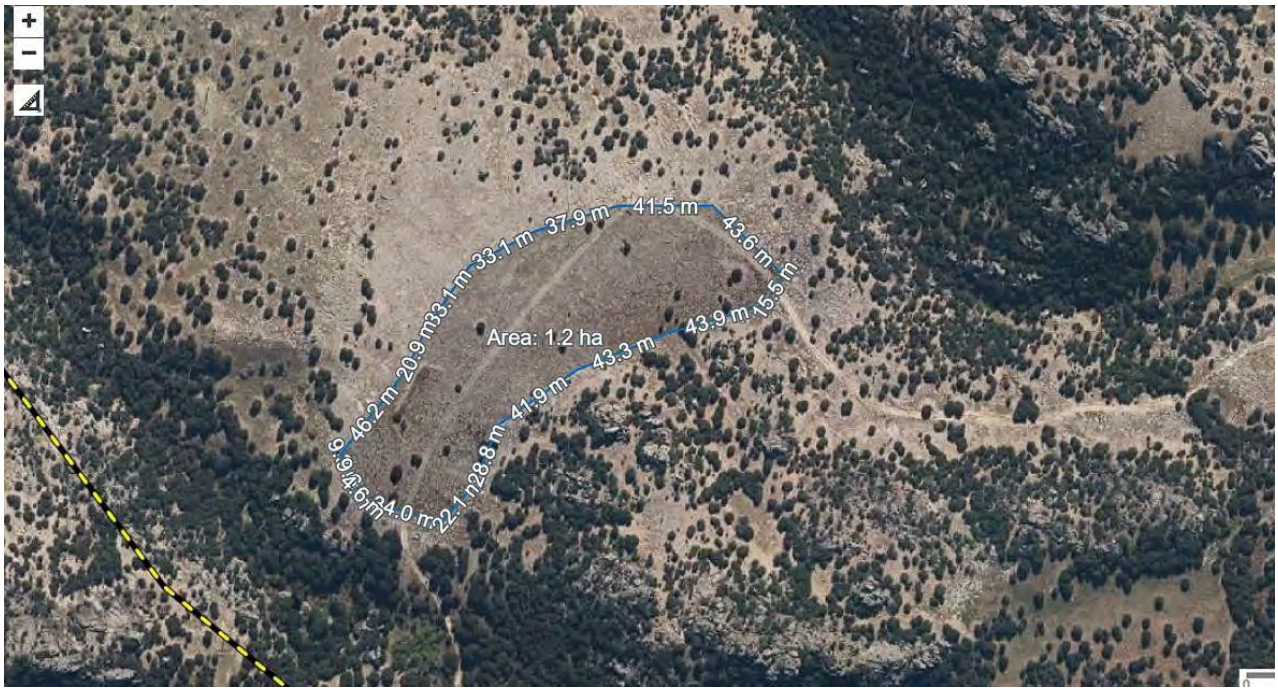
Soil Analysis Results

Sample Name:		RP Lot 26	RP 30 Over Fence				
Lab Number:		3578852.7	3578852.8				
Sample Type:		SOIL Grape, Vineyard	SOIL Grape, Vineyard				
Sample Type Code:		S49	S49				
pH	pH Units	7.0	6.0	-	-	-	-
Olsen Phosphorus	mg/L	9	10	-	-	-	-
Potassium	me/100g	0.49	0.19	-	-	-	-
Potassium	%BS	8.3	3.3	-	-	-	-
Potassium	MAF units	12	5	-	-	-	-
Calcium	me/100g	4.5	2.1	-	-	-	-
Calcium	%BS	77	36	-	-	-	-
Calcium	MAF units	7	3	-	-	-	-
Magnesium	me/100g	0.71	1.11	-	-	-	-
Magnesium	%BS	12.0	19.5	-	-	-	-
Magnesium	MAF units	18	33	-	-	-	-
Sodium	me/100g	< 0.05	1.64	-	-	-	-
Sodium	%BS	0.7	28.9	-	-	-	-
Sodium	MAF units	2	100	-	-	-	-
CEC	me/100g	6	6	-	-	-	-
Total Base Saturation	%	97	88	-	-	-	-
Volume Weight	g/mL	1.15	1.33	-	-	-	-
Soluble Salts (Field)	%	< 0.05	0.22	-	-	-	-
EC (in 1:5 Extract)	mS/cm	0.03	0.63	-	-	-	-
Soil Sample Depth*†	mm	0-75	0-75	-	-	-	-
Soil Type*†		Sedimentary	Sedimentary	-	-	-	-

Appendix B. Aerial Imagery showing boundaries of areas sampled in initial visit.

RPL1Below, Below proposed lot 1 Approx area 0.2ha

RPL1-7 – Approx area 1.2ha



RPL21-26 – Proposed lots 21-26 approx area 1.2ha

RPL29– Bottom of proposed lots 29, approx area 0.1ha

RPL30, approx area 0.2ha

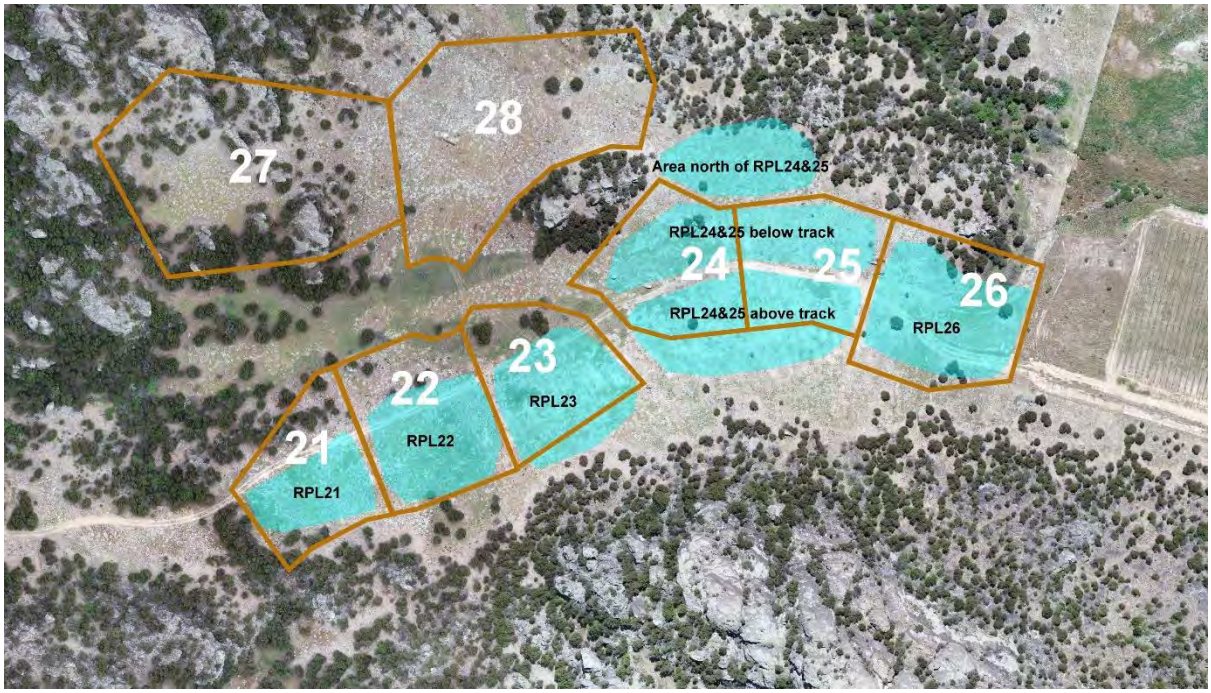
RPL30EAST, approx area 0.2ha

RPL30 Over the fence, approx area 0.4ha

RPL31-32, approx area 0.2ha

RPComp East, approx area 1.3ha

Appendix C. Aerial Image showing areas sampled in secondary survey of proposed Lots 21-21.



Vegetation succession and climax communities at Rocky Point

Contract Report No. 7080

Providing outstanding ecological services to sustain and improve our environments

Wildlands

Vegetation succession and climax communities at Rocky Point

Contract Report No. 7080

July 2024

Project Team:

Andrew Wells – Field work and report author

Simon Beale – Field work

Kelvin Lloyd – Peer review and technical advisor

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5/07/2024
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1.0 Introduction

1.1 Background

TKO Properties Limited is proposing to subdivide a property at Rocky Point, near Bendigo in Central Otago. The 68.6-hectare property is located above the head of Lake Dunstan between the Tarras Cromwell Road and the Bendigo Scenic Reserve (Figure 1).

A resource consent application was lodged with the Central Otago District Council (CODC) in July 2023, but the proposed subdivision layout has since been revised. The revised subdivision layout has been guided in part by ecological assessments undertaken by Beale Consultants (2024), and the identification of areas of saline-sodic soils by Roger Gibson Land and Sea Services (Gibson 2024).

TKO Properties Limited has subsequently commissioned Wildland Consultants to undertake a review of vegetation succession at Rocky Point, to supplement the ecological assessments. This review will form part of the background ecological material to be submitted to CODC with the revised subdivision layout. Wildland Consultants has also been commissioned to provide an evaluation of climax vegetation communities (what would be there if humans had never colonised Aotearoa) at the Rocky Point site, and to develop offset benchmark parameters. The purpose of this is to inform a biodiversity offset accounting model for the proposed subdivision.

1.2 Project scope

The report is divided into two parts. Part 1 provides an assessment of post-human-settlement vegetation change and vegetation succession at Rocky Point and the surrounding area. The assessment utilises the following:

- Early historical accounts of European settlers and scientists
- Aerial and satellite imagery from the 1950s to the present
- Palaeoecological studies in the Central Otago region
- Field investigation of the Rocky Point site and the surrounding lower western flanks of the Dunstan Range.

Part 2 of the report provides an assessment of potential climax vegetation communities at the Rocky Point site, and provides suggested parameters for these communities to inform a biodiversity offset accounting model. This assessment utilises the following:

- Palaeoecological studies in the Central Otago region
- Field investigation of the Rocky Point site and the surrounding lower western flanks of the Dunstan Range, including RECCE plot surveys to obtain benchmark values for offset modelling.

2.0 Ecological Context

2.1 Rocky Point site

The site is located adjacent to the northern end of Lake Dunstan, and varies in elevation between 200 metres and 417 metres above sea level with a predominantly north to northwestern aspect (Figure 1). Schist rock outcrops and bluffs are a prominent feature of the site, with stony hillslopes and small gullies interspersed. Postglacial terrace remnants between rock bluffs are also present at the north of

the site. Annual rainfall is low at 400-450 millimetres, which in combination with the rocky substrates and northern aspect of the site results in Rocky Point having a very high evapotranspiration rate.

The site is currently vegetated with a mix of young kānuka (*Kunzea serotina*) scrub, cushionfield, exotic herbfield and exotic grassland. Refer to Beale Consultants (2024) for detailed site and vegetation descriptions.

2.2 Ecological district

Rocky Point is located within the Dunstan Ecological District (ED) and Central Otago Ecological Region. The Dunstan ED is characterised by a dry pseudo-subcontinental climate with strong altitudinal gradients. Most of the fans and terraces have been modified and are now in exotic pasture with sweet briar (*Rosa rubiginosa*) and grey scrub communities widespread on lower slopes outside those landforms (McEwen 1987).

The Dunstan ED is described by McEwen (1987) as: "Tilted, block-faulted schist range to 1692 m a.s.l surrounding lowlands, glacial outwash gravels, moraines: dry, subcontinental climate, snow lies for weeks in winter; shallow to moderately deep soils with variable loess cover on rolling, hilly and steep slopes, shallow to deep soils on terrace and fans in valleys; formerly mostly tussockland, no beech forest, rare small Hall's totara remnants E, extensive kānuka shrubland SW; local endemics; burnt, grazed, rabbits."

2.3 Nearby protected areas

The 627-hectare Bendigo Scenic Reserve lies to the east of Rocky Point, and occupies the lower northern and western flanks of the Dunstan Range immediately above the grape growing area of Bendigo, incorporating Chinamans Creek and west of School Creek (Figure 1). The western part of the reserve includes most of the Pigeon Creek catchment, less than one kilometre from the southern boundary of Rocky Point and adjoining the Bendigo Hills property owned by TKO Properties Limited. The area east of School Creek is contained in the 458-hectare Bendigo Historic Reserve. Together these two reserves provide legal protection to 1,085 hectares of land on the lower western and northern flanks of the Dunstan Range between 340 and 760 metres above sea level, on landforms very similar to those at Rocky Point, and preserve the largest example of successional kānuka forest in the Dunstan ED.

3.0 Methods

Published and unpublished scientific literature related to vegetation change in the wider Central Otago District and the Rocky Point/western Dunstan Range area was reviewed. Historic and recent aerial and satellite imagery was examined to understand broad changes in vegetation over the past 75 years.

A walk over of the Rocky Point site was conducted on 5 December 2023, with TKO Properties and Simon Beale (Beale Consultants), to provide familiarisation with the site and the proposed development. This was followed by a three-hour helicopter fly over of the Dunstan Ecological District (ED) and adjoining Central Otago and Pisa ED's, to assess the extent of cushionfield vegetation and kānuka succession. The focus was on the lower elevation hillslopes (200-700 metres) within comparable settings to Rocky Point, and particularly the northern and western flanks of the Dunstan Range within the Dunstan ED.

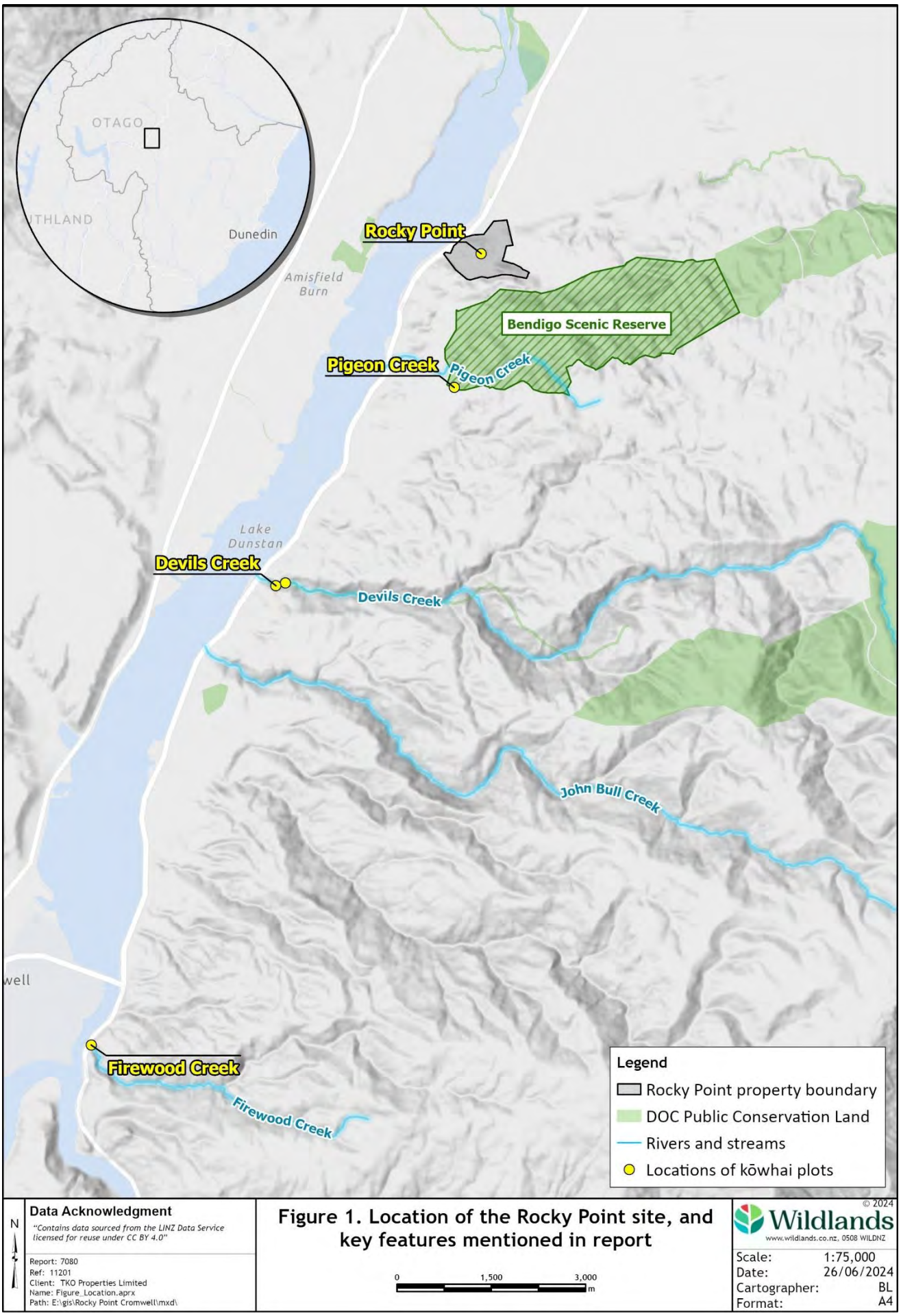

Figure 1. Location of the Rocky Point site, and key features mentioned in report

Further site inspections were carried out on 25 March and 29 April 2024 with Simon Beale, to assess potential offset and compensation sites. Walk over surveys of the entire Rocky Point site and RECCE plot surveys were conducted with Simon Beale on 10, 14, 15 and 30 May 2024. The RECCE plot surveys included cushionfield and kānuka scrub at Rocky Point, three potential offset sites in the adjacent Bendigo Hills Estate, and offset benchmark sites at Devils Creek and Firewood Creek. Additional RECCE plot surveys were undertaken on 13 May 2024, of offset benchmark sites at Rocky Point and at Pigeon Creek (Figure 1). During RECCE plot surveys of offset benchmark sites, any indigenous species that were observed outside of the plots in the nearby area but not found within the plots were also noted.

The combined information from the above sources was used to assess vegetation succession at Rocky Point, and to assess climax vegetation communities at Rocky Point. Suggested offset benchmark communities were also described, and their attributes and parameters quantified based on RECCE plot data.

4.0 Part 1 – Vegetation Succession

4.1 Overview

Vegetation in the drier parts of Central Otago has undergone rapid and profound changes since human settlement. Polynesian fires approximately 750 years BP resulted in the rapid replacement of predominantly woody forest and shrubland communities with predominantly tussock grasslands and successional shrubland assemblages (Rogers *et al.* 2007). European settlers brought further changes through the introduction of exotic plants, rabbits and stock grazing, and repeated burning for pasture development (Walker *et al.* 2009). This radically transformed the vegetation patterns of the entire region, as succinctly described by McGlone (2001): “Eight hundred years of fire and 150 years of pastoral development have obscured the original vegetation patterns of the south-eastern South Island. Over large stretches of country no vegetation associations corresponding to those of the pre-human situation remain.”

Today, woody indigenous plants in Central Otago typically remain as patches of ‘grey scrub’ (Wardle 1991), shrubland communities arising through secondary succession.

4.2 Post-European settlement vegetation change in Central Otago

4.2.1 Early history

While no recorded details are available that describe the vegetation in the district at the time of Māori arrival, there are historic accounts from European settlers. When the first European farmers arrived in Central Otago in 1857, they found an extensive tussock-covered landscape, an absence of trees, and considerable areas of shrublands. At this time inland Otago was described as “all open, well grassed and watered, with sufficient scrub for fuel for many years but no bush or timber”. By 1859 all suitable land in the district had been taken up by graziers (Hercus 1966).

Overburning and overstocking with sheep soon began to cause problems for farmers. Rabbits were first reported as a pest in the area in 1876, and by the 1880s the combination of overburning, overstocking, and rabbit invasion was having a devastating effect on farming. Sheep numbers declined and many of the early settlers were ruined. Bare ground replaced vegetation cover over large tracts of land, and where vegetation was present it often comprised low-growing inedible plants such as indigenous scabweeds (*Raoulia* spp.) and exotic herbs. Rabbits continued as a serious plague in the region from the mid-1870s to the 1950s.

As noted by Hercus (1966), it took bitter experience to learn that in this arid environment, mistakes in land management have dramatic long-term consequences. These mistakes left behind the largely human-induced 'deserts' of the Central Otago hill country from which vegetation has been slowly recovering since the 1950s.

4.2.2 Present-day indigenous vegetation

As previously mentioned, indigenous woody plants in the drier parts of Central Otago commonly remain as patches of 'grey scrub'. Stands of early successional kānuka shrubland/scrub are also present (Plate 1), such as at Rocky Point and Bendigo Scenic Reserve. Kōwhai (*Sophora microphylla*) is the most prominent large indigenous tree left at elevations below c.700 metres, and these typically occur as isolated individuals or small clusters restricted to rocky fire-protected sites. The lower western and northern flanks of the Dunstan Range (between c.200-700 metres) that are still grazed or that have continuing high rabbit numbers contain a high abundance of *Raoulia australis* within cushionfields (Plate 2), reflecting a very early successional community on semi-arid highly-degraded land. At higher altitudes (above about 750 metres), relict trees of Hall's tōtara (*Podocarpus laetus*) are present but restricted to rocky gorges or fire-protected rocky outcrops (Wells 1972).

Plate 1. A young stand of successional kānuka shrubland at Rocky Point.

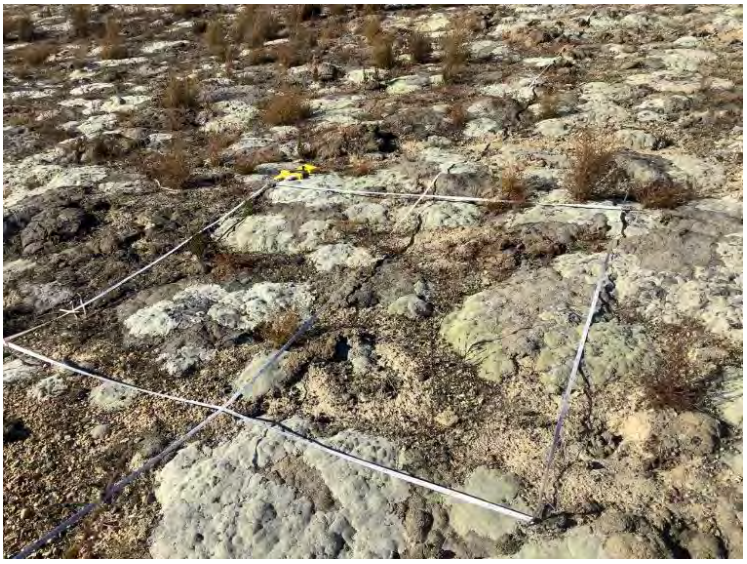

Plate 2. Cushionfield at Rocky Point, with a high cover of *Raoulia australis*.

4.2.3 Cushionfield extent from aerial fly over

The aerial fly over conducted on 5 December 2023 revealed that low-elevation cushionfields with a high proportion of indigenous *Raoulia* spp. remain extensive within the Dunstan ED. In particular, large areas of cushionfield are present between 200-700 metres elevation on the western and northern flanks of the Dunstan Range. An estimated 168.9 hectares of cushionfield was mapped within five kilometres of Rocky Point (Figure 2). Other vegetation present includes extensive successional kānuka-dominant scrub, exotic pasture, tussock grasslands and vineyards.

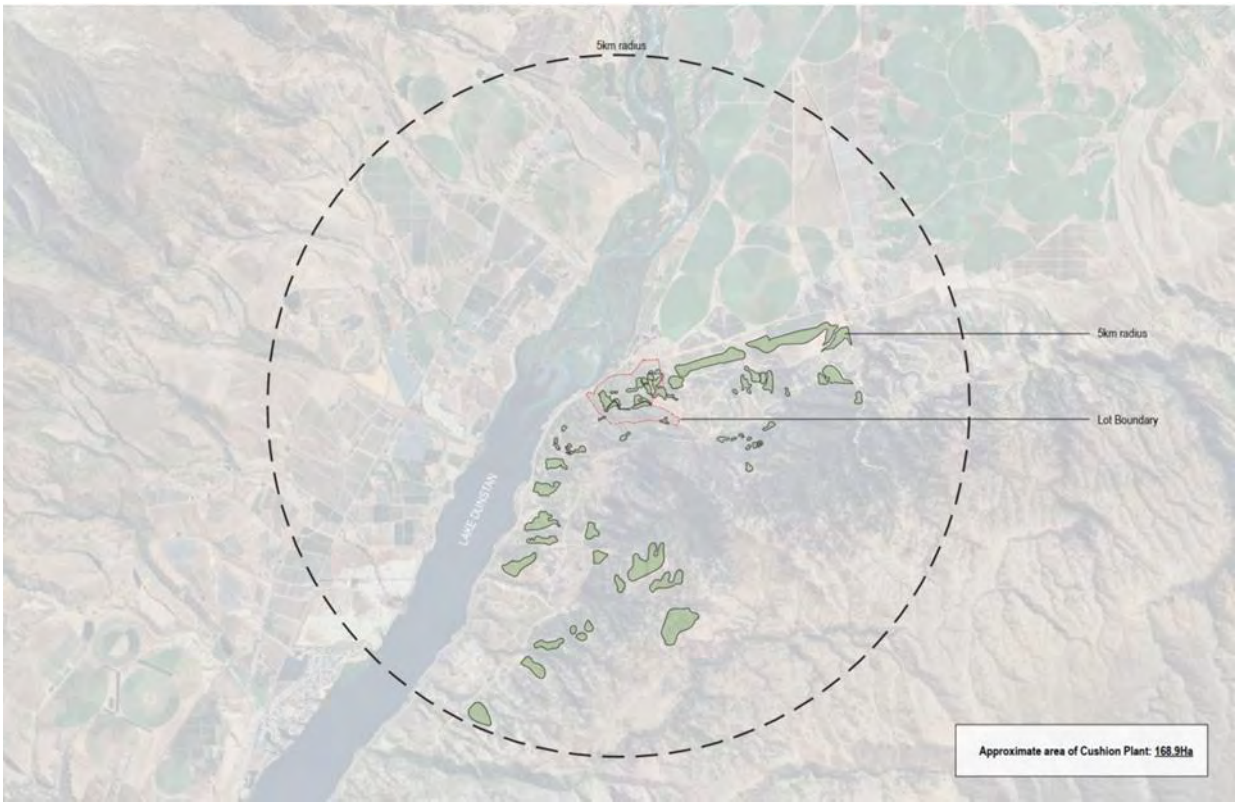

Figure 2. Indicative areas of *Raoulia australis* cushionfield on the lower western flanks of the Dunstan Range within a five-kilometre radius of the Rocky Point site, based on a fly over survey conducted on 5 December 2023. Only areas with a high density of cushion plants are mapped.

Small areas of cushionfield are also located in the adjoining ED's, but occur only as isolated patches and are not extensive. Vegetation on the lower hillslopes in the adjoining ED's is dominated by exotic pasture, tussock grasslands, and successional kānuka-dominated scrub.

The relatively large areas of cushionfield remaining in the lower northern and western flanks of the Dunstan Range, relative to other areas in Central Otago, presumably reflects the particularly harsh nature of this area resulting from low rainfall, exposed northwestern aspects and rocky/stony soils. Restoration of grassland or succession to woody vegetation following historic land degradation is therefore slower than in other environments of Central Otago, and may often require the removal of grazing and rabbits. This is discussed further below.

4.3 Vegetation change at Rocky Point from 1950s to the present day

In the early 1950s the Bendigo Station lease was suffering from all of the issues mentioned above, and was considered to be in a very run down condition. Rabbits remained a very serious problem and continued to cause widespread, extreme depletion across the entire lease area below 610 metres (Coterra 2024). Between 1953 and 1978, changes in management were reported to bring about some

vegetation improvement. The property underwent tenure review in the late 1990s, at which time Rocky Point was privatised.

4.3.1 Aerial and satellite imagery of Rocky Point – 1958 to 2024

Aerial imagery from 1958 shows the Rocky Point property overwhelmingly dominated by non-woody vegetation, and almost devoid of woody vegetation (Figure 3). A few individual shrubs are evident in the main gullies and on rocky outcrops throughout, most probably of kānuka and a few remnant kōwhai. A large crack willow (*Salix ×fragilis*) is present mid-way up the southwestern gully, and this is still present today.

Based on interpretation of the 1958 aerial imagery using present-day field observations, it is almost certain that the lighter, white areas reflect *Raoulia australis* cushionfield vegetation with a high percentage cover of cushion plants, while the slightly darker areas reflect bare gravelly ground and other low-growing vegetation (including young kānuka) with a lower abundance of cushion plants. The 1958 imagery thus indicates that well over half of the site area was likely dominated by *Raoulia australis* cushionfield with a high percentage cover of cushion plants. This is consistent with reports of severe degradation at the site at this time. Low stature kānuka shrubland occupies only a very small portion of the site.

This pattern remains essentially unchanged in 1975 imagery, with only a slight increase in woody vegetation in gullies and rocky outcrops. Between 1975 and 2001 there is a notable increase in the density and extent of woody vegetation in gullies and rock outcrops, as well as a spread of woody vegetation onto the gravelly faces and hillslopes at the site, as kānuka shrubs developed mature canopies. This trend of increasing density and extent of woody vegetation continued through the 2000's, and is obvious in the 2024 imagery (Figure 3). Site investigations verify that almost all of this colonisation comprises kānuka, with a minor component of sweet briar, and occasional korokio (*Corokia cotoneaster*) and mingimingi (*Coprosma propinqua*) in rock outcrops.

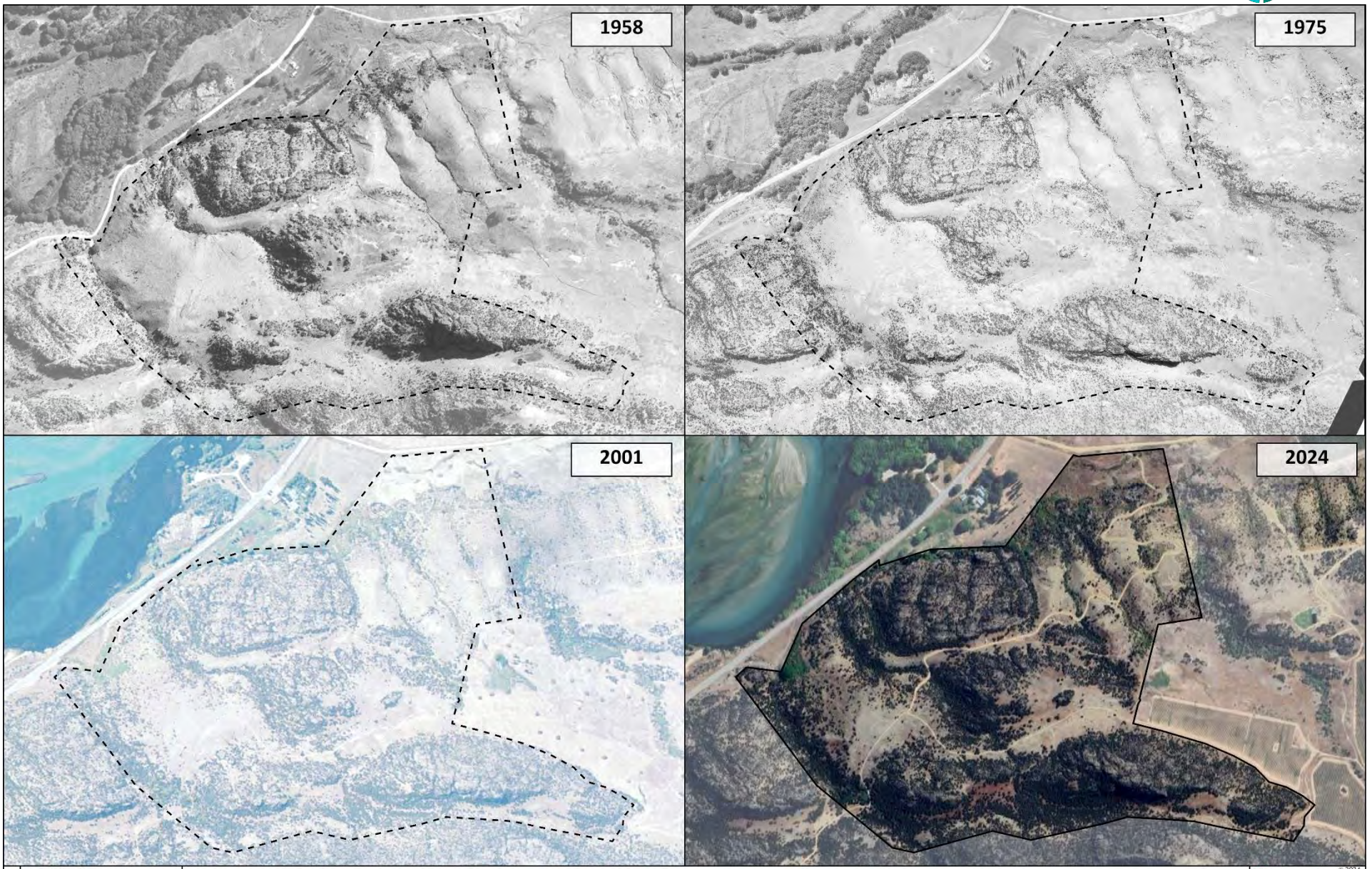

Figure 3. Retrolense imagery of Rocky Point

4.3.2 Field observations

General observations of relevance to succession made during the walk over surveys and RECCE plot surveys at the Rocky Point site are outlined here. These observations supplement the RECCE plot data provided in Beale Consultants (2024).

1. Ongoing expansion of kānuka into areas of bare ground and cushionfield, and ongoing reductions in the extent of cushionfield and bare ground and in the diversity and abundance of cushionfield plant species

Seedlings and saplings of kānuka were widely observed across the site, in almost all landform settings including rocky outcrops, hillslopes and gullies. Regeneration was more pronounced close to already-established older kānuka, indicating that kānuka is continuing to expand its range across the site as conditions are ameliorated by existing plants. This expansion is primarily into areas of cushionfield and bare ground (Plate 3). This is consistent with the successional pattern observed in aerial imagery over the past c.70 years discussed above, and reflects the gradual recovery from human-induced degradation. If this successional trend continues uninterrupted, almost all of the site will be covered in low woody vegetation dominated by kānuka within another 30-40 years.

Kānuka has been able to persist and colonise because it regenerates after fire, and is not palatable to rabbits or farm stock. Few other indigenous woody species share these traits, and thus are much more restricted in the landscape today.

Directly related to the expansion of kānuka and other woody species, the extent of bare ground and cushionfield at the site continues to reduce. This reflects the ongoing recovery of the site from the impacts of overburning, overgrazing and rabbits, all of which induced the previous dominance of bare ground and cushionfield. Current regeneration of kānuka demonstrates that climate and soils are not a limiting factor for the re-establishment of woody vegetation at the site. It is probable that over the next 30-40 years, in the absence of human disturbance, cushionfield will become restricted to small relict patches amongst woody vegetation.

Further observational evidence indicating that the cushionfield vegetation at the site is largely a human-induced early successional stage is presented in Appendix 1.

Plate 3. Young kānuka shrubland succeeding cushionfield at Rocky Point.

The notable exception to this is the localised patches of saline soil identified by Gibson (2024). No kānuka regeneration was observed on these areas, and as Gibson (2024) notes, colonisation by woody species is unlikely due to the extreme soil conditions. The natural climax vegetation in these areas is therefore indigenous cushionfield/herbfield.

2. Regeneration of kōwhai from relict trees, and development of kōwhai as a prominent component of scrub/forest vegetation

A few old mature relict kōwhai trees are present at Rocky Point (Plate 4). These trees are in rocky outcrops where they have presumably survived fires. While their age is unknown, their knarled trunks and rocky site positions (where slow growth is expected) suggest that they are well over 100 years old. Several younger trees have established within about 20 metres of these trees, and there are also several saplings and seedlings nearby and downslope. This indicates that active regeneration of kōwhai from the relict trees has been occurring for some time. Regeneration of kōwhai will continue in the absence of human disturbance, and will be hastened by the amelioration of site conditions brought about by the developing kānuka shrubland.

More advanced examples of kōwhai succession from relict trees were observed on similar landforms and elevations at several other locations in the lower western flanks of the Dunstan Range, including at Bendigo Hills (Plate 5), Bendigo Scenic Reserve, Pigeon Creek (Plate 6), Devils Creek and Firewood Creek. The closest example to Rocky Point is on north-facing rocky and gravelly hillslopes at Bendigo Hills, less than 100 metres south of the Rocky Point boundary. At this location, over 50 kōwhai ranging from small trees to young seedlings are scattered over an area of hillside, and appear to have established below a few mature relict trees near the ridgeline.

Plate 4. An old kōwhai tree (on the left) at Rocky Point, with younger regeneration surrounding it.

Plate 5. A relict kōwhai on a ridge at Bendigo Hills, with the Rocky Point site visible below.

Plate 6. Trunks of relict kōwhai at Pigeon Creek.

3. Gradual expansion and diversification of indigenous woody species within kānuka shrubland

Several woody species besides kānuka are present in low abundances at Rocky Point, notably kōwhai, *Coprosma propinqua*, korokio, porcupine shrub (*Melicytus alpinus*), mountain tauhinu (*Ozothamnus leptophylla*), *Olearia odorata* and *O. lineata* (Plates 7 and 8). These species would be expected to increase in abundance at the site amongst the kānuka shrubland, as more diverse establishment microsites and microclimates develop. Other indigenous woody species not currently found at the site but known to still be present in the lower western flanks of the Dunstan Range may also eventually self-introduce, such as poataniwha (*Melicope simplex*), *Carmichaelia* spp., *Coprosma virescens*, and *Veronica* spp.

Plate 7. Young *Olearia lineata* in the southern gully at Rocky Point. Only four individuals of this species were observed at Rocky Point

Plate 8. Korokio, mingimingi, porcupine shrub, kōwhai and kānuka in a rocky refuge at Rocky Point.

4. Expansion of exotic woody and herbaceous weeds

Several small wilding pine (*Pinus radiata* and *P. contorta*) seedlings and saplings were observed across the site. The expanding open indigenous shrubland/scrub provides ideal establishment conditions for wilding pines. Franchet's cotoneaster (*Cotoneaster franchetii*), wild plum (*Prunus* sp.), flowering currant (*Ribes sanguineum*) and stinking iris (*Iris foetidissima*) are also present in substantial numbers along the lower northeastern slopes of the site; if not controlled, these species will continue to spread up the hillslope and into the rest of the site.

Sweet briar is widespread at the site, but poses less of a long-term threat as it will be succeeded by woody indigenous vegetation. Observations at the site of indigenous woody species established underneath sweet briar suggest that sweet briar may even facilitate regeneration of indigenous woody species, by creating favourable microsite conditions for seedling establishment.

Various exotic herbs are abundant at the site within cushionfield and herbfield communities, most notably hemlock (*Conium maculatum*), stonecrop (*Sedum acre*) and scarlet pimpernel (*Anagallis arvensis*). These species pose a particular long-term threat to vegetation on saline soils, where woody vegetation is unlikely to establish.

4.4 Vegetation change at Bendigo Scenic Reserve

Successional patterns in the nearby Bendigo Scenic Reserve since the 1950s show very similar trends to Rocky Point, in which indigenous woody vegetation dominated by kānuka has been steadily replacing cushionfield, exotic herbfield and bare ground over the past 60-70 years. Aerial imagery from the 1950s shows a slightly higher abundance of woody plants in gullies than at Rocky Point, and on south facing hillslopes in the upper reaches of Pigeon Creek, but otherwise an overwhelming dominance of bare ground and cushionfield. Consequent expansion of woody vegetation in gullies and adjoining side slopes was more rapid than at Rocky Point, likely reflecting the deeper gullies and localised patches of more favourable soils. However, colonisation rates of kānuka over the remainder of the reserve have been similar to Rocky Point.

Field observations within Bendigo Scenic Reserve and Bendigo Historic Reserve (made during recreational trips by Wildlands staff) confirm very similar vegetation patterns to Rocky Point. Low kānuka shrubland and scrub with very low species diversity and remnant cushionfield amongst shrubs now covers most of the reserves (Plates 9-11), with taller kānuka forest restricted to deep gullies. Cushionfield now remains in only a few places including the lower northern slopes, the upper southern slopes (Plate 10), and the lower western slopes around Pigeon Creek (Plate 11), where it continues to be colonised by kānuka and exotic grasses. Shrublands on the northern flanks of the reserves contain scattered mingimingi and korokio, with only a few individuals of *Coprosma dumosa*, mountain tauhinu, *Olearia lineata*, *O. odorata* (mainly in the historic reserve), koromiko (*Veronica salicifolia*)and desert broom (*Carmichaelia petriei*). As at Rocky Point, a few relict kōwhai are present with regeneration nearby. Damp soils in gullies in upper Pigeon Creek are notable for locally common *Olearia lineata*. Also of note are observations of single individuals of *Veronica pimeleoides* subsp. *faucicola* (At Risk-Naturally Uncommon) and *V. pimeleoides* subsp. *pimeleoides* on hillslopes at the southwestern margin of the reserve above Pigeon Creek.

Plate 9. Looking northeast into Chinamans Creek and towards School Creek, within Bendigo Scenic Reserve.

Plate 10. The upper slopes of Chinamans Creek contain cushionfield being colonised by kānuka. Three kōwhai trees are also visible as lighter green patches, in the lower centre of the image.

Plate 11. The lower western slopes of Bendigo Scenic Reserve contain a mix of cushionfields and colonising kānuka shrubland.

4.5 Summary – vegetation succession

Rocky Point is currently in the early transitional successional stages of indigenous vegetation recovery following years of severe human-induced degradation of soils and vegetation. The first stage has involved colonisation of denuded soils by the most resilient early successional species of Central Otago – cushion plants and small herbs. Reductions in grazing pressure and fires over the past c.50 years have since enabled kānuka, a hardy, unpalatable, and prolific early colonising woody species, to progressively establish within cushionfield and bare ground at the site. Over the next 50 years (in the absence of further human disturbance) kānuka-dominated shrubland will further increase in extent at the site, and will be progressively succeeded by a low forest with a canopy of kōwhai, kānuka and *Olearia lineata*, and a diverse shrub understorey. The diversity of forest that develops in future succession will depend to a large extent on seed sources for woody indigenous species, and the virtual absence of species other than kānuka, korokio and mingimingi is likely to be a key factor. The suite of

cushionfield species at the site will continue to reduce in abundance as succession progresses. Exotic woody weeds will pose a growing threat to the ecological integrity of the developing indigenous woody vegetation communities.

Long term ecological management at Rocky Point will hasten the successional transition at the site from cushionfield to woody vegetation, as the slightly more advanced succession at Bendigo Scenic Reserve demonstrates. The persistence of cushionfield at the site (other than those in saline ecosystems) would require a continuation of the management regime that induced these communities, including a continuation of stock grazing and high rabbit numbers.

The successional trends at Rocky Point provide a good example of how communities of plants 'come and go', or at least drastically change in relative abundance, during stages of vegetation recovery from severe human-induced disturbance. These changes are particularly dramatic at Rocky Point and within the adjoining lower western and northern flanks of the Dunstan Range, because they are occurring at a landscape level. At present the decline of the formally-dominant *Raoulia australis* cushionfield community is particularly apparent, along with the associated increased extent of kānuka shrubland. Over the next 50-100 years of succession kānuka is likely to begin to decrease in abundance as it is succeeded by trees such as kōwhai and *Olearia lineata* and diverse small-leaved shrubs.

The presence and abundance of specific Threatened and At Risk plant species also varies greatly as succession proceeds. For example, species such as *Colobanthus brevisepalus* (At Risk-Declining) and At Risk-Declining species of *Raoulia* have almost certainly greatly declined in abundance at the site over the past 50 years, while other species such as dwarf mistletoe (*Korthalsella salicornioides*; Threatened-Nationally Critical), spring annuals (Threatened and At Risk) and kānuka (At Risk-Declining) have greatly increased in abundance over this time. In the future woody species such as *Olearia lineata* (At Risk-Declining), *Coprosma virescens* (At Risk-Declining) and fierce lancewood (*Pseudopanax ferox*; At Risk-Declining) may well increase in abundance or recolonise the site, as soils and establishment microsites become increasingly favourable for these species.

5.0 Part 2 – Climax Vegetation Communities at Rocky Point

The following section examines the likely pre-settlement vegetation patterns at Rocky Point, and uses this information to develop an overview of likely climax vegetation communities at the site.

5.1 Pre-settlement vegetation in Central Otago

5.1.1 Palaeoecological research

Because virtually no pre-settlement vegetation remains in Central Otago at lower elevations, palaeoecological research and modelling have provided the only means to reconstruct likely pre-settlement vegetation patterns. These studies have typically focussed on subfossil logs, palynology, and macrofossils in localised accumulation sites such as wetlands and rock overhangs. A brief summary of studies relevant to the Dunstan Range/Rocky Point area is presented here.

The first comprehensive study of subfossil wood and charcoal from the region was undertaken by Molloy et al. (1963), who concluded that forest would have covered almost all areas of Central Otago below treeline, other than sites that were too dry or prone to frequent natural disturbance. Consequent studies noted widespread subfossil logs and charcoal of Hall's tōtara in the drier Central Otago ranges including the Dunstan, Pisa and Carrick Ranges, along with some mountain toatoa (*Phyllocladus alpinus*), bog pine (*Halocarpus bidwillii*), and kānuka (Wardle 2001). Evidence of conifers was only found at altitudes from 590-1,040 metres.

Palynological studies have indicated that various associations of shrubland and forest dominated on lower hillsides and valley floors. Clark et al. (1996) concluded that late Holocene vegetation was mainly a small-leaved shrubland or woodland containing *Coprosma* spp., *Muehlenbeckia* spp., *Sophora* spp., *Plagianthus* sp. and probably kānuka, possibly with patches of taller podocarp forest. McGlone and Moar (1998) reached similar conclusions, but suggested podocarp pollen was likely sourced from higher-altitude forests. Walker et al. (2003) mapped 12 woody ecosystem types across Central Otago, and concluded that the widespread present-day associations of tūkatakuru/matagouri (*Discaria toumatou*)-mingimingi are derived from invasion of more disturbance-tolerant shrubs following destruction of the forests that used to grow in these locations. Their modelling mapped kānuka-kōwhai woodland on the lower western flanks of the Dunstan Range, and noted that other more fire-sensitive canopy species may have been under-represented in their model. Other modelling has suggested various scenarios for forests on the lower hillslopes in drier areas (such as the western Dunstan Mountains) including vegetation in which broadleaved trees and shrubs were important (e.g. kānuka, kōwhai, mānatu/lowland ribbonwood [*Plagianthus regius*], coprosma) (Walker et al 2003, 2004b; Rogers et al. 2005; Leathwick et al. 2012), and vegetation in which conifers may have been an important component (Hall and McGlone, 2006; McGlone et al., 2017).

Other studies have examined plant macrofossils (leaf, wood and seed material) dating from the mid to late Holocene preserved in rock shelters in gorges and lower hillslopes of Central Otago, including many samples from the western Dunstan Mountains. Wood and Walker (2008) concluded that broadleaved species forest with scattered Hall's tōtara occupied rocky gorges in Central Otago in the mid to late Holocene, and that lowland ribbonwood was likely to have been widely distributed on valley floors. This study included sites in the Cromwell Gorge and the western Dunstan Mountains close to Rocky Point. Kānuka and matagouri were not recorded in the sites sampled by Wood and Walker (2008), suggesting the current abundance of these species in Central Otago is due to increased fire frequency and early vegetation succession after forest clearance following the arrival of humans. This does not support the modelling of Walker et al. (2003), which suggested kānuka-dominant woodland occurred in these gorges.

A recent study by Pole (2022) investigated macrofossils from 115 rock shelters, including many in the Cromwell Gorge and lower western Dunstan Mountains near Rocky Point. Pole (2022) concluded that kōwhai was the dominant tree on the lower hillslopes and gullies, likely forming a forest with a continuous but low (perhaps 14 metre) and open canopy over the study area. Other prominent tree species were kōhūhū (*Pittosporum tenuifolium*), fierce lancewood (*Pittosporum ferox*) and lowland ribbonwood, but these species were subordinate to kōwhai. Other common plants included *Carmichaelia* spp., *Rubus* spp., and *Veronica lycopodioides,* which Pole (2022) noted to be more suggestive of lower, open vegetation but which may also have been present beneath the kōwhai canopy. Evidence of kānuka was rare, and there was no indication of a conifer component to the vegetation or of forest species typical of moister habitats such as kāpuka or beech.

5.1.2 Potential terrestrial ecosystem mapping for Rocky Point

Mapping of 'potential terrestrial ecosystems' (i.e. those ecosystems that would have occurred in Otago if humans had never colonised Aotearoa) was undertaken across Otago by Wildland Consultants (2020), based on the Singers and Rogers (2014) classification of indigenous ecosystem types. Mapping was undertaken using a range of existing layers and database information, as well as palaeoecological data and local knowledge of remnant vegetation. These provide a valuable broad-scale overview of likely vegetation. While potential ecosystem mapping necessarily results in lines determining boundaries between different ecosystem types, actual ecological boundaries are often diffuse or have significant inter-fingering.

This mapping identified three Singers and Rogers ecosystem classes at the Rocky Point site (Figure 4). Most of Rocky Point is mapped as TI2 kānuka, Olearia scrub/treeland, with the mapped area extending into the surrounding north-facing hill country up to about 800 metres elevation, south to John Bull Creek and east to Bendigo Creek. TI2 is described by Singer and Rogers (2014) as, "scrub and treeland of kānuka, and species of *Olearia*, *Carmichaelia* and *Melicytus*, with korokia, matagouri, mountain tauhinu, prostrate kōwhai and lianes (e.g. *Muehlenbeckia*), and locally *Leonohebe cupressiodes*. Early successional derivatives include short tussock grasslands of species of Poa, Festuca, Deyeuxia and Rytidosperma, with inter-tussock prostrate herbfield species." Within Otago, TI2 was also mapped on north-facing rocky slopes near Luggate, where kānuka woodland is extensive today, and near the junction of the Kawarau River and Clutha River where a smaller existing stand of kānuka remains. It was also mapped in the upper Clutha River catchment on recent alluvial soils and on the drier parts of outwash terraces. Singers and Rogers (2004) notes that drought may play an equally important role to frost in the derivation of these communities because they occur predominantly in the South Island's dry interior.

The small area of alluvial soils at the north of the Rocky Point site was mapped as CLF13 Mataī, broadleaf forest. Besides mataī (*Prumnopitys taxifolia*) and kāpuka/broadleaf (*Griselinia littoralis*), it is likely that the CLF13 ecosystem type would also have included trees such as kōwhai, lowland ribbonwood, narrow-leaved lacebark (*Hoheria angustifolia*), and fierce lancewood. However, no indigenous forest remains in the areas where CLF13 was mapped, so there is considerable uncertainty relating to the occurrence and extent of this ecosystem type.

A small area of CL8 Helichrysum, Melicytus shrubland/tussockland/rockland was mapped at the northeast of the site, in an area where postglacial terrace scarp merges with bedrock. CL8 comprises colluvial slopes with mosaics of scrub, shrub, fern and grass species.

Although not mapped at Rocky Point, Wildland Consultants (2020) also note the presence of localised saline and alkaline soils between about 200-600 metres elevation in the main basins of Otago, in which herbaceous communities form the natural vegetation.

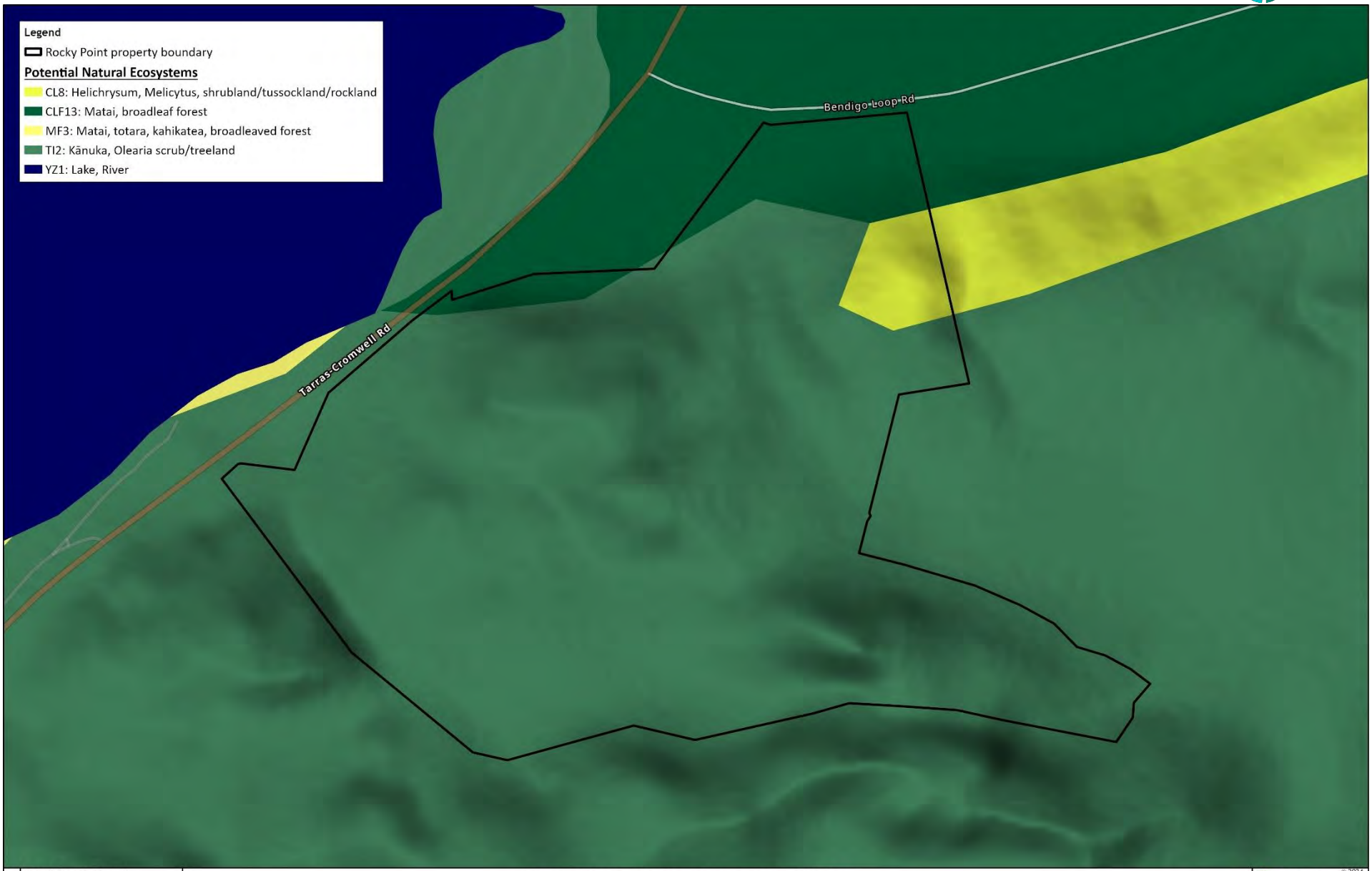

Figure 4. Potential Natural Ecosystems at Rocky Point

5.1.3 Summary

The available evidence indicates that Rocky Point would have supported forest vegetation communities across almost the entire site, with the exception of cushionfield/herbfield communities on localised areas of saline soils (Gibson 2024) and possible persistence of shrubland on postglacial terrace escarpments. The small area of alluvial deposits at the northeast of the site may have supported a podocarp-broadleaved species forest.

The remainder of the site (mapped as TI2 in Figure 4) would have likely been covered in a forest with a canopy that included kōwhai, fierce lancewood, lowland ribbonwood, *Olearia lineata* and kānuka, and an understorey of diverse shrubs including *Coprosma* spp., *Olearia* spp., *Carmichaelia* spp. and *Veronica* spp. There is significant variance in the literature regarding the relative dominance of kānuka and kōwhai, with potential ecosystem mapping suggesting a dominance of kānuka and *Olearia lineata*, and macrofossil evidence suggesting a dominance of kōwhai and broadleaved species such as lowland ribbonwood with little canopy kānuka. Recent research suggests that a high abundance and local dominance of kōwhai in the forest canopy at the site was likely. This suggested dominance of kōwhai (with a much reduced presence of kānuka) is considered most consistent with present-day observations of woody vegetation in the district, in which the only large remnant trees remaining are relict kōwhai, and in which evidence of kōwhai regeneration is present around all remaining relict trees throughout the lower western Dunstan Range. This is discussed below.

5.2 Present-day field observations and RECCE plots in regenerating remnants of indigenous woody vegetation

5.2.1 General field observations

Small relicts of indigenous vegetation preserved in the lower western flanks of the Dunstan Range provided the opportunity to investigate modern-day regenerating forest communities. These relicts are often within refuges (rocky outcrops and gorges), and typically contain one or two old kōwhai trees surrounded by regeneration of kōwhai and other woody species. They provide one of the few examples of what may naturally develop at Rocky Point in the absence of human intervention.

Relict kōwhai at Rocky Point and Bendigo Hills were described in Section 4.3.2. Other relict kōwhai observed in the lower northern and western flanks of the Dunstan Range are summarised below, with further details and representative photos contained in Appendix 2a:

- A single very large tree on a hillslope in the southwest of Bendigo Scenic Reserve at about 600 metres elevation, with three younger individuals nearby. Adjoining vegetation comprises cushionfield with kānuka.
- A single very large tree on a rocky slope on the western flanks of Bendigo Scenic Reserve in upper Pigeon Creek at about 550 metres elevation, with at least 20 younger kōwhai nearby.
- A few scattered trees on dry hillsides above Pigeon Creek on the lower western flanks of Bendigo Scenic Reserve, with recent regeneration surrounding them.
- A single large tree in the lower Pigeon Creek gorge in Bendigo Scenic Reserve, with at least 15 younger trees and saplings nearby.
- Two small patches of regenerating kōwhai in lower Devils Creek just above the highway, one patch on rocky cliffs above the creek and the other on a dry north-facing rocky slope.
- A patch of regenerating kōwhai in lower Firewood Creek just above the highway, consisting of more than 50 young trees extending from the creek up adjoining south-facing hillslopes.

5.2.2 RECCE plot surveys

Five of the small patches of vegetation developing near relict kōwhai were surveyed using RECCE plots (see Figure 1 for locations). The structure and composition of vegetation were recorded using rectangular RECCE plots of variable size, positioned subjectively so as to best capture the areas of relict/regenerating vegetation. Numbers of seedlings (<30 centimetres tall) and saplings (30-200 centimetres tall) were recorded by species. The diameter at breast height (DBH) of all trees (>2 metres tall) was recorded. Canopy cover (%), mean canopy height and top height were also recorded for each plot. Further details of the sampled sites are presented in Appendix 2b, including a summary of key measured attributes.

All plots contained regenerating kōwhai that included small seedlings, saplings and small trees. Even with the currently established kōwhai individuals, the vegetation will develop into a relatively closed-canopy forest with a kōwhai canopy in the absence of disturbance. The plots and their immediate surrounds also contained a higher diversity of woody indigenous plants than present in young kānuka regeneration at Rocky Point, likely reflecting the fact that the locations are relicts in refuges.

The most developed vegetation was at Firewood Creek. This site contains a stand of young kōwhai forest on a rocky hillslope near the base of a gorge. A closed forest canopy is present, and trees have already reached a height of 10 metres. This site provides a good example of the young forest that can develop in the current environment of the lower western flanks of the Dunstan Range. This young developing forest is consistent with Pole's (2022) suggestion of kōwhai forest with "a continuous but low (perhaps 14 metre) canopy" in the area.

5.2.3 Woody species presence and abundance

A combined total of 24 woody indigenous species were observed during field work at Rocky Point (13 species noted) and the lower western flanks of the Dunstan Range (24 species noted). An additional 10 species are likely to have been prominent in the vegetation of the lower western Dunstan Range based on palaeoecological studies (Table 1).

The likely pre-settlement and present-day abundances of these 33 key woody species in the lower western flanks of the Dunstan Range are summarised in Table 1. Rocky Point shows low species diversity relative to the present-day lower western Dunstan Range, and a very low diversity compared to the palaeoecological record.

Table 1 – Observed abundances and inferred pre-settlement abundances of 31 key woody species in the study area. Blank cells represent absence of that species.

Species	Abundance in landscape[1]		
	Rocky Point - present-day	Lower western Dunstan Range - present-day	Lower western Dunstan Range - pre-settlement
Trees:			
Hoheria angustifolia			Locally common
Kunzea serotina	Abundant	Abundant	Occasional/locally common
Myrsine australis			Occasional
Myrsine divaricata		Very rare	Locally common
Olearia avicenniifolia		Very rare	Occasional/locally common

[1] Abundance classes: Very rare – <10 plants found; Rare – 10-50 plants found, not common anywhere; Occasional – scattered occurrence; Locally common – common in particular habitats, but not elsewhere; Frequent – occurring widely but not dominant; Abundant – dominants vegetation across most of area.

Species	Abundance in landscape[1]		
	Rocky Point - present-day	Lower western Dunstan Range - present-day	Lower western Dunstan Range - pre-settlement
Olearia bullata		Occasional	Occasional/locally common
Olearia lineata	Very rare	Occasional	Locally common/frequent
Olearia odorata	Very rare	Occasional	Locally common/frequent
Phyllocladus alpinus			Rare
Pittosporum tenuifolium			Locally common
Plagianthus regius			Locally common/frequent
Podocarpus laetus			Rare
Pseudopanax crassifolius			Occasional
Pseudopanax ferox			Locally common/frequent
Sophora microphylla	Rare	Occasional	Abundant
Shrubs:			
Carmichaelia compacta		Locally common	Locally common
Carmichaelia petriei		Rare	Locally common
Coprosma crassifolia		Rare	Locally common
Coprosma dumosa	Very rare	Rare	Locally common
Coprosma propinqua	Occasional	Occasional	Locally common
Coprosma virescens		Rare	Locally common
Corokia cotoneaster	Occasional	Locally common	Locally common
Discaria toumatou	Very rare	Occasional	Occasional
Melicope simplex		Very rare	Occasional
Melicytus alpinus	Rare	Occasional	Locally common
Ozothamnus leptophyllus	Very rare	Rare	Occasional
Ozothamnus vauvilliersii	Very rare	Rare	Occasional
Veronica lycopodioides			Locally common
Veronica pimeleoides subsp. *pieleoides*		Very rare	Locally common
Veronica pimeleoides subsp. *faucicola*		Very rare	Unknown
Veronica salicifolia		Very rare	Locally common
Vines:			
Muehlenbeckia australis		Occasional	Frequent
Muehlenbeckia complexa	Rare	Occasional	Frequent
Rubus spp.	Occasional	Occasional	Frequent

5.3 Climax community descriptions, and benchmark parameters

5.3.1 Vegetation types

In light of the combined information discussed above, it is considered that the pre-settlement vegetation at Rocky Point most likely comprised a kōwhai-dominant forest across most of the site, characterised by a relatively continuous canopy approximately 8-14 metres tall. Lower canopy heights of around eight metres were likely on bony soils on exposed north and west facing slopes, with taller canopy heights up to 14 metres likely in gullies and more sheltered hillslopes. Other canopy trees present amongst the backbone of kōwhai would have included fierce lancewood, kōhūhū, *Olearia lineata*, lowland ribbonwood and narrow-leaved lacebark, with less frequent kānuka, weeping māpou (*Myrsine divaricata*), māpou (*Myrsine australis*) and *Coprosma virescens*, and possibly occasional Hall's tōtara and mountain toatoa in deeper soils at the southern gully. A diverse assortment of shrubs would have been present throughout the forest understorey, including the species listed in Table 1, contributing to the canopy in open areas. The most abundant shrub species are likely to have included *Coprosma* spp., *Olearia* spp., korokio, weeping māpou, *Veronica* spp., and *Carmichaelia* spp.

The postglacial terrace escarpment remnants at the northeast of the site may have been an exception to this forest pattern, and may have retained a shrub canopy on the very exposed and dry spurs and faces. However, the current vigorous regeneration of kānuka within the small gullies suggests that even these areas are likely to have had forest cover.

The small localised patches of saline soils identified at the site are most unlikely to have contained woody-dominant vegetation, due to the extreme soil conditions. These areas would most probably have comprised herbaceous cushionfield communities dominated by *Raoulia australis* in pre-settlement times, but possibly also with indigenous halophytic plants.

Idealised vegetation type descriptions for each community, using vegetation classes outlined by Atkinson (1985), are outlined below. The likely extent of each vegetation type are mapped in Figure 5.

1. (Mataī)/kāpuka-lowland ribbonwood-māpou-fierce lancewood forest

This vegetation type would have occurred on the small area of alluvial gravels at the base of the hillslopes at the north of the site. It is equivalent to the CLF13 ecosystem class. While there is no remaining CLF13 vegetation in Otago, it would likely have comprised occasional emergent mataī above a broadleaved canopy including kāpuka, lowland ribbonwood, kōwhai, narrow-leaved lacebark, māpou (*Myrsine australis*) and fierce lancewood. Species from this community would have been present on pockets of deeper moister soils on the hillslopes.

2. Kōwhai-fierce lancewood-lowland ribbonwood/Olearia lineata-kānuka forest and scrub

This vegetation type would have occurred on rocky slopes, rocky ridges and areas of shallow stoney soil, which occupy the vast majority of Rocky Point. The canopy is likely to have been dominated by kōwhai 8-10 metres tall, with common but less frequent lowland ribbonwood, narrow-leaved lacebark and fierce lancewood, and occasional kānuka, māpou, kōhūhū and *Olearia lineata*. A dense and diverse shrub layer is likely to have comprised *Coprosma* spp., porcupine shrub, *Olearia odorata, O. bullata*, *O. aviceniifolia*, korokio, weeping māpou, poataniwha and mountain tauhinu. Other species would have included *Veronica* spp. and *Carmichaelia* spp. Lianes of *Rubus* spp. and *Muehlenbeckia* spp. were likely abundant throughout. While some of the most infertile areas may have been dominated by shrubs and lacked a forest canopy, it is more probable that at least a low open tree canopy was present even in these areas; this is based on observations of kānuka colonisation over virtually all of the landscape, and observations of recent kōwhai regeneration in some of the driest and most rocky parts of the landscape.

3. Kōwhai-Olearia lineata-kōhūhū-lowland ribbonwood forest

Small areas of the site mainly within basins, gullies and small alluvial deposits contain deeper soils (Plate 12). These areas retain more moisture and have higher soil fertility than the surrounding rocky country typical of the site. A variant of Type 1 forest is likely to have occurred in these areas. The canopy is likely to have been taller, denser, and more diverse, and while likely dominated by kōwhai would have included a higher proportion of *Olearia lineata*, fierce lancewood and kōhūhū, as well as narrow-leaved lacebark and lowland ribbonwood. The forest may also possibly have had occasional Halls' tōtara, kāpuka, and mountain toatoa.

Plate 12. The southern gully at Rocky Point, showing an area of dense hemlock (*Conium maculatum*) on deeper soils.

4. Kānuka/porcupine shrub-korokio-Olearia-Coprosma-Carmicahelia scrub

Small areas of postglacial terrace escarpment at the north of the site between incised gullies and rock outcrops would have contained vegetation similar to the CL8 Singers and Rogers ecosystem class. This scrub would have been dominated by small-leaved *Olearia*, *Coprosma*, *Carmichaelia*, *Veronica*, kānuka, korokio, porcupine shrub, *O. avicenniifolia*, and kōwhai. Kānuka and *Olearia odorata* are presently replacing cushionfleld within the shallow gullies incised into the escarpment, and are indicative of the woody vegetation likely to develop on adjoining escarpments over time.

5. Raoulia australis *cushionfield*

Cushionfield would have been confined to areas of saline soils, where soil conditions restrict colonisation by woody vegetation. While it is possible that small areas of very exposed crests or hillslope with compacted soils may have retained small patches of cushionfield, this is considered unlikely as conditions would have been ameliorated by adjoining forest vegetation and higher organic carbon contents within soils. The current expansion of kānuka into cushionfields even at some of the most unfavourable microsites supports this.

5.3.2 Attributes and values

Objective measures of selected attributes from plot work, and suggested climax community values for some of these attributes based on plot data combined with the information from palaeoecological studies, are presented in Appendix 3 for vegetation types affected by the proposed development.

Appropriate objectives for offset plantings based on the above analysis could include:

1. To recreate plant compositions and structures that were most probably present in pre-settlement climax vegetation at the site, and that are appropriate for present-day conditions.

2. To increase plant diversity at Rocky Point and surrounding area by re-introducing a variety of species that would have formerly been key components of the vegetation, but that are now locally extinct and/or very rare. It is anticipated that these plants will provide a seed source for further spread into the Rocky Point site, and into the nearby Bendigo Scenic Reserve.

It is suggested that the backbone of the plantings comprises kōwhai and kānuka. Kānuka is important, even though likely less reflective of climax vegetation, as it is a proven successful early coloniser at the site. Other canopy species that should be included as an important component of the plantings are *Olearia lineata*, fierce lancewood, kōhūhū, lowland ribbonwood, narrow-leaved lacebark, kāpuka, tī kōuka/cabbage tree (*Cordyline australis*), and māpou. A diversity of shrubs listed in Table 1 should also be included, including *Olearia* spp., *Coprosma* spp., weeping māpou, *Carmichaelia* spp, and *Veronica* spp.

Figure 5. Climax vegetation communities at Rocky Point.

5.3.3 Impacts of changed fire regimes and climate change on future vegetation development

Pole (2022) has noted, "As a vegetation type, we have no idea how all the species of the sophora [kōwhai] forest were placed in a structural sense, or how they interacted over long periods of no fire." It is equally unknown how regenerating woody vegetation will respond to the present-day fire regime, let alone possible climate change over the long term. The uncertainties are too great to make meaningful assessments.

In light of this, a pragmatic approach is to focus efforts on ensuring a wide variety of appropriate indigenous species from the ecological district is present in plantings, and that these species are able to develop naturally at a landscape scale wherever possible. It would also be prudent to include a considerable component of species in plantings that are thriving in the present-day environment and are resilient to fire and grazing. This will foster the greatest resilience in vegetation communities, and provide a favourable environment for future adaption to changing fire and climatic regimes.

With this in mind, it is also suggested that kāpuka and tī kōuka are added to the mix of appropriate climax community species for plantings. Kāpuka is fire resistant and has wide environmental tolerance. While recent palaeoecological evidence implies kāpuka may not have been an important component of pre-settlement forest in the area (Pole 2022), kāpuka is today present on steep rocky ground in Central Otago (e.g. Mt Iron), and would be a valuable ecological addition to plantings. Tī kōuka is a prominent component of the present-day planted flora in the district, and is resistant to fire and grazing once mature.

6.0 Conclusion

Human settlement of Central Otago transformed a predominantly forested lansdcape into a predominantly non-woody landscape within a few centuries, through a combination of fires, grazing and rabbits. The very dry lower areas of the western Dunstan ED were especially impacted, to the extent that even exotic grasslands were replaced by large areas of bare ground and herbfields, including cushiofields. Over the past half century, natural vegetation recovery in these areas has resulted in colonisation by predominantly kānuka and a few exotic trees and shrubs. This trend towards woody vegetation will continue in the absence of human disturbance.

Palaeoecological studies suggest that pre-settlement vegetation of the Rocky Point area would have comprised forests of broadleaved species, the canopy dominated by kōwhai with several other important accompanying species. Observations of very large, old relict kōwhai trees scattered through the landscape support this, and kōwhai regeneration over the past century near relict trees demonstrates that kōwhai will continue to increase in abundance as succession advances. Many of the other canopy species likely to have been present with kōwhai are no longer present in the area, and their re-introduction through planting would be required if they are to be a part of future forests.

RECCE plot surveys were undertaken within five small regenerating kōwhai forest patches, to provide measures of attributes of potential climax kōwhai-dominated forest. These will assist in providing benchmark values to aid in the development of a biodiversity offset accounting model for the proposed Rocky Point subdivision.

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References

Beale Consultants (2024). Rocky Point subdivision terrestrial ecology impact vassessment. Unpublised report prepared for TKO Properties Limited. 24pp.

Clark, G.R., Petchey, P., McGlone, M.S., and Bristow, P. (1996). Faunal and floral remains from Earnscleugh Cave, Central Otago, New Zealand. Journal of the Royal Society of New Zealand, 26:363-380.

Coterra (2024). *Rocky Point – report on property and consent history*. Unpublished report prepared for TKO Properties Limited. Coterra, Wānaka. 18pp.

Gibson (2024). Rocky Point Subdivision Bendigo. Saline/sodic soils identification and location. Unpublished report prepared for TKO Properties Limited by Roger Gibson Land and Sea Services. 26pp.

Hall, G.M.J. and McGlone, M. (2006). Potential forest cover of New Zealand as determined by an ecosystem process mode. New Zealand Journal of Botany, 44:211-232.

Hercus J.M. (1966). Farming in Central Otago. Proceedings of the New Zealand Grassland Association, vol. 28. 26 pp.

Leathwick, J., McGlone, M., and Walker, S. (2012). Documentation for 'New Zealand's potential vegetation pattern'. Landcare Research.

McEwen W.M. (1987). Ecological Regions and Districts of New Zealand. Third revised edition in four 1:500,000 maps. Publication No. 5 (in four parts). Part 3. New Zealand Biological Resources Centre, Department of Conservation, Wellington. 137 pp.

McGlone, M.S. (2001). The origin of the indigenous grasslands of southeastern South Island in relation to pre-human woody ecosystems. New Zealand Journal of Ecology, 25:1-15.

McGlone, M.S. and Moar, N.T. (1998). Dryland Holocene vegetation history of Central Otago and Mackenzie Basin, South Island, New Zealand. New Zealand Journal of Botany, 36:91-111.

McGlone, M.S. and Wood, J.R. (2019). Early Holocene plant remains from the Cromwell Gorge, Central Otago, New Zealand. New Zealand Journal of Ecology, 43:3363.

McGlone, M.S., Richardson, S.J., Burge, O.R., Perry, G.L.W., and Wilmshurst, J.M. (2017). Palynology and the ecology of the New Zealand conifers. Frontiers in Earth Science, 5.

Molloy, B.P.J., Burrows, C.J., Cox, J.E., Johnston, J.A., and Wardle, P. (1963). Distribution of subfossil forest remains, eastern South Island, New Zealand. New Zealand Journal of Botany, 1:68-77.

Pole M. (2022). A vanished ecosystem- *Sophora microphylla* (kōwhai) dominated forest recorded in mid-late Holocene rock shelters in Central Otago, New Zealand. Palaeontologia Electronica https:/doi.org/10.26877/1169

Rogers G., Hewitt A., and Wilson J.B. (2000). Ecosystem-based conservation strategy for Central Otago's saline patches. Science for Conservation 166. Department of Conservation, Wellington.

Rogers, G.M., Walker, S., and Lee, W. (2005). The role of disturbance in dryland New Zealand: past and present. Science for Conservation, 258:1-122.

Singers N.J.D. and Rogers G.M. (2014). A classification of New Zealand's terrestrial ecosystems. Science for Conservation 325. Department of Conservation, Wellington.

Walker, S., King, N., Monks, A., Williams, S., Burrows, L., Cieraad, E., Meurk, C., Overton, J.M., Price, R., and Smale, M. (2009). Secondary woody vegetation patterns in New Zealand's South Island dryland zone. New Zealand Journal of Botany, 47:367-393.

Walker, S., Lee, W.G., and Rogers, G.M. (2003). The woody vegetation of Central Otago, New Zealand. Science for Conservation, 226:5-99.

Walker, S., Lee, W.G., and Rogers, G.M. (2004a). The woody vegetation of Central Otago, New Zealand. New Zealand Journal of Botany, 42:589-612.

Walker, S., Lee, W.G., and Rogers, G.M. (2004b). Pre-settlement woody vegetation of Central Otago, New Zealand. New Zealand Journal of Botany, 42:613-646.

Wardle, P. (1991). Vegetation of New Zealand. Cambridge University Press, Cambridge.

Wardle, P. (2001). Holocene forest fires in the upper Clutha district, Otago, New Zealand. New Zealand Journal of Botany, 39:523-542.

Wells, J.A. (1972). Ecology of Podocarpus hallii in Central Otago, New Zealand. New Zealand Journal of Botany, 10:399-426.

Wildland Consultants (2020). Mapping of potential natural ecosystems and current ecosystems in Otago Region. Contract Report 5015a, prepared for Otago Regional Council. 20pp.

Wood, J.R. and Walker, S. (2008). Macrofossil evidence for pre-settlement vegetation of Central Otago's basin floors and gorges. New Zealand Journal of Botany, 45:239-255.

Wood, J.R., Rawlence, N.J., Rogers, G.M., Austin, J.J., Worthy, T.H., and Cooper, A. (2008). Coprolite deposits reveal the diet and ecology of the extinct New Zealand megaherbivore moa (Aves, Dinornithiformes). Quaternary Science Reviews, 27:2593-2602.

Appendix 1

Observations of cushionfield replacement in Dunstan ED

Field observations from Rocky Point and the surrounding landscape indicate that the extensive cushionfield/bare ground communities in the lower western and northern flanks of the Dunstan Range are largely human-induced communities. Two key indicators are discussed below.

A. Ongoing regeneration of kānuka within cushionfield and bare ground across the site.

Kānuka seedlings and saplings are abundant in areas of bare soil and cushionfield in many parts of the site, and demonstrate ongoing colonisation of the site consistent with trends evident in aerial imagery over the past 50 years. This regeneration includes 'infilling' of gaps within existing open shrubland, and expansion of range into areas lacking existing kānuka shrubs. Kānuka is now actively regenerating in one of the largest remaining areas of dense cushionfield at the site, in the vicinity of Lots 1-7. Cushion plants themselves are often favoured establishment microsites for kānuka. Existing kānuka shrubs are also resulting in the decline of cushionfields, as their canopy extent increases shading out cushionfield habitat. The ongoing development of soil organic horizons and leaf litter/woody debris around kānuka is also evident, creating conditions unfavourable for cushion plants to persist or regenerate.

Representative photos are presented below.

Plate A1-1. Kānuka regeneration infilling remaining patches of cushionfield within open kānuka shrubland at Rocky Point. Location: transect line 4 (see Beale Consultants 2024).

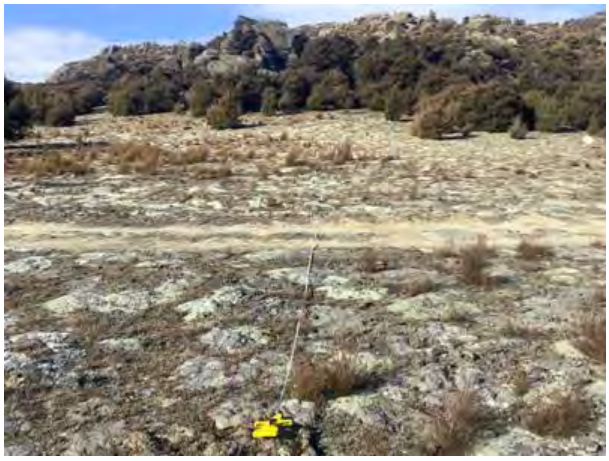

Plate A1-2. Regenerating kānuka within dense cushionfield at Rocky Point. Location: lots 1-7 (see Beale Consultants 2024).

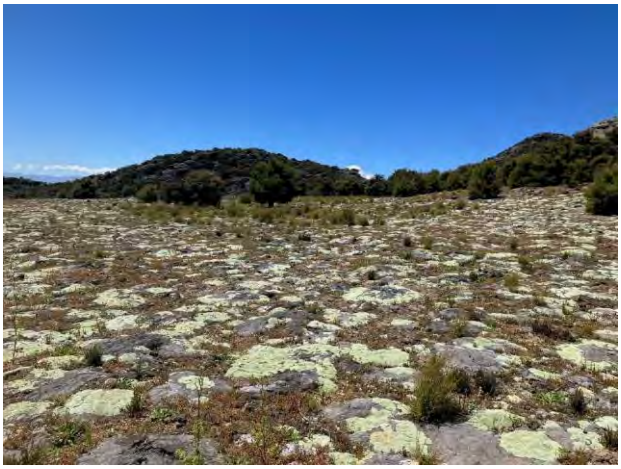

Plate A1-3. Regenerating kānuka within dense cushionfield at Rocky Point. Note the concentration of seedlings downwind of kānuka shrubs. Location: lots 1-7 (see Beale Consultants 2024).

Plate A1-4. Cushion plants can provide favourable microsites for kānuka establishment at Rocky Point.

Plate A1-5. As kānuka shrubland matures cushionfield is dying and being replaced by leaf litter and woody debris at Rocky Point. Location: transect line 5 (see Beale Consultants 2024).

Plate A1-6. Large hillslopes near the southern boundary of Bendigo Scenic Reserve formerly dominated by cushionfield are being progressively colonised by kānuka.

B. Fence lines delineating vegetation responses to differing management regimes

Further evidence that cushionfields have largely been induced by human management in the lower western flanks of the Dunstan Range is provided by vegetation on either side of fence lines that separate differing management regimes. While no such fence lines are present at Rocky Point, they are relatively common and widespread in the surrounding landscape. These generally arise when grazing has been removed and rabbits controlled on formerly-degraded land, often for the purposes of horticulture or viticulture. Three examples are provided below, from locations at 250-400 metres elevation on the lower western flanks of the Dunstan Range with landscape positions and soil conditions similar to Rocky Point . These graphically show that in the absence of stock grazing, rabbits and fire, cushionfield vegetation is colonised by exotic grasses and herbs. These would succeed to shrubland and forest, as at Rocky Point and Bendigo Scenic Reserve, if permitted.

Plate A1-7. A fence line on Devils Creek true left hillside, on public walkway just above the kōwhai plots sampled in this study (see Figure 1).

Plate A1-8. A fence line on the crest of the postglacial terrace just east of Rocky Point. The area to the left of the fence has been developed as a vineyard, and stock and rabbits have been excluded.

Plate A1-9. This fence line just south of Rocky Point separates Bendigo Scenic Reserve (to the right) from private land managed for vineyards. Grazing has ceased on both blocks, but rabbit control has also been undertaken on the private land.

Appendix 2

Details of field observations and RECCE plot surveys in relict/regenerating kōwhai forest remnants

A. Selected field observations

1. A single very large, old kōwhai tree on a hillslope in the southwest of Bendigo Scenic Reserve at about 600 metres elevation, with three younger individuals nearby. Adjoining vegetation comprises cushionfield with colonising kānuka (Plates A2-1 to A2-3).

Plate A2-1 This one large, old kōwhai measured 49 centimetres diameter, and was estimated to be 6-7 metres tall.

Plate A2-2. The large kōwhai is surrounded by cushionfield and regenerating kānuka.

Plate A 2-3. A young kōwhai growing near to the large kōwhai.

2. A single very large, old tree on a rocky slope on the western flanks of Bendigo Scenic Reserve in upper Pigeon Creek at about 550 metres elevation, with at least 20 young kōwhai nearby (Plates A2-4 to A2-6).

Plate A2-4. This very large, old kōwhai had a main stem measuring 51 centimetres in diameter with two other large stems, and was estimated to be 8-9 metres tall. This was the largest tree observed by Wildlands staff.

Plate A2-5. Over 20 kōwhai trees, saplings and seedlings were observed in the area surrounding the large, old kōwhai (upper centre of image), seven of which are visible on the hillside in this image.

Plate A2-6. This young, straight kōwhai has established c.50 metres north of the large, old kōwhai, and now has young regeneration around it.

3. A single large tree in the lower Pigeon Creek gorge in Bendigo Scenic Reserve, with at least 15 younger trees and saplings nearby (Plates A2-7 and A2-8).

Plate A2-7. This large kōwhai was estimated to be 10 metres tall, with an estimated diameter of 35 centimetres. The tree was in full flower when viewed on 29 June 2024. A group of seven tui and several bellbirds were observed feeding on the nectar of this tree and a younger flowering tree nearby, highlighting the importance of such trees for avifauna.

Plate A2-8. Over 15 small trees, saplings and seedlings were observed near to the older tree, four of which are visible in this photo.

B. RECCE plot details, representative photos, and survey data summary

Table A2-1 – Details of RECCE plots surveyed in regenerating kōwhai forest in the lower western Dunstan Range. All plots contained several older kōwhai trees with regeneration present.

Site Location	Details of plot and site		
	Site description	Plot size	Other indigenous species in plot/nearby
Rocky Point	Rocky outcrop on ridge	10x15m	Kānuka, korokio, porcupine shrub, rock fern, *Raoulia australis*
Pigeon Creek	Rocky outcrop on ridge	10x10m	Kānuka, korokio, *Veronica pimelioides* subsp. *pimelioides, Rubus schmedelioides*, rock fern
Devils Creek Upper	Rocky outcrop on north facing hillside	33x5m	Kānuka, *Olearia lineata*, korokio, porcupine shrub, mingimingi, *Coprosma virescens*, weeping māpou
Devils Creek Lower	Stony north facing hillside with rocky outcrops in gully above creek	10x10m	Kānuka, mingimingi, porcupine shrub
Firewood Creek	Rocky outcrops and stony soils on south facing hillside above creek	20x20m	Mingimingi, koromiko, *Carmichaelia compacta*, *Melicope simplex, Coprosma crassifolia*

Representative plot photographs

Plate A2-9. Rocky Point plot, southwestern corner looking northeast.

Plate A2-10. Pigeon Creek plot locality, looking west to Lake Dunstan.

Plate A2-11. Devils Creek Upper plot locality, looking east.

Plate A2-12. View from just above the northeastern corner of the Firewood Creek plot, looking southwest towards Cromwell. The kōwhai canopy visible on the centre and left of the image is within the plot.

Plate A2-13. The central area of the Firewood Creek plot.

Plate A2-14. Regenerating kōwhai on south-facing slopes above Firewood Creek, outside of the sampled plot.

Table A2-2 – Summary data from RECCE plots surveyed in regenerating kōwhai forest in the lower western Dunstan Range. All plots contained several older kōwhai trees with regeneration present.

Site	Measured and predicted Attributes								
	Stems/ha	Kōwhai BA/ha	Kānuka BA/ha	Canopy cover	Top height	Mean height	Woody indigeous species (no.)	Likely mature canopy cover	Likely mature mean height
Rocky Point	467	7.8	0.6	25%	6m	4m	4	75-100	6-8m
Pigeon Creek	1,100	8.6	0.3	20%	6m	4m	5	75-100	6-8m
Devils Creek Lower	1,000	12.9	0	45%	8m	6m	4	75-100	>8m
Devils Creek Upper	667	9.4	0.9	45%	6m	4m	8	75-100	>8m
Firewood Creek	1,050	24.5	0	85%	10m	6m	5	85-100%	>10m

Appendix 3

Selected attributes and suggested attribute values for climax communities at Rocky Point

Table A3-1 – Attributes and values for benchmark climax communities at Rocky Point.

Attribute	Measure	Attribute values for climax vegetation community			
		Kōwhai-fierce lancewood/ *Olearia lineata*-(kānuka) forest	Kōwhai-Olearia lineata-kōhūhū-lowland ribbonwood forest	Kānuka/porcupine shrub-korokio-Olearia-Coprosma-Carmichaelia scrub	Raoulia australis cushionfield
Indigenous spp. cover abundance	% cover	>75	>75	>75	>50
Woody indigenous canopy cover abundance	% cover	>75	>75	>75	<10
Woody indigenous canopy height	Average height (m)	8-12	10-14	2-4	2-3
Indigenous tree basal area	m2/ha	20-30	25-40	<10	<1
Indigenous tree density	Stems/ha	1,000	1,000	<400	<100
Structural diversity present - tree, shrub, ground cover/litter, lianes)	No. of developed layers present (0-4)	4	4	3	1-2
Indigenous species diversity (woody spp?)	No. of species	>15	>15	>10	5-10

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Stormwater Management Plan and Flood Assessment

Rocky Point - Bendigo Loop Road

TKO Properties Ltd

Document Information

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Office of Origin	Auckland

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Appendix 1 **Drawings**

Appendix 2 **Calculations**

1 Introduction

This report summarises the stormwater management and flood assessment conducted by CKL NZ Ltd (CKL) for Rocky Point, Bendigo Loop Road, Central Otago. This assessment aims to provide guidance to support resource consent with respect to a proposed subdivision. This assessment has been undertaken based on information from the following sources:

- New Zealand Building Code Clause, E1 Surface Water.
- Central Otago District Council - Addendum to NZS 4404:2004, July 2008.
- Surveyed data of the site undertaken by Coterra Ltd.
- Revised Scheme Plan -Draft, prepared by Baxter design, 30 May 2024.
- Resource consent application by Brown & Company, June 2023.
- Land Information New Zealand 8 m DEM.
- NZS 4404:2010 Land Development and Subdivision Infrastructure

2 Existing Site Conditions

The project area is situated in the lower reaches of the Dunstan Ranges and is colloquially known as Rocky Point. The proposed development shall span two existing Lots. These are Bendigo Hills, LOT 2 DP 561457 and Rocky Point, Lot 1 DP 561457. To the east of the development is 'Chinamans Terrace', which consists of approximately 65Ha of viticulture area. The site is bordered to the northwest by State Highway 8/Tarras-Cromwell Road and is accessed from the north on Bendigo Loop Road. The project location and extent of the development is shown in Figure 1.

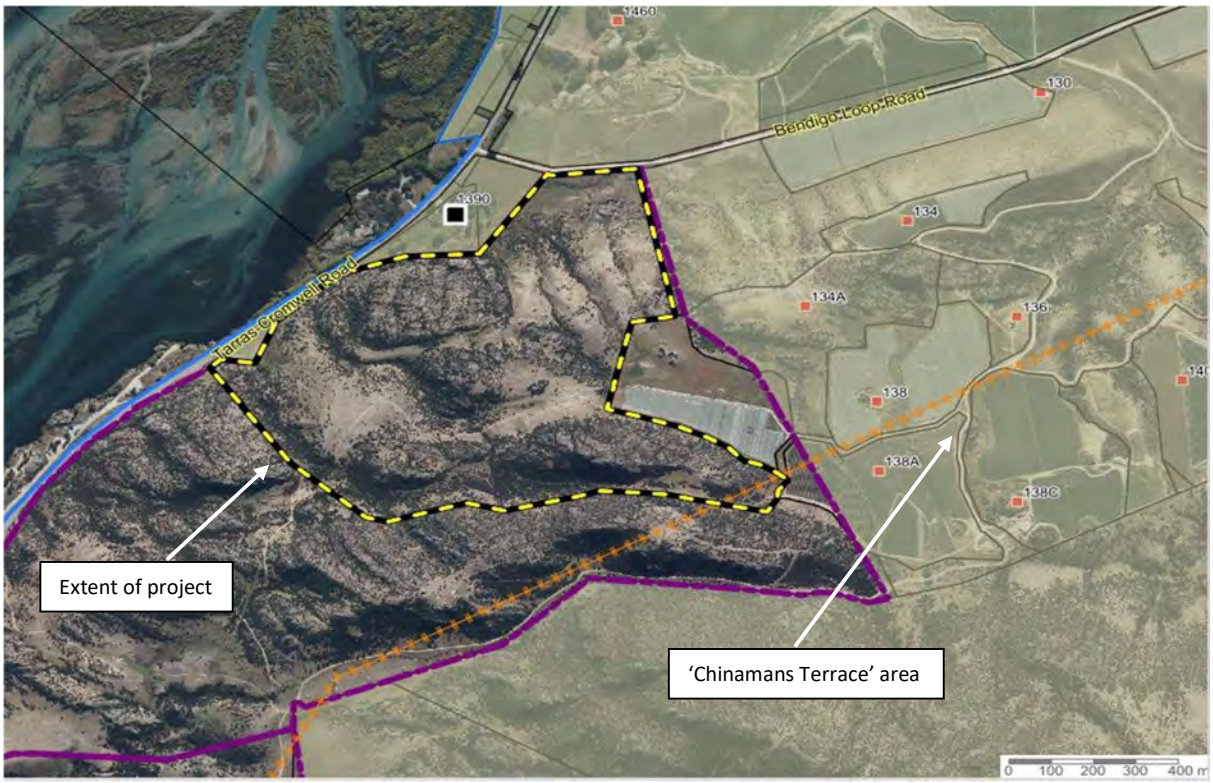
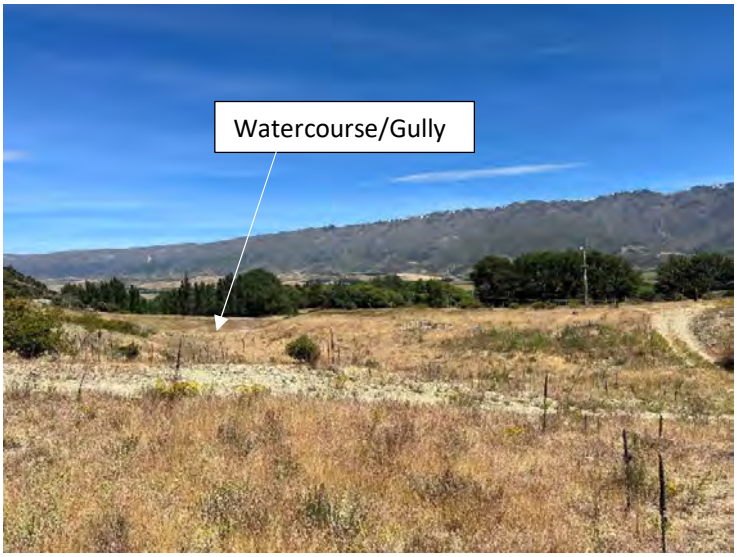


Figure 1: Site Location and project extent.

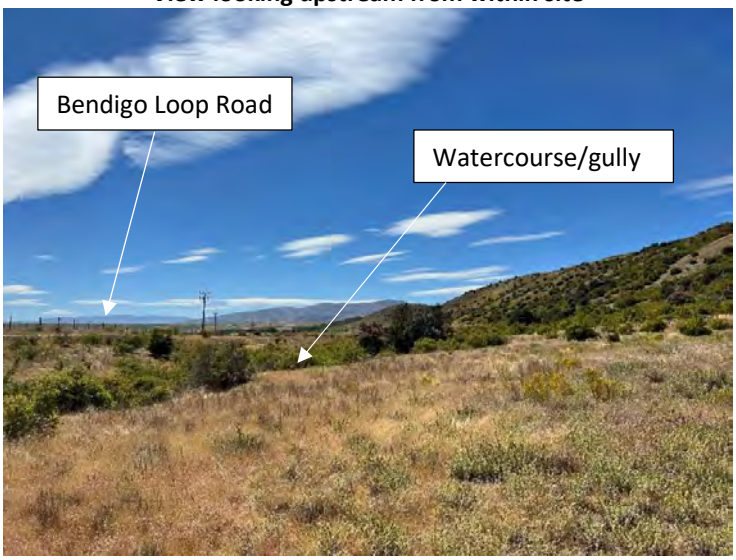
Ground inclinations across the site vary between gently sloping to very steep, and generally are northwest to west facing. The hills are incised by minor ridgelines, gullies and ephemeral overland flow paths that largely direct surface water to the northwest and towards two culverts installed beneath State Highway 8. From here, water is conveyed towards the Clutha River and Lake Dunstan. The site and surrounding area are populated by kanuka scrub and shrubland, cushion field and exotic grassland with very high ecological value (Beale Consultants, reference INN01). A landscape assessment has been carried out for the site by Baxter Design. The assessment is summarised in the resource consent application by Brown & Company.

2.1 Existing gullies

The site has several gullies and intermittent watercourses that support the conveyance of flow during rainfall events that generate surface runoff. The watercourses and gullies will be termed as "gullies" throughout this report. The general conditions of the gullies can be described as bare during dry spells and are illustrated by the following photographs taken on 14th December 2023:



View looking upstream from within site



View towards Bendigo Loop Road from within site

Figure 2: Photos of Watercourse adjacent to Bendigo Loop Road

View looking towards Clutha River and Lot 33 from within site

View towards northern slopes from Bendigo Loop Road

Upper catchment slopes near Lot 23 &24

Figure 3: Photos- Typical open gullies within site- northern and upper slopes of site

3 Proposed Development

The proposed development shall consist of 30 lots with a mix of residential and communal uses as shown in Figure 4.

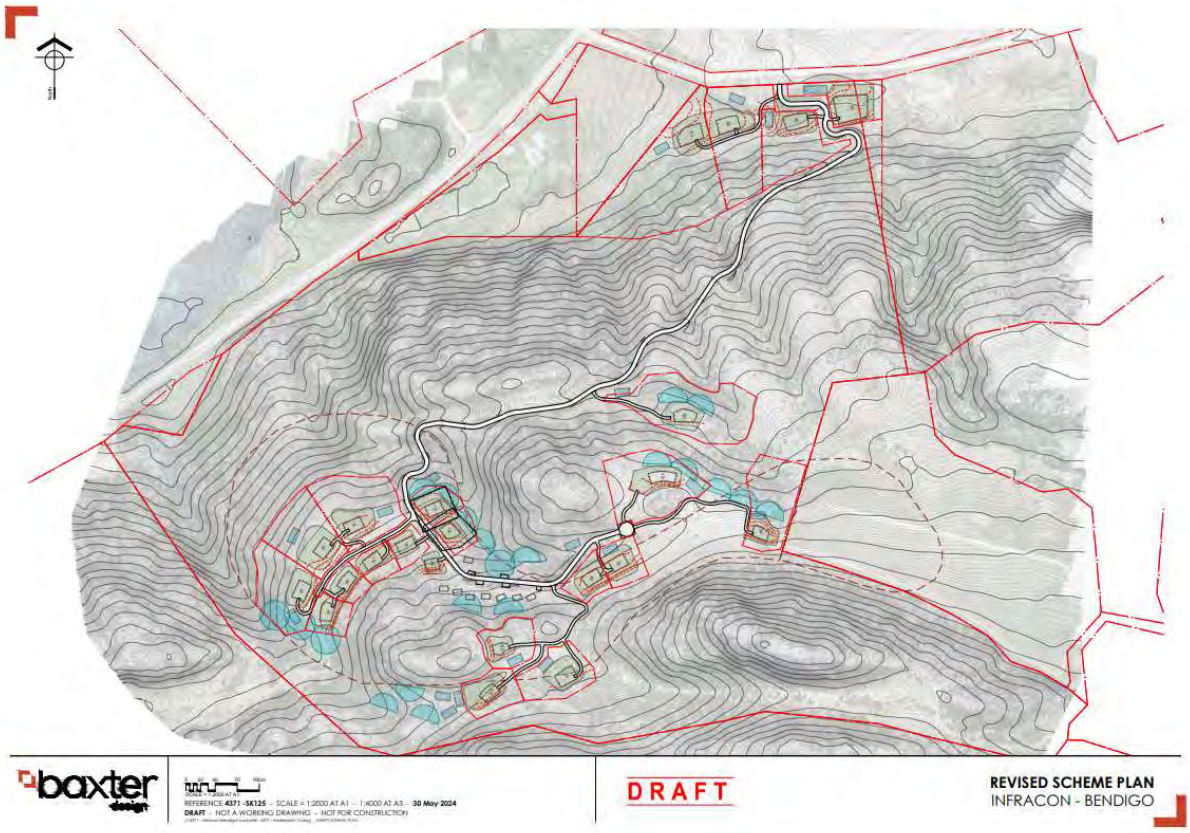


Figure 4: Proposed development[1]

This area will be owned as undivided shares in common by each private lot owner. This surrounding area will remain undeveloped and will provide open space and amenity, as well as limited recreation, for owners. The proposal includes the identification of residential building platforms on proposed Lots 1 – 30. The size of the building platforms range depending on the lot size and location within the landscape. A range of design control will apply to any future building within the platforms as set out in the Landscape assessment.

The proposal includes the construction of new accessway, beginning at Bendigo Loop Road and ending near the top of the development at a cul-de-sac. The proposed accessway will have grades ranging approximately from 8% - 15% and a 5.5m wide carriageway.

[1] Ref: Revised scheme plan, Baxter design, dated 30 May 2024.

4 Overarching Stormwater Regulation

This section details the various overarching acts, plans, manuals and guidelines which influence this stormwater management strategy.

4.1 Resource Management Act

The purpose of the Resource Management Act 1991 (RMA) is to "promote the sustainable management of natural and physical resources".

Sustainable management is defined in the RMA as "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."

Therefore, the stormwater strategy must define the potential positive *and* negative effects of the proposed stormwater discharge. Strategies must be proposed to ensure the negative effects on the environment are avoided, remedied, or mitigated, while the positive effects must be enhanced where possible.

The RMA has a unique definition of environment, which includes:

a. "Ecosystems and their constituent parts, including people and communities; and
b. all natural and physical resources; and
c. amenity values; and
d. the social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) or which are affected by those matters".

Thus, the stormwater strategy aims to consider the effects on these broader elements as well, not just the natural ecosystems.

4.2 National Policy Statement for Freshwater Management

The National Policy Statement for Freshwater Management[2] (NPSFM) "recognises Te Mana o te Wai and sets out objectives and policies that direct local government to manage water in an integrated and sustainable way, while providing for economic growth within set water quantity and quality limits."

The NPSFM provides national bottom lines for freshwater quality such that communities and iwi/hapū have a minimum standard to aim for through assistance of local Councils. The NPSFM also provides objectives to ensure the ongoing enhancement of mauri of all freshwater bodies in New Zealand.

4.3 Central Otago District Plan

The Central Otago District Plan[3] sets out the direction (objectives and policies) and rules for land use activities and subdivision for the district.

[2] Ministry for the Environment, National Policy Statement for Freshwater Management, (Updated August 2017)
[3] https://maps.codc.govt.nz/intramaps90/default.htm?project=Public&module=District%20Plan&touch=false

Under current district plan zoning, the site is within the "Rural Resource 1-5 Zone" and includes Outstanding natural landscape zone.

Development within the Zone has the potential to either benefit or adversely affect the health and well-being of the downstream environments, and the network of interconnected watercourses throughout the catchment.

4.4 Central Otago District Council – Land development guidelines

The Central Otago District Council follows the requirements for land development under the following national documents:

- New Zealand Building Code (NZBC), Section E1 & Section G13
- NZS 4404:2004 Land Development and Sub-division Infrastructure[4]

These are the principal technical references for the design and construction of subdivisions and public infrastructure within the Central Otago District. These documents are also the primary source of guidance for any stormwater related development considerations.

5 Stormwater Management Strategy and Objectives

A stormwater management strategy has been developed based on the expected discharge rates, volumes, and quality in accordance with the guidance documents identified in Section 4. The stormwater management strategy demonstrates the overarching principles of how the site's stormwater is to be managed.

High-level objectives are designed to be consistent with the regulatory requirements, which are:

- Minimising or mitigating any detrimental effects of urban development on the receiving environment.
- Meeting the Central Otago District Council Guidelines and other regulatory requirements
- Initiating best practice low-impact design that integrates with urban design.

These objectives are the cornerstone to preparing the Stormwater Management Strategy for Rocky Point. As a result, the approach to Stormwater management in this area has the objective of minimising or mitigating any detrimental effects of urban development on the receiving environment.

5.1 Expected Stormwater Outcomes

The effects of the proposed stormwater discharge can be grouped into separate categories: quantity, and quality. The conveyance of flow is described in the design philosophy which integrates with these expected outcomes.

5.1.1 Quality

The water quality assessment and design are developed with guidance from the (overarching) documents identified in Section 4.

As the stormwater runoff from the development is discharging into multiple open channels and intermittent stream environments, it is imperative to address the quality of runoff before discharge.

[4] Current CODC's regulation is NZS 4404:2004. Even though NZS 4404:2010 is latest version.

The design philosophy for stormwater quality controls reflects the nature of the development which is (essentially) a large lot rural residential development. This includes low traffic volumes and minimal earthworks. As such this is a low contaminant generating environment and water quality will be addressed to reflect this status.

5.1.2 Quantity

As with any development, due to the increased impervious coverage, it is expected that the runoff peak flows and volumes from the development site will increase. The increased flows and volumes have the potential to lead to accelerated erosion of natural streambanks and could have flooding implications downstream if it is not examined carefully and managed appropriately.

For frequent rainfall events:

Rocky Point discharges to an open gully and intermittent stream environment that is sensitive to accelerated erosion of the bed and banks. Therefore, the stormwater management design will include erosion protection measures.

For larger rainfall events:

An assessment is to be conducted with respect to the level of risk or hazard currently experienced in this environment and if the Rocky Point development will increase (this risk or hazard).

It is essential that the proposed development does not cause any increase in flooding effects on any other properties adjacent or downstream. A HEC RAS[5] flood model has been undertaken for the development (presented in Section 9) that analyses the changes in flooding between existing and MPD[6] conditions.

5.2 Design Philosophy -Conveyance

The overarching design philosophy for the conveyance of surface flow is described as primary and secondary flow conveyance as presented below:

5.2.1 Primary Flow

Primary flow management will be developed to capture and convey runoff prior to discharge which will mitigate the effects of the change in surface conditions due to the development. The overarching design characteristics for primary flow design is:

- 10-year annual recurrence interval (ARI) rainfall event including effects of climate change ($10yr_{CC}$)
- Tc (Time of Concentration): Assumed 10 minutes.
- Building and impervious coverage, as presented in:
    - Baxter Design Ltd.'s Landscape plan.

5.2.2 Secondary flows

Secondary flow managemental includes the expected outcomes for larger rainfall events up to and including 100-yr event, whilst considering the existing OLFP and primary conveyance systems. With secondary flow management the upstream and downstream conditions are to be included in the design process.

The overarching design characteristics for secondary flow design is:

- 100-year annual recurrence interval (ARI) rainfall event including effects of climate change ($100yr_{CC}$)

[5] Hydrologic Engineering Center (US). The River Analysis System (HEC-RAS). US Army Corps of Engineers
[6] Maximum probable development

- Catchment and overland flow path delineation.
- Tc (Time of Concentration): Calculated from topography data and catchment assessment.
- Hydrograph distribution method
    - Peak flow Rational Method
    - Rainfall distribution = TP108 rainfall pattern[7].
- Building and impervious coverage, as presented in:
    - Baxter Design Ltd.'s Landscape plan.

[7] Auckland Council, April 1999, Guidelines for stormwater runoff modelling in the Auckland Region (TP108)

6 Hydrology assessment

A hydrological assessment has been undertaken to identify the magnitude and direction of flow through the site during the pre (existing) and post development (proposed) conditions.

Five sub-catchments were delineated which reflect the stormwater runoff patterns associated with the Overland flow paths (OLFP) within the site. The sub catchments and OLFPs are illustrated in Figure 5.

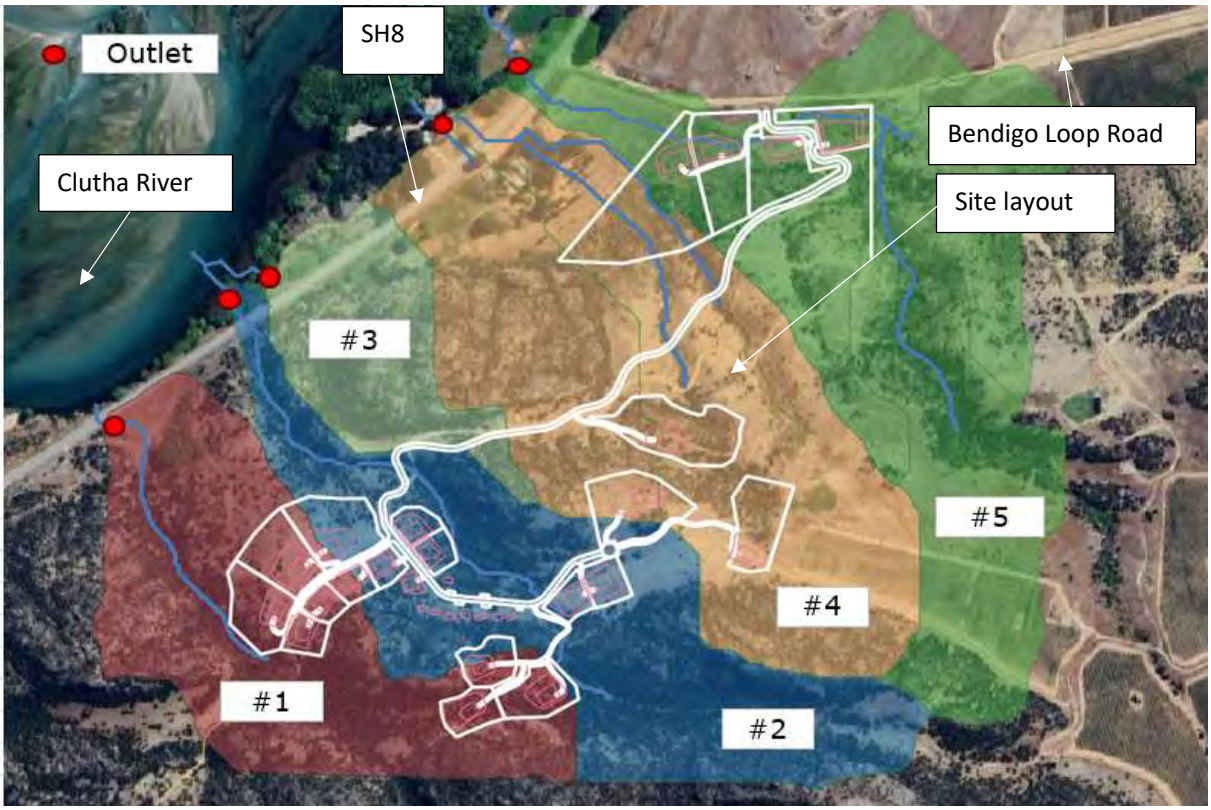


Figure 5: Sub-catchments and OLFPs alignments.

It is to be noted that for this assessment of overland flow path alignments, the culverts have been considered as blocked. In particular it is to be noted that the SH8 culverts have been blocked which provides a conservative result for the downstream assessment of effects.

6.1 Peak flow assessment

An assessment of pre and post development peak flows, utilising the rational method for hydrology, has been undertaken to assess the effects of the proposed development on the watercourses and downstream environment. The results for $10yr_{CC}$ and $100yr_{CC}$ ARI rainfall events are presented in Table 1.

Table 1 Peak flows, 10-Yrcc and 100-Yrcc.

Sub-Catchment	$10Yr_{CC}$ peak flow [m^3/s]			$100Yr_{CC}$ peak flow [m^3/s]		
	Pre	Post	Post-Pre	Pre	Post	Post-Pre
#1	0.493	0.507	**0.014**	0.930	0.957	**0.027**
#2	0.537	0.569	**0.032**	1.010	1.069	**0.059**
#3	0.224	0.224	-	0.430	0.430	-
#4	0.806	0.821	**0.015**	1.522	1.550	**0.028**
#5	0.696	0.711	**0.015**	1.299	1.327	**0.029**

There is an increase in flow for most sub catchments due to the increase in impervious coverage, albeit a minor increase. The change in flow rate is summarised as follows:

- 10yr event
  - between 14 L/s to 32L/s

- 100yr event
  - Between 27 L/s to 59L/s

This minor change in flow rate is reflecting the small change in impervious coverage in the maximum probable development state of the development.

6.2 Post development flow management recommendations.

The minor increase of flow during rainfall events, up to $100yr_{CC}$ event, indicates that this flow is likely to be accommodated in the current OLFP's and gullies within the site and downstream environment. This flow capacity is further investigated with the hydrological and hydraulic assessment, including a HEC RAS model, as presented in Section 11.

7 Stormwater Management Plan

The implementation of Rocky Point stormwater management strategy reflects the stormwater objectives to mitigate the potential effects of this development whilst considering the discharge locations. Therefore, the strategic approach to stormwater management follows the regime presented diagrammatically below:

A stormwater management options assessment has been undertaken which reflects the stormwater management strategy and objectives. The outcome of this assessment is presented for the quality, conveyance of flow, within both primary and secondary flow management, and outlet protection.

8 Stormwater Management Options Assessment

This section provides the outcomes of the options assessment for stormwater devices to achieve the overall stormwater management plan (SMP) for Rocky Point per the strategy and objectives.

Within the context of Low Impact Design (or water-sensitive design), individual stormwater devices must be aligned with specific design principles, including being:

- Compliant with the CODC requirements
- Aligned with natural hydrology.
- Reflective of Māori values
- Functional for the whole intended life of the device
- Designed for safety.
- Designed and constructed to support the intended plant functions (such as soil, sun, and water requirements)
- Designed for low maintenance.
- Evaluated in the context of whole-of-life cost and performance.
- Designed for resilience.
- Designed to achieve multiple benefits.
- Designed to promote native biodiversity.

It is to be noted, these design principles will be undertaken during the next design stage for individual devices.

8.1 Quality

The options for quality management, or treatment of runoff prior to discharge, is presented in table 2, which includes the benefits, limitations, and recommendations.

Table 2: Stormwater treatment device assessment

Device	Pros	Limitation	Recommendation
Swales (Rock type for road)	- Able to provide quality treatment and conveyance -Simple to construct with well-understood operation and maintenance.	-Easily damaged (e.g. compression of soil from vehicles). - Required treatment level -slopes greater than 5% require check dams for velocity and erosion protection.	Recommended for this site. Addition of rock check dams recommended for steep slopes.
Catchpit System	- Able to provide quality treatment -Simple to construct with well-understood operation and maintenance -Access for cleanout and maintenance is provided without impeding traffic flow	- Need to address maintenance cost and responsibility. - requires piped system for discharge	On-lot management if pipeline system installed Install for on lot soakage system

In addition to the above stormwater management options, the implementation of non-contaminant yielding cladding and architectural features will contribute to the mitigation with respect to stormwater runoff quality.

8.2 Primary Flow Management

Primary flow management from land subject to development must be carefully considered to ensure that the development does not contribute to adverse impacts downstream. These impacts can be flow related (i.e. flooding or scour) or water quality related. The proposed primary flow management system must therefore respond to downstream conditions and the natural receiving environments.

When selecting primary flow management solutions, the following Table 3 presents options with regards to stormwater management.

Table 3: Primary flow management options

Method	Pros	Limitation	Recommendation
Retention of rainwater / stormwater for reused on site (Rainwater tank)	- Able to provide retention of runoff on site. - reduce the use of potable water from the public water supply system for non-potable uses (such as garden irrigation). -Dual use for providing attenuation of flow if required	- Need adequate space for tank installation.	It is recommended to use tank to collect roof water
Soakage techniques	- Able to provide simple stormwater on lot disposal with effective groundwater recharge -Simple to construct with well-understood operation and maintenance.	- Depends on the site's underlying geology. -requires pre-treatment prior to discharge, e.g. catch pit	Recommended for primary stormwater disposal from lots however requires specific input from geotechnical engineer due the site's topography and underlying geological conditions.
Swales (Rock type for road)	- Able to provide quality treatment and conveyance. -Simple to construct with well-understood operation and maintenance.	-Easily damaged (e.g. compression of soil from vehicles). --slopes greater than 5% require check dams for velocity and erosion protection.	Recommended for each lot and Road's stormwater conveyance depending on site condition, such as steep slopes.
Catchpits (Sump)	- Able to capture and retain some gross pollutants - Shall be accurately positioned so that the grate and kerb block fit neatly into the kerb and channel. -The impact of a blockage or ponding is addressed.	-Does not provide any treatment. -Can block causing localised ponding.	-Recommended for the on-site stormwater management from paved areas if deemed necessary. -Recommended prior to soakage devices.
Gradual release to a Natural watercourse	- Able to be used where it is in keeping with the existing drainage regime. -Simple connection. -Can minimise earth disturbance.	- Need to be designed to avoid erosion of the stream banks. - Depends on the site's topography condition.	Recommended for primary stormwater discharge from lots where soakage is not viable, however depends on the site's topography and any adjacent watercourses.
Gradual release to a piped stormwater system	- Simple method for stormwater conveyance. -Can discharge from piped system into proposed road swale. -Reasonable maintenance costs.	- Depends on the site's topography.	Recommended for primary the stormwater conveyance within lots, however depends on the site's topography.

8.3 Secondary Flow Management

Options for conveyance of secondary flow including overland flow paths have been investigated, to minimise the effects of the proposed developed within the site as well as upstream and downstream. It is acknowledged that there is limited upstream catchment areas that are associated with this site as well as downstream.

The conveyance options for the development area are essentially either (or a combination) of the following.

- Overland flow/conveyance channels
- Swales

However, there are some specific considerations that need to be adopted to ensure the effects of conveyance of secondary flow is successful and mitigate effects.

Table 4: Secondary flow conveyance methods

Method	Pros	Limitation	Recommendation
Maintain existing secondary flow paths (OLFP).	- protect existing watercourse. - Provide connectivity through the site - Mitigate effects of OLFP blockage	- Earthworks within OLFP's may be restricted. - Development can be restricted. - Depends on the site's condition and building design.	It is recommended to design culverts to convey 100yr$_{CC}$ flow without restriction for road crossing. Overland flow alignment to match the pre-development runoff conditions where practicable.
Swales and Road channel	- On lot large rainfall event flow management. - Able to use the proposed swales and road for overland flow management.	- Depends on the site's underlying geology. - Depends on the site topography and building design.	on lot design to consider site layout, topography and geology. Roads to integrate with existing OLFP for discharge location

8.3.1 Outlet protection

The overarching principle for the design of the outlets is to ensure non-scouring flow velocities at the point of discharge is achieved. Acceptable outlet velocities will depend on soil conditions[8] and specific provision for energy dissipation and velocity reduction is required. This velocity limitation will be confirmed at detailed design stage with guidance from geotechnical input.

Table 5 shows options for erosion protection.

Table 5: Outlet protection methods

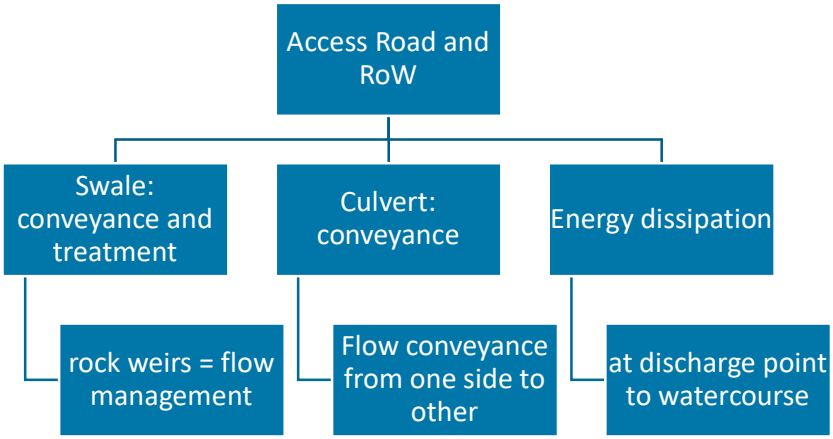
Method	Pros	Limitation	Recommendation
Check Dams for Swales	- Able to reduce flow velocity and channel grade. - can use existing rock from site	- Need maintenance - Add complexity to design and construction.	Recommended for swales and overland flow paths where gradients exceed 5% or velocity exceeds erosive flow behaviour.
Riprap Apron	- Able to reduce flow velocity. - can use existing rock from site if suitable	- Depends on outlet site's condition. - Need maintenance	Recommended for some outlets from road to discharge stormwater into natural gullies.
Level Spreaders	- Able to reduce flow velocity. - Simple design and construction. - Low cost.	- Depends on site's condition - Need maintenance	Recommended for some lots where located near an existing water course.

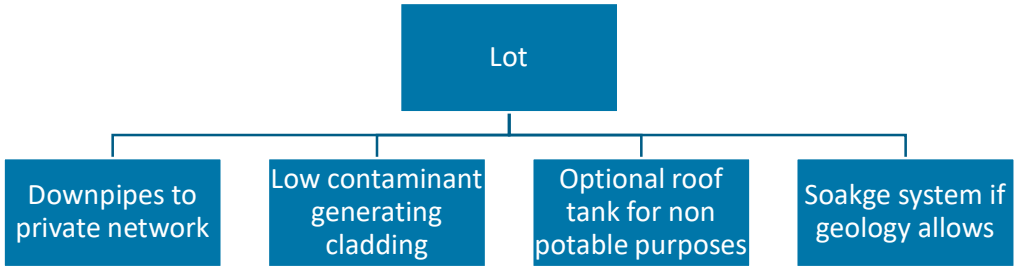
[8] Velocity reduction is needed to protect from erosion and scour.

9 Best Practicable Stormwater Management

The best practicable stormwater management for Rocky Point development considers the discharge to the existing downstream watercourses. This proposed stormwater management reflects the existing nature of the site and the proposed large lot rural residential development which has both Road and Access ways with minimal earthworks for the development within each lot.

The best practicable management will include a combination of options for stormwater quality management, primary and secondary flow management as presented in Section 7. The best practicable option (BPO) for stormwater management associated with the Roads, Accessways, right of ways (RoW) and lots are presented in the following diagrams.





Details of the best practicable stormwater management for quality, primary and secondary flow is presented in the following sections. The components for these options are detailed in Section 9. Indicative stormwater layout is presented in drawing 4001, Appendix A.

9.1 Stormwater Quality Management

The expected stormwater runoff quality is to be associated with the low contaminant environment; however, several management options are to be implemented to ensure that the effects of the development are mitigated. These include the following specific requirements:

- Non contaminant generating building cladding and architectural features.
- Integrated primary flow conveyance with water quality management techniques.
    - Swales for both quality and conveyance capability

9.2 Primary flow Management

Primary flow management constraints depend on each lot, road, and right of way's site condition, topography, and geological condition, which provide direction as to BPO for stormwater management as presented in previous sections.

The hydrology assessment, as presented in Section 6.1, shows the change in flows from pre-development to post-development results in a small increase. As this increase is considered very minor, attenuation for the primary event up to the 10-year ARI, is not deemed necessary. Any stormwater devices and methods assessed will be designed to convey stormwater and manage any potential erosion effects.

A private on-lot piped network is proposed to be installed to connect:

- Downpipes and any catchpits to discharge to the proposed private network.
- Stormwater pipe from roof to respective Soakage system (depending on soil condition and specific geotechnical advice) and/or the private connection to the existing watercourses and proposed Swales.
- Channel network for sheet flow management if required, with erosion protection.

A Swale for the roads (Access roads and ROW) is proposed to be installed to connect:

- Sheet flow of road runoff to the proposed rock type swales (to convey up to $100yr_{CC}$ flow)
- On-lot runoff from private network (as per above)
- Discharge via sump and/or culvert with erosion protection.

9.3 Secondary flow Management

The management of the secondary flow, associated with the $100yr_{CC}$ ARI rainfall event, can be undertaken with the roadside swales and culvert crossings for the Access Roads and ROWs. These swales and culverts will be designed with erosion protection to minimise scour and convey the flow towards the natural watercourses and gullies on the site.

The On-lot management during the large storm events will be unchanged from the current situation however during detailed design the discharge of the flows will be protected from scour.

The overland flow path that traverses Lots 19-21 and Lots 27- 30, during large rainfall events, has been investigated further with hydrological and hydraulic modelling, as presented in Section 10. The development on these lots will need to be in sympathy with this OLFP and mitigation provided as per NZ Building Code and district council standards.

In summary:

- Existing gullies and watercourses (Overland flow paths) will be utilised to convey flow for $100yr_{CC}$ ARI rainfall events.

- Culvert crossings with erosion protection to provide conveyance and discharge of flow from Access Roads and ROW.
- On lot management to provide sustainable discharge during 100-year events
- OLFP protection through lots by means of adhering to NZ Building code and Otago District Council standards

10 Stormwater management components

The BPO stormwater management system will have several components. This section provides more detail with respect to the application of the stormwater management devices, or components, for Rocky Point.

10.1 Rain tank

The rain tank can manage stormwater quantity effects for primary flows. Also, can be used during emergency times, such as water supply unavailability, in a temporary nature. Therefore, this rain tank is recommended for all lots, if conditions allow, and will be designed at building consent stage.

10.2 Soakage system

The assessment reviewed the Soakage system as the best option for managing and discharging primary flow if the ground conditions allow and geotechnical input deems it acceptable. In summary:

- all lots can use a soakage system if the specific lot's soil conditions are deemed viable to soakage.
- Specific Geotechnical advice **must** be sought prior to soakage being utilised on lot.
- Design to be undertaken at building consent stage.

10.3 Swales

Roadside swales are deemed to be best practical options for treatment, and conveyance of flow. These are detailed in the Coterra Ltd's Road cross sections, DWG W1699, Appendix A.

The swale design will include the following characteristics:

- Check dams:
    - reduce velocity and increase treatment capacity.
- Conveyance capacity for runoff from 100yr rainfall event
- Discharge to culverts.
    - Culverts to include erosion protection.
    - Located in a vertical sag location.

10.4 On lot – discharge to Road Swales

With respect to on lot management, and if the ground condition is suitable, an underground pipeline and catchpit construction can be appropriate. This pipeline would discharge to the proposed roadside swales.

The pipeline discharge to roadside swale is appropriate option for most of the lots, such as the following lots:

- Lots 5-7
- Lots 10 and lots 12-18
- Lots 22-23

The remaining lots will require alternative disposal option to connect to the receiving environment.

10.5 Discharge to Watercourses

The proposed Access Road and ROWs are to be established with empathy of the natural contours of the slopes to create vertical sags, where connection and discharge to the natural watercourses are possible. This will occur through culverts with appropriate erosion protection to mitigate scour.

On Lot management of discharge for the primary system can also occur, to connect to the existing watercourse. This will require erosion protection, such as a level spreader. This disposal system is to be adopted if the ground conditions are deemed not acceptable for using soakage.

The lots where this disposal system is a practicable option are:

- Lot 1-4
- Lot 8-9 and lot 11
- Lot 19-21 and Lot 24-30

It is to be noted that discharge to watercourses description includes the discharge across land until it reaches a watercourse or natural gully.

10.6 On-lot considerations

As the development of Rocky Point continues, from the subdivision consent stage, there are specific considerations that will be required during the building consent design stage for each lot, identified in the scheme plan, which are presented in the table below. These considerations are with respect to the selection of best practicable stormwater management and for the purpose of guiding the future design aspects within each lot.

It is to be noted that Geotechnical advice is recommended for each lot prior to stormwater management device design.

Table 6 BPO Stormwater management considerations for future design within each lot

Lot	Discharge regime		Design considerations[2]
	Discharge to network	Dispersed discharge[1]	
1	-	Yes	Permeability of soils. Depth to rock
2	-	Yes	
3	-	Yes	Possible shallow depth to rock, location of discharge to watercourse/gully to provide unimpeded OLFP
4	-	Yes	
5	Yes	-	lot size limitations for location of devices such as above ground tanks etc., Permeability of soils.
6	Yes	-	
7	Yes	-	
8	-	Yes	
9	-	Yes	
10	Yes	-	
11	-	Yes	
12	Yes	-	

Lot	Discharge regime		Design considerations[2]
	Discharge to network	Dispersed discharge[1]	
13	Yes	-	Smaller lot size, limitation due to smaller lot size to accommodate above ground tanks etc. Permeability of soils.
14	Yes	-	
15	Yes	-	
16	Yes	-	
17	Yes	-	
18	Yes	-	
19	-	Yes	Permeability of soils, Depth to rock, location of discharge to dispersed flow to mitigate erosion effects
20	-	Yes	
21	-	Yes	
22	Yes	-	Possible shallow depth to rock, location of dwelling and infrastructure to provide unimpeded OLFP
23	Yes	-	
24	-	Yes	Low permeability soils, Possible shallow depth to rock, location of discharge to dispersed flow to mitigate erosion effects
25	-	Yes	Low permeability soils, Possible shallow depth to rock
26	-	Yes	Possible shallow depth to rock, location of dwelling and infrastructure to provide unimpeded OLFP, location of discharge to dispersed flow to mitigate erosion effects
27	-	Yes	Location of dwelling and infrastructure to provide unimpeded flow through watercourse/gully that traverses lots, location of discharge to dispersed flow to mitigate erosion effects, integration with wastewater disposal field options
28	-	Yes	
29	-	Yes	
30	-	Yes	

Notes:

1. Discharge via dispersed flow, to mitigate effects of erosion at point of discharge.
2. Design considerations are not limited to the tabulated aspects.

11 Flood Modelling and Hazard Assessment

Flood modelling and hazard assessment has been undertaken to determine the flow presence, location and magnitude during large rainfall events and changes to these due to the proposed development. The hydrological analysis and hydraulic modelling have been assessed for a 100-year ARI rainfall event, including climate change, ($100yr_{CC}$) for the subject site and contributing catchments. The outcome of this assessment is presented in the following sections.

11.1 Hydrology Analysis

A catchment analysis was conducted using the following background information:

- Coterra Ltd, Ground Lidar 1m DEMs, Lindas Peak 2000, NZVD2016
- Google maps

Five sub-catchments were delineated for the OLFPs potentially affecting the site (sub-catchments 1 to 5). Previously presented in Section 6, Figure 3 shows the OLFPs alignment and delineation of the sub-catchment areas. For ease of reference this figure is duplicated and presented below:

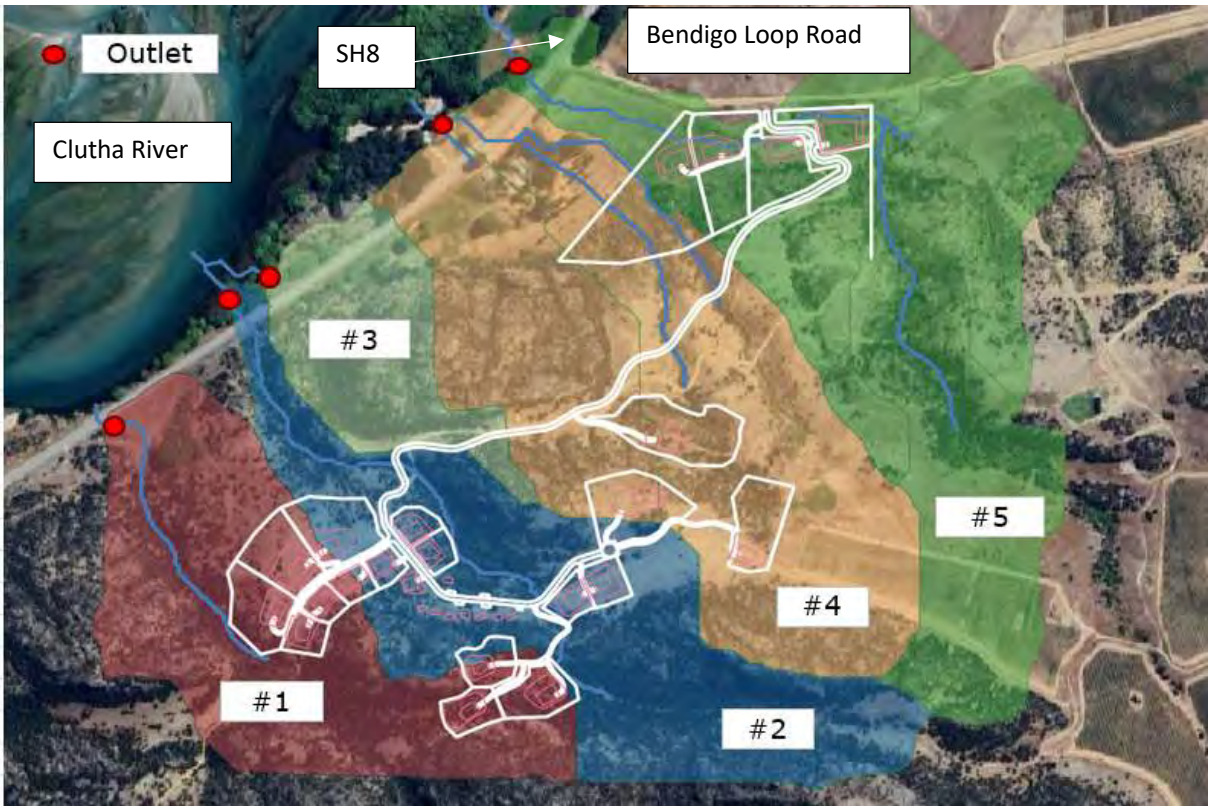


Figure 6: Overland flow path assessment[9]

Table 7 summarises the OLFP's characteristics including the contributing catchment areas and the associated peak flow during 100-year climate change rainfall events, taking into consideration the Maximum Probable Development (MPD) of the catchments, including the proposed development at the

[9] Ref: Section 6, Figure 3

subject site. The peak flow represents the flow from the whole of the contributing catchment at the point of discharge, which is the Clutha River. Supporting calculations are appended for reference.

Table 7 OLFP characteristics

Sub-Catchment	Area [ha]	Length of OLFP [m]	Slope [%]	Pre-100Yrcc peak flow [m^3/s]	Post-100Yrcc peak flow [m^3/s]
#1	18.36	839	17.15	0.930	0.957
#2	20.78	1230	15.00	1.010	1.069
#3	7.01	385	20.90	0.430	0.430
#4	29.73	837	15.00	1.522	1.550
#5	29.44	1392	10.00	1.299	1.327

11.2 Hydraulic Flood Modelling

A 2D hydraulic flood model was run using HEC-RAS 6.4.1 software to determine the flow direction, floodplain area and Water Surface Elevation (WSE) affecting the site during 100yrcc rainfall events for the pre-development and post-development scenarios.

The post development terrain is very similar to the predevelopment (scenario), with only minor surface cover changes which reflects the access roads, right of ways and minor earthworks for the building platforms, as presented in the in the proposed site plan, Appendix A.

The terrain used for the existing condition was built using following information:

- Coterra Ltd, Ground Lidar 1m DEMs, Lindas Peak 2000, NZVD2016 for pre-development and post-development.
- Computation Cell Grid, 3 m x 3 m
- Computation time, 0.5 seconds

Table 8 below presents the parameters used for the hydraulic models:

Table 8 Hydraulic Model Parameters

Descriptions	Condition
Geometry	Coterra Ltd, Ground Lidar 1m DEMs, Lindas Peak 2000, NZVD2016
Manning roughness value (n)	0.04 (Grassland / Herbaceous) for watercourses
Internal boundary condition	Flow hydrograph, based on TP108 rainfall pattern, corresponding to 100-year (RCP 8.5) rainfall events for sub-catchment 1 to 5, with peak flow generated by the Rational method[10] based on New Zealand Building Code Clause E1, Surface water
Downstream boundary condition	Normal Flow Catchment #1, friction slope = 0.1715m/m Catchment #2, friction slope = 0.1500m/m

[10] The C parameter in the Rational method is adjusted for slope.

Descriptions	Condition
	Catchment #3, friction slope = 0.2090m/m Catchment #4, friction slope = 0.1500m/m Catchment #5, friction slope = 0.1000m/m
Culverts	No culverts have been considered = culverts are blocked

This hydraulic modelling approach using the peak flow loaded in the upper reaches of each sub catchment is considered conservative as the full peak flow (generated from the subcatchment) is discharged through the terrain. Thus, the watercourse and gullies are accepting the full peak flow throughout the length of the flow path.

11.3 Hydraulic Model Result

The hydraulic modelling results represented by the maximum flood depth, flow velocities and water surface elevation (WSE) of the OLFPs for the existing and proposed terrain condition are presented in the following sub sections.

Refer to supporting calculations and modelling summary, Appendix B

11.3.1 Existing site condition

The hydraulic modelling results for the existing (pre- development) site condition is presented in the following figures:

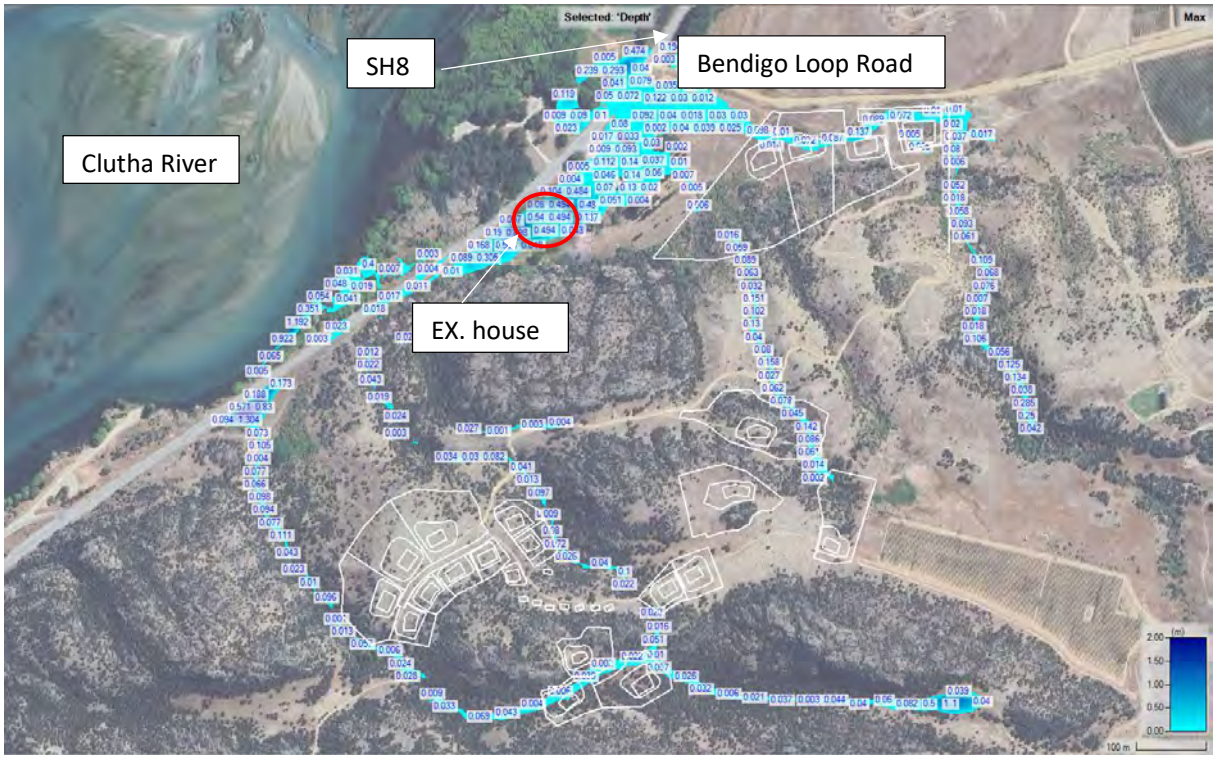


Figure 7: Pre development - Maximum flood depth.

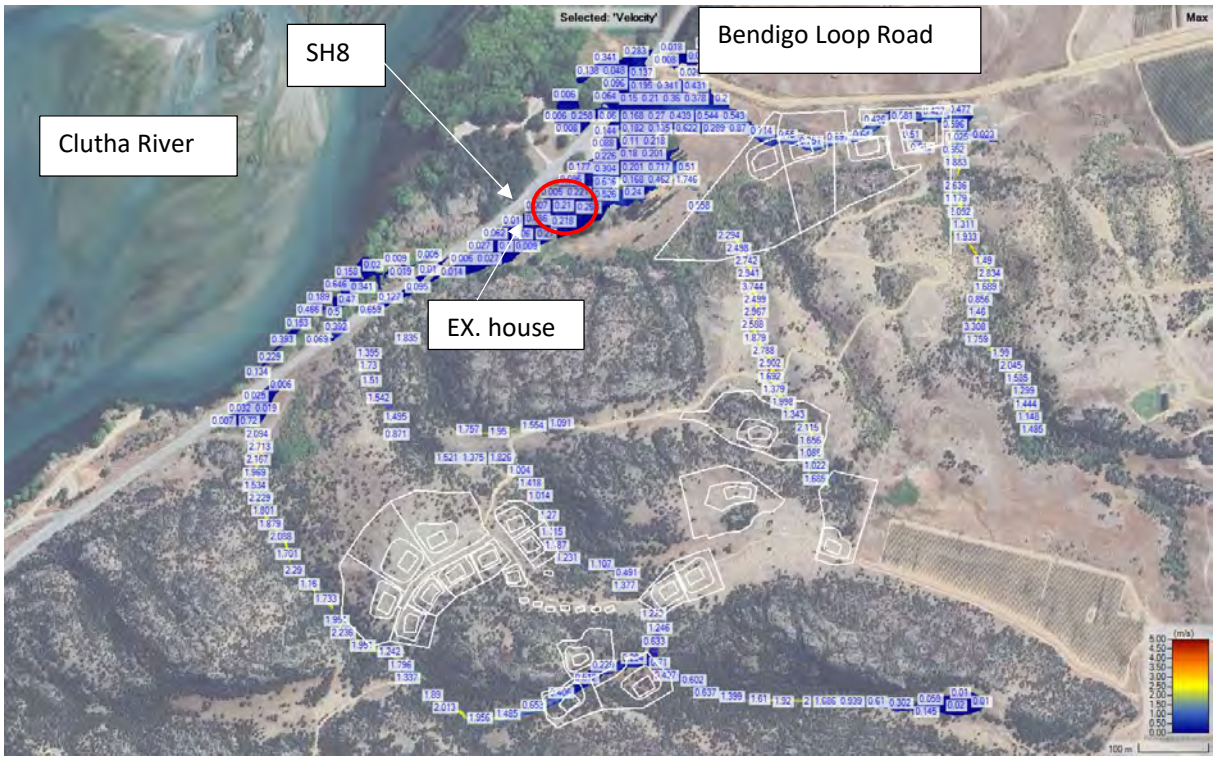


Figure 8: Pre development 100-Yrcc Maximum Velocity

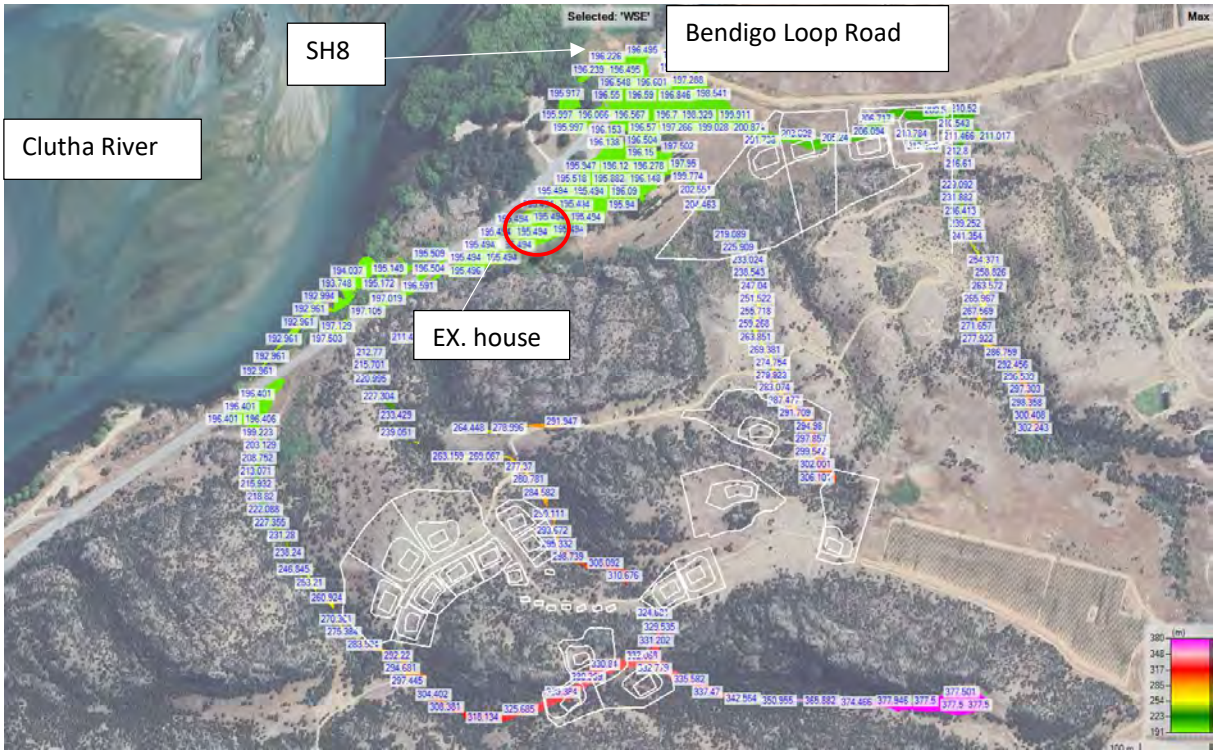


Figure 9: Pre development 100-Yrcc Maximum water surface elevation[11]

[11] NZVD2016 Vertical datum

11.3.2 Proposed site condition

The proposed site condition reflects the minor changes to the terrain, with respect to access roads, ROWs and building platforms.

The proposed condition flood modelling results are presented in the following figures.

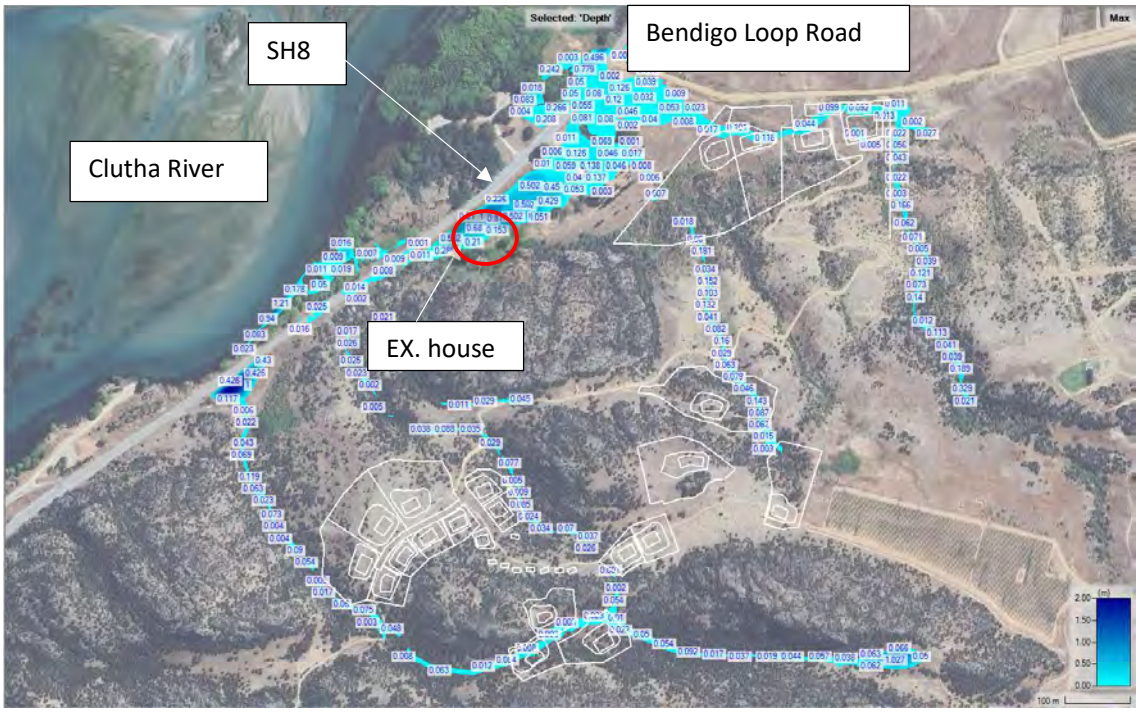


Figure 10: Post development - Maximum flood depth.

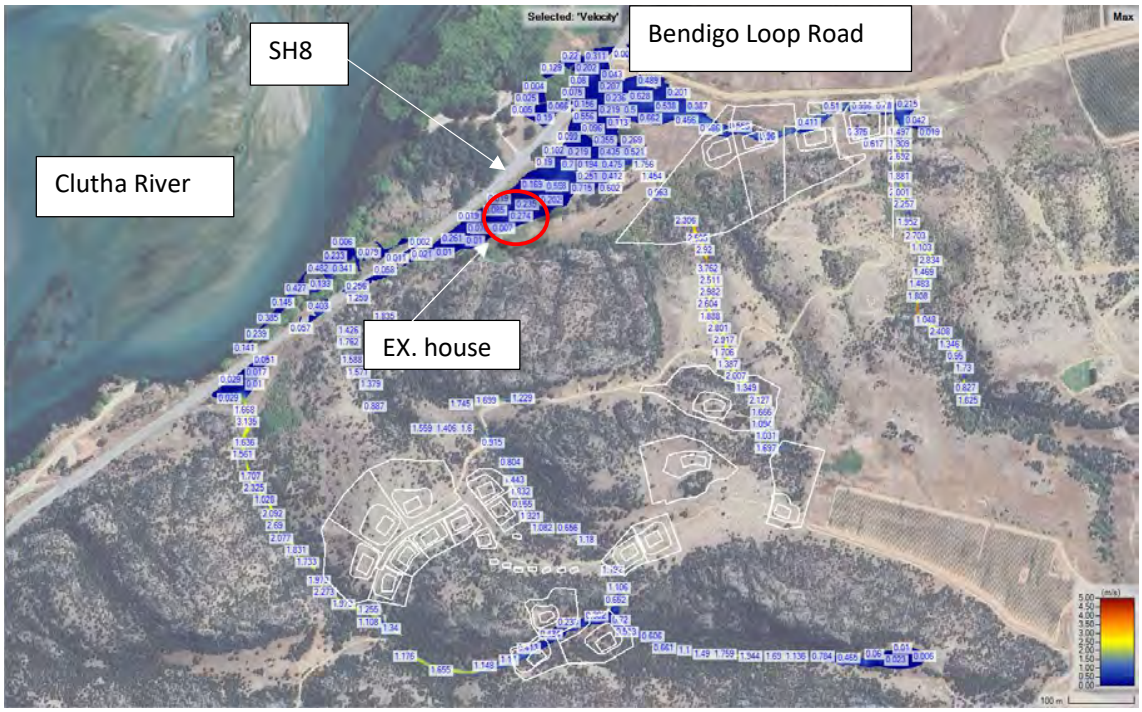


Figure 11: Post development 100-Yrcc Maximum Velocity

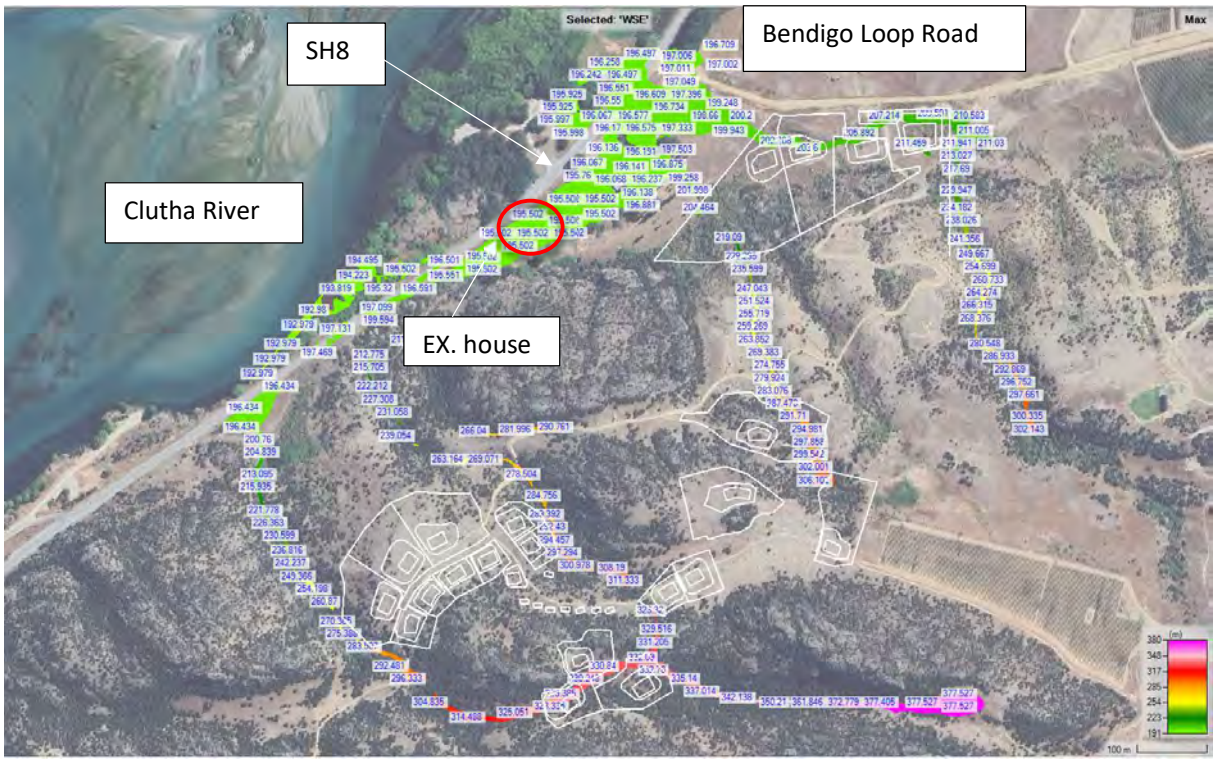


Figure 12: Post development 100-Yrcc Maximum water surface elevation [12]

The majority of the proposed site development is located outside of the OLFP extents. Where the access roads cross the OLFP a culvert will need to be installed to accommodate this flow, to provide uninhibited and continued flow regime.

The OLFP associated with sub catchment 5 crosses through Lots 27-30, which are located adjacent to Bendigo Loop Road. This is represented by the existing natural depression, as shown in Figure 10 and also within the photos of Figure 2. The depth of the flow in this location is between 7mm - 315mm, which will be contained within this depression area.

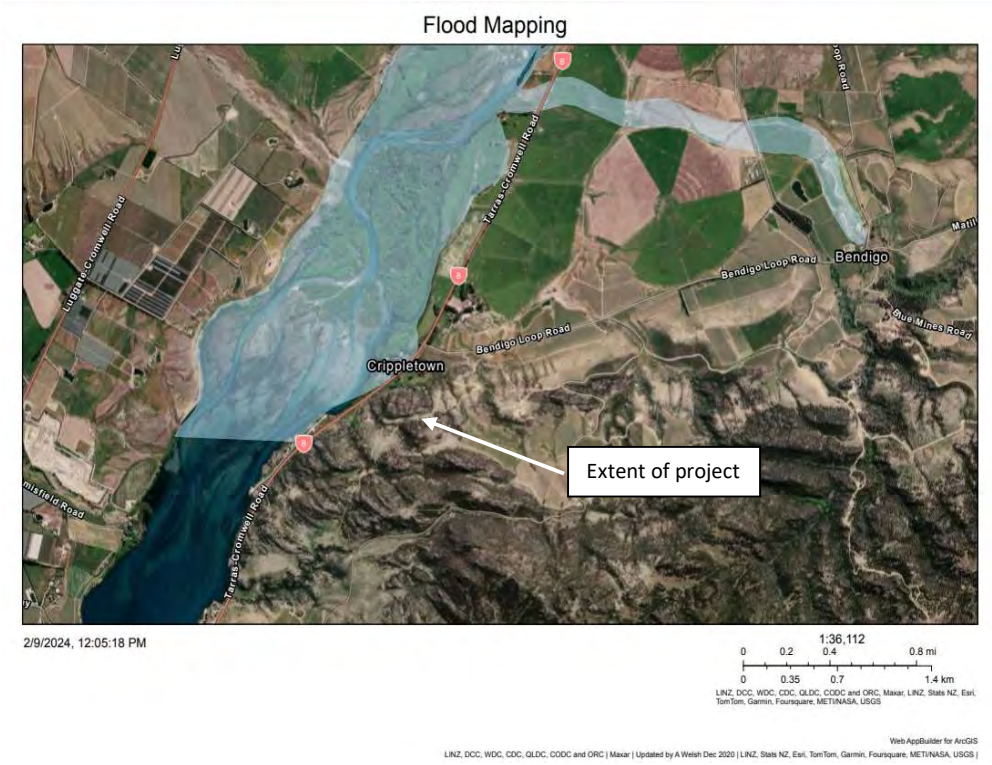
There is another OLFP associated with sub catchment 1 which traverses Lot 19-21. This OLFP has a flood depth of up to 215mm, which also reflects the nature of the terrain and soil conditions. These sites will be developed with the OLFP being considered and setback or mitigation provided.

11.3.3 Clutha River Flood Assessment

In addition, as a very high-level review, the Clutha River flow capacity has been assessed to check if this influences the OLFP and flood hazard on the lower-level sites at lots 27-30. This assessment has assumed that any hydraulic structures or pipes/culverts are blocked.

This subject site is located outside of the flood zone, according to the Otago Flood Hazard map as presented in Figure 13.

[12] NZVD2016 Vertical datum


Flood Mapping
Cromwell Road
Terras Cromwell Road
Bendigo Loop Road
Bendigo
Blue Mines Road
Cromwell Road
Bendigo Loop Road
Cromwell Road
Cromwell Road
Cromwell

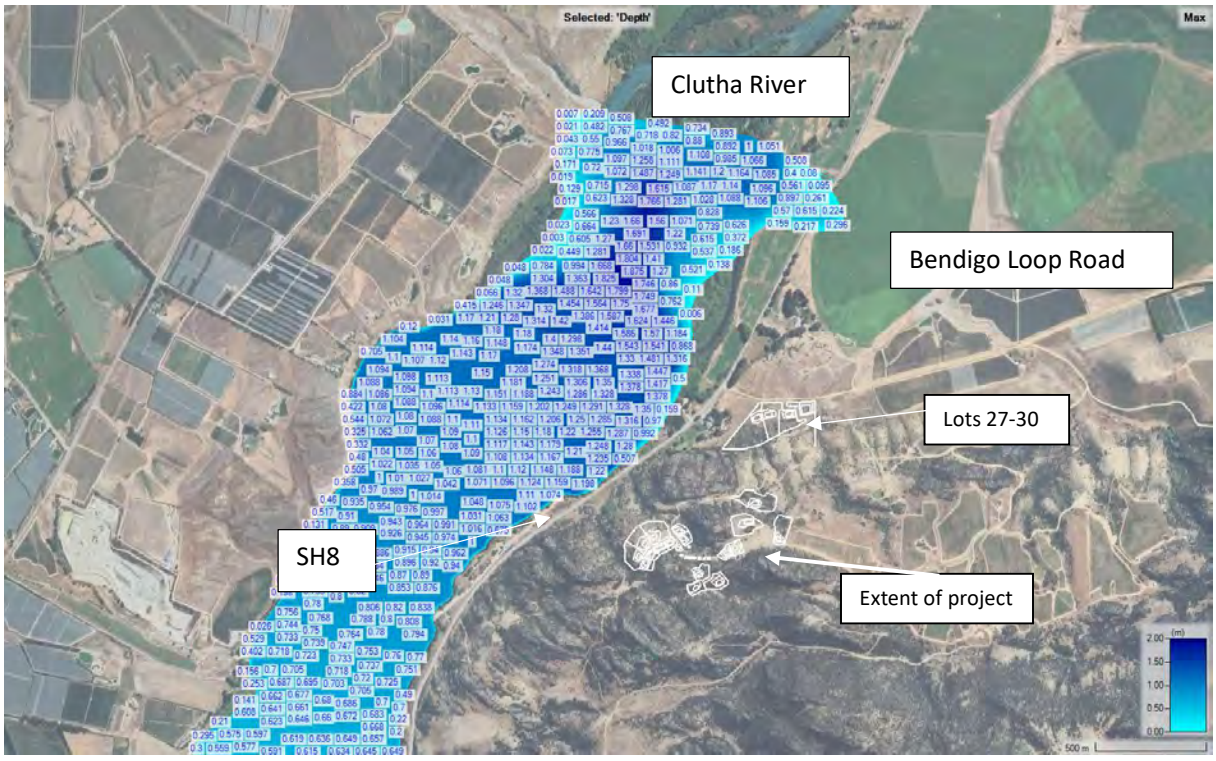


Figure 14: Hydraulic modelling for Clutha River flow

11.4 Flood Hazard Assessment

An assessment of effects with respect to flood hazard and OLFP management for the post development conditions has been undertaken. This is represented in the flood difference mapping, showing the change in water surface elevation (WSE), as presented in Figure 15.

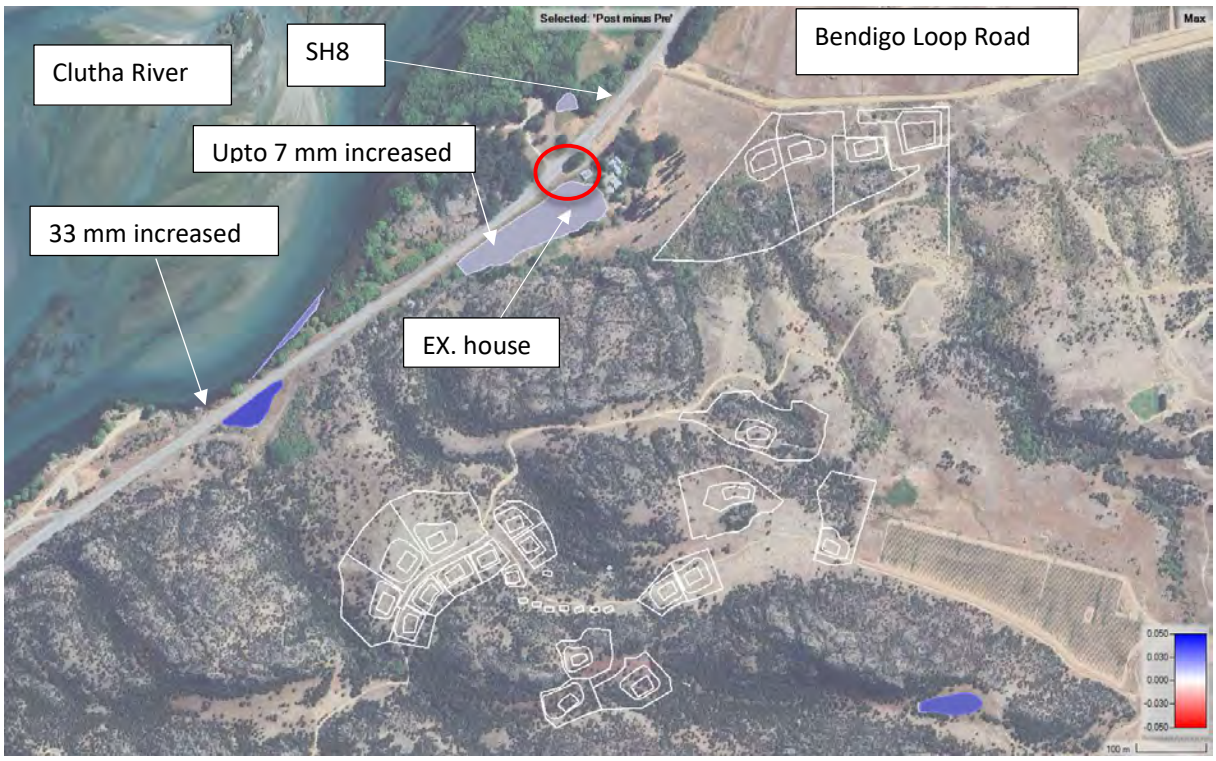


Figure 15: Flood level difference map (Post minus pre-development)

There is a minor increase of top water level, of 7mm and 33 mm, in 100yr event downstream of the site and adjacent to the culverts under SH8. The slight increase in water surface elevation does not alter the land use in these isolated areas. It is to be noted that the modelling is considered conservative (Secondary flow) as all primary flow structures, culverts, are blocked. Therefore, this effect is considered negligible and are not likely to contribute to any increased flood risks or hazards on any downstream properties.

The minor increase of flow (rate) during rainfall events, up to 100-year ARI event, and the OLFP mapping indicates that this flow is likely to be accommodated in the current OLFP's and gullies within the site and downstream environment. This leads to attenuation of flows not being required for surface flow runoff during rainfall events.

The hydraulic model results show that most of the development areas lie outside of the OLFPs. However, the OLFP associated with subcatchment #5 passes through Lot 27 to 30 with a flow depth between 7mm – 315mm. This OLFP can be accommodated in the existing depression area, however further assessment of flood depth and extent is recommended in the next stage of the design to accommodate the proposed earthworks and site layout within these Lots. There is another OLFP associated with sub catchment 1 which traverses Lot 19-21. This OLFP has a flood depth of up to 215mm, which also reflects the nature of the terrain and soil conditions.

It is to be noted that the flood modelling for flood hazard assessment purposes has been undertaken at the concept design stage. Therefore, the following flood mitigation methods are recommended.

- Setbacks from OLFP extents, for Lots 27- 30 and Lots 19-21, be applied during the next phase of design.
- Road culvert crossings to accommodate 100-year OLFP flows.
- Implementing the NZ Building code requirements during building design.

11.4.1 Existing house

With respect to the existing house located at 1390 Tarras-Cromwell Road (SH8) and the implications of the overland flow and extent of flood flow, an assessment has been undertaken. This house is located slightly below, in elevation, to the state highway carriageway as shown in photo below.

Figure 16: Existing dwelling 1390 Tarras-Cromwell Road (SH8)

The flood modelling undertaken and presented in sections 11.3.1 and 11.3.2 indicate that this dwelling is located in a minor flood extent, albeit modelled with all culverts blocked. In actuality this flow is likely to continue downstream via culvert conveyance under the State Highway. However, flood modelling requires an assessment with these culverts blocked.

The change in top water level adjacent to the dwelling is in the order of 7mm. This will not change the presence of flood waters in this location nor influence the management of such. Therefore, it is considered that the increase in top water level during a flood event is less than minor.

12 Summary

A stormwater management and flood hazard assessment has been undertaken for the Rocky Point proposed subdivision at Bendigo Loop Road, Central Otago. This assessment provides guidance to support resource consent and the future design stages for the delivery of this subdivision.

The best practicable stormwater management plan has been developed to deliver the overarching Rocky Point strategic principles and objectives of how the site's stormwater is to be managed.

High-level objectives are designed to be consistent with the regulatory requirements, which are:

- Minimising or mitigating any detrimental effects of urban development on the receiving environment.
- Meeting the Central Otago District Council Guidelines and other regulatory requirements
- Initiating best practice low-impact design that integrates with urban design.

These objectives are the cornerstone to preparing the Stormwater Management Strategy for Rocky Point. As a result, the approach to Stormwater management in this area has the objective of minimising or mitigating any detrimental effects of urban development on the receiving environment.

In summary the delivery of the stormwater management plan can be presented with respect to quality, primary and secondary flow conveyance.

- ***Quality:***

This development could be considered a low contaminant generating environment, however specific quality mitigation principles are to be adopted. These are managed in the following ways:

  - ✓ Non contaminant generating building cladding and architectural features.
  - ✓ Integrated primary flow conveyance with water quality management techniques.
    - Swales for both quality and conveyance capability

- ***Primary flow conveyance:***

The primary conveyance is associated with the $10yr_{CC}$ ARI rainfall events and are managed in combination with the other stormwater management attributes of quality and secondary flow conveyance. In summary the application of best practicable options are:

  - ✓ management systems must consider the site's topography and soil conditions.
  - ✓ Rain tank for lots for retention purposes, if (each lot) site conditions allow.
  - ✓ Soakage system: Recommended for lots only where geotechnical constraints are deemed acceptable.
  - ✓ On – lot private connection is dependent on individual lot site condition, as follows:
  - ✓ to proposed road swale.
  - ✓ to existing watercourses and/or natural ground topography
  - ✓ Attenuation is NOT required for discharge of runoff.

- ***Secondary flow conveyances:***

The secondary conveyance is associated with the $100yr_{CC}$ ARI rainfall events and are managed in combination with the other stormwater management attributes of quality and primary flow conveyance. In summary the application of best practicable options are:

  - ✓ Swales for conveyance of road runoff and lot discharge where appropriate
  - ✓ existing watercourses and overland flow paths are to be maintained and accommodated within the Access roads, ROWS and lot design.

- ✓ Provide adequate culverts for conveyance of flow under roads.
- ✓ Attenuation is NOT required for discharge of runoff from the proposed development.

Flood modelling and hazard assessment has been undertaken to determine the flow presence, location and magnitude during large rainfall events and changes to these due to the proposed development. The hydrological analysis and hydraulic modelling have been assessed for a $100yr_{CC}$ ARI rainfall event for the subject site and contributing catchments. The outcome of this assessment is summarised as follows:

- ✓ OLFPs pass through the site with Lots 19-21 and Lots 27-30 being subjected to these flows.
- ✓ Flow depth.
  - All overland flow paths are accommodated within the natural gullies and watercourses.
- ✓ Lot 27~30
  - Associated with sub catchment #5
  - flow maximum depth between 7mm - 315mm in these lots.
  - future development within lots will require further assessment with regard to development adjacent to this flow path.
- ✓ Lot 19~21
  - Associated with sub catchment #1
  - flow maximum depth up to 215mm in these lots.
  - reflects the nature of the terrain and soil conditions.
- ✓ Freeboard
  - Development within the Rocky Point subdivision will need to adhere to NZ Building code for any mitigation with respect to freeboard.
- ✓ Downstream effects
  - The change in flood levels is minimal and within the tolerances of modelling.
  - There is no change in use of land due to flood flows post development.

13 Limitations

This report has been prepared solely for the benefit of our client with respect to the particular brief and it may not be relied upon in other contexts for any other purpose without the express approval by CKL. Neither CKL nor any employee or sub-consultant accepts any responsibility with respect to its use, either in full or in part, by any other person or entity. This disclaimer shall apply notwithstanding that the memo/report may be made available to other persons including Council for an application for consent, approval or to fulfil a legal requirement.

Appendix 1 Drawings

LEGEND

- STORMWATER CONVEYANCE (REFER NOTE 1)
- CULVERT
- LEVEL SPREADER
- LOT CONNECTIONS
- OVERLAND FLOW PATH

NOTE 1:
1) STORMWATER CONVEYANCE METHOD (SWALE OR PIPELINE) SHALL BE DETERMINED BY LOCATION SPECIFIC GEOLOGICAL CONDITIONS.
2) REFER TO SMP FOR MORE DETAILS.
3) LOCATION OF DEVICES INDICATIVE ONLY (SUBJECT TO DETAILED DESIGN)

NOTE 2:
1) MAINTANING THE ENTRANCE AND EXIT OF THE OLFP FROM UPSTREAM.
2) BUILDINGS TO CONSIDER FREEBOARD AND SETBACKS TO OLFP, WASTEWATER DISPOSAL TRENCH LOCATION TO BE COGNISANT OF OLFP IN THIS AREA.

NOTE 3:
1) MAINTANING THE ENTRANCE AND EXIT OF THE OLFP FROM UPSTREAM.
2) BUILDINGS TO CONSIDER FREEBOARD AND SETBACKS TO OLFP .

FOR INFORMATION ONLY

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ROCKY POINT
TKO Properties LTD
Lakefront Terrace, Bendigo

INDICATIVE SW / OLFP LAYOUT
1 OF 1

Issue	Description	Checked	Date
01	FOR INFORMAION	PP	7/2/24
02	SCHEME PLAN UPDATE	PP	12/7/24

		Date
Designed:	PP	12/7/24
Drawn:	PP	12/7/24
Checked:	BR	12/7/27

Scale: 1:4000 (A3 Original)

Job No: A23205 | Dwg No: 4001 | Rev: 02

C:\ProgramData\12DSynergy\data\CKL-AZU-SYN-1\C1 - Environmental_24787\03 Engineering\Modelling\C3D Models\SW-R2-reviced.dwg

North

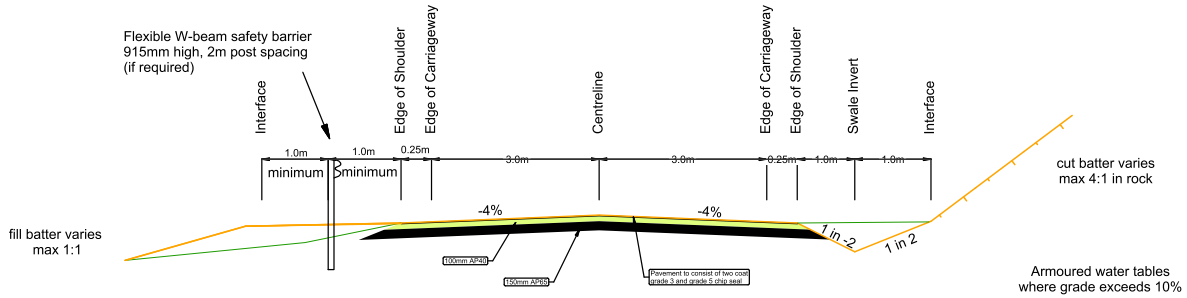
baxter design

0 20 40 70 100m
SCALE = 1:2000 AT A1

REFERENCE **4371 -SK125** - SCALE = 1:2000 AT A1 - 1:4000 AT A3 - **05 Jun 2024**
DRAFT - NOT A WORKING DRAWING - NOT FOR CONSTRUCTION
j:\4371 - infracon bendigo\cad\xref - 4371 - masterplan 10.dwg - DRAFT SCHEME PLAN

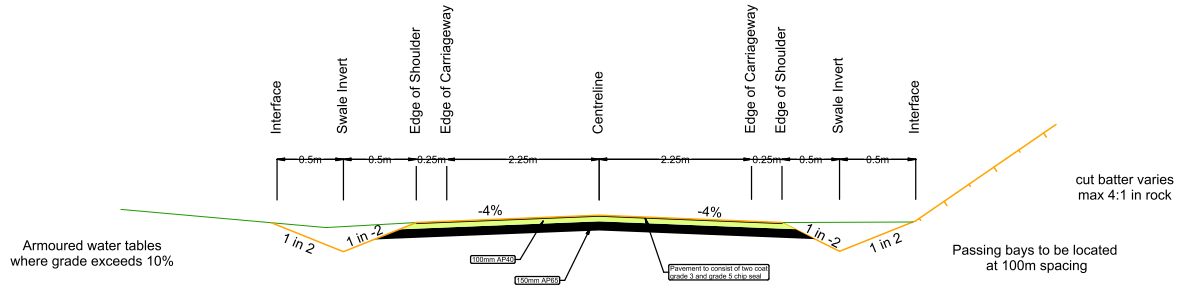
DRAFT

REVISED SCHEME PLAN
INFRACON - BENDIGO

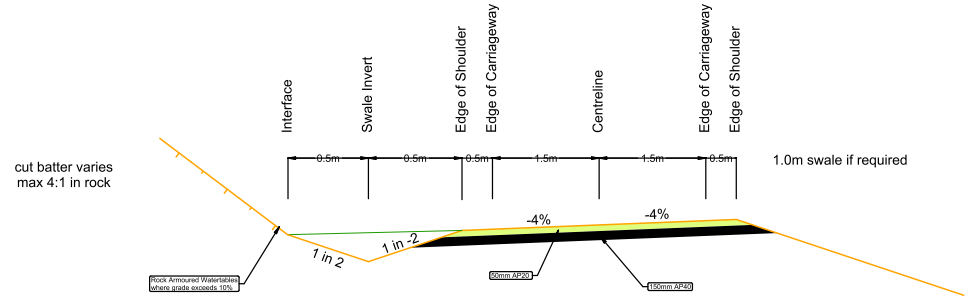


Typical Road Section 6.0m Carriageway
Road to vest
Legal width 20.00m

NOTE: Final pavement design
sunject to site specific CBR testing



Typical Road Section 4.5m Carriageway
Shared Right of Way
Legal width 10.00m



Typical Road Section 3.0m Carriageway - Single Crossfall
Unsealed Private Driveway

REVISION	DETAIL	DATE

C HUGHES & ASSOCIATES LTD
Surveying and Resource Management • Central Otago
WANAKA
LEVEL 3, 80 ARDMORE ST
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03 443 5052
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www.chasurveyors.co.nz

Project

INFRACON LTD
ROCKY POINT
BENDIGO

Title

TYPICAL CROSS SECTIONS
SHEET 1 of 1
FOR RC APPLICATION

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Scale: 1:1000

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6178	MJS	NZVD2016	
Drawing No:	Sheet No:	Revision:	Date Created:
W1699	901	B	7 Aug 2023

Appendix 2 Calculations

Rocky Point, Bendigo
Stormwater management
ENGINEERING CALCULATIONS

Prepared for:
Infracon Ltd

Ref# A23205

Rev: For Information olny (Revised Scheme Plan) **Calc By:** PP
10 July 2024 **Check By:** -

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CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	1
Description:	Stormwater management	Designed:	PP		
Date:	10 July 2024	Checked:	-		

A Introduction

This design report outlines the Stormwater management options assessment requirement for Rocky Point near Bendigo loop Road, Central Otago. CKL Ltd has been engaged to demonstrate serviceability for Stormawaters designs and flood modeling for this project proposal. This document presents the design of the MPD scenario.

B Basis of Design

Stormwater:

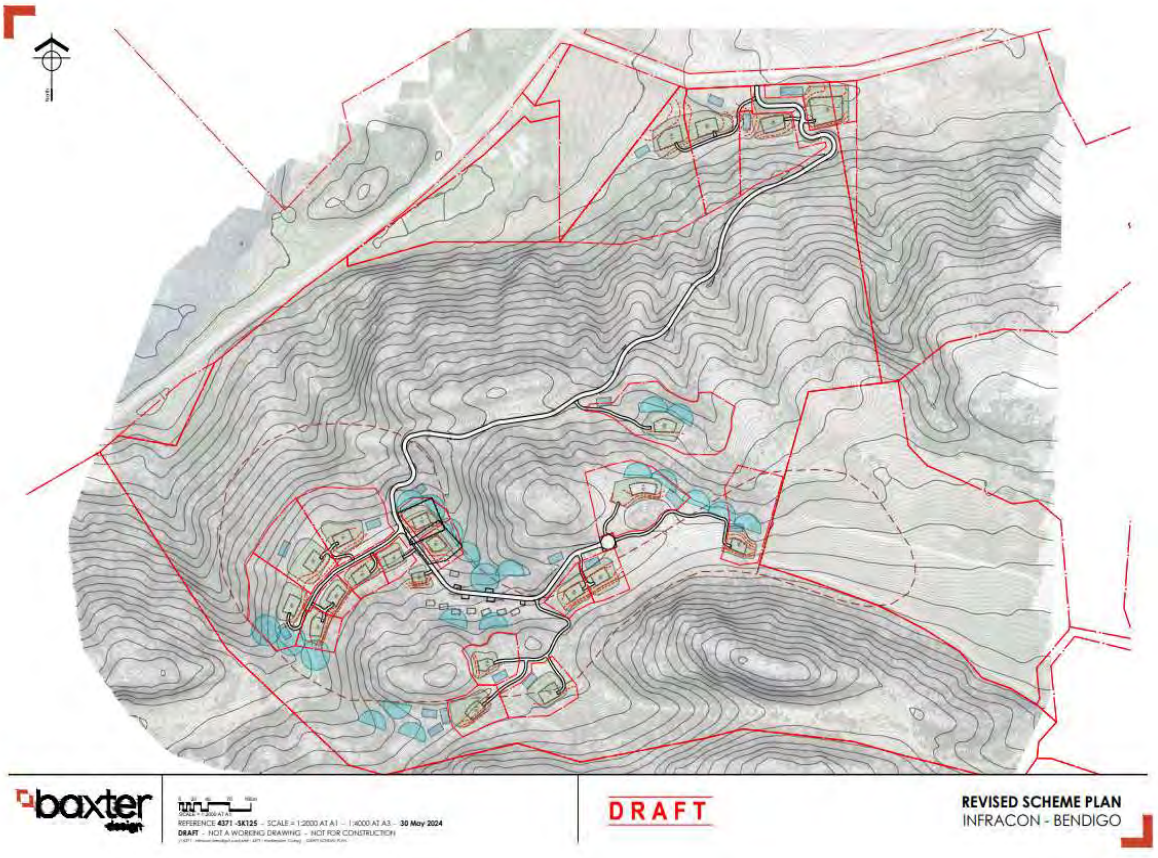
The design presented herein is based on CODC's Code of Practice and associated documents;

- **Central Otago District Council Addendum to 4404:2004, July 2008**
- **Rational Method based on New Zealnad Building Code Clase, E1 Surface Water**

1. Catchment Management Planning (Effects of Land use on receiving waters, Catchments, and off-site effects)
2. **Primary system flow** calculation for pre-development and post-development **(10-year, ARI, climate change effect scenario)**
3. **Secondary system flow** calculation for pre-development and post-development **(100-year, ARI, climate change effect scenario), All primary system flows are blocked.**

****References**

1. Surveyor information: Coterra Ltd, Lidar 1m DEM, 2024, Ground, Lindas Peak 2000, NZVD2016.
2. LINZ, Lidar 8m DEM, 2012, Bendigo, Lindas Peak 2000, NZVD2016.
3. S-map online, https://smap.landcareresearch.co.nz/
4. Revised Scheme Plan -Draft, prepared by Baxter design, 30 May 2024.
5. Infracon Bendigo Geotech Report, Mt. Iron Geodrill Ltd, 06 June 2023.
6. New Zealand Building Code Clase, E1 Surface water
7. Auckland Stormwater Soakage and Groundwater Recharge in Auckland Region, version 1, 2021.
8. Central Otago District Council Addendum to 4404:2004



CALCULATION SHEET

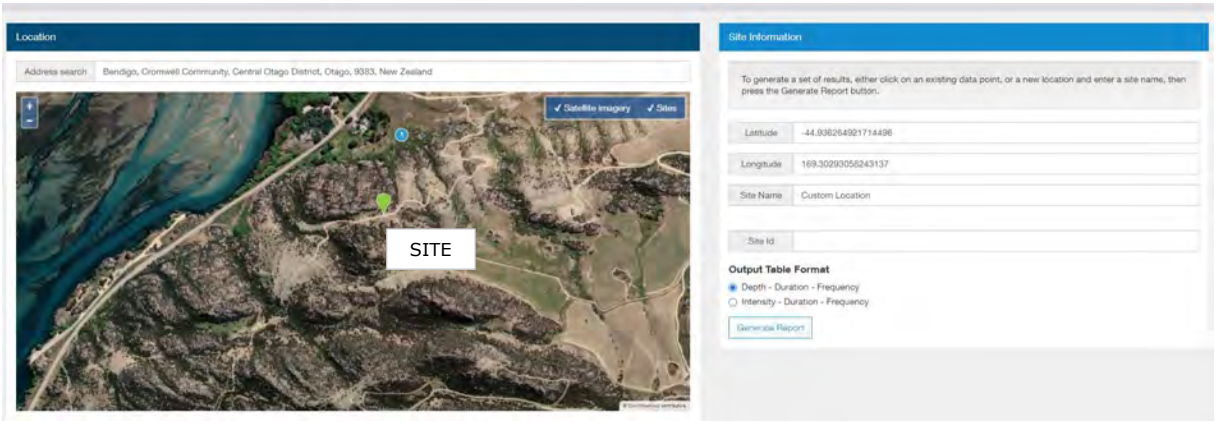
Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	2
Description:	Flood modelling and 3-water design	Designed:	PP		
Date:	10 July 2024	Checked:	-		

C SW-Flood assessment

C.1 Storm water Management Design Philosophy

- Rainfall data: NIWA, HIRDS Version 4, RCP 8.5 for future development.
- On-site waterways delineation: Raingrid method by HEC-RAS.
- River assessment: hydrographs from Otago Reginal Council's Environmental Data Portal.
- On-site flood assessment: Rational method with 2D of HEC-RAS modelling.

C.2 Rainfall (HIRDS Version 4, RCP8.5, Depth, mm)



- Rainfall depths (mm) :: RCP 8.5 for the period 2081-2100

ARI	AEP	10m	``	30m	1h	2h	6h	12h	24h	
1.58	0.633	3.68	5.31	6.63	9.76	14.1	24	32	40.8	
2	0.5	4.2	6.03	7.51	11	15.9	26.9	35.6	45	
5	0.2	6.15	8.71	10.8	15.6	22.2	36.7	48.1	59.8	
10	0.1	7.8	10.9	13.5	19.3	27.2	44.5	57.7	71	
20	0.05	9.68	13.5	16.5	23.4	32.8	52.8	67.9	82.7	
30	0.033	10.9	15.1	18.4	26	36.3	58	74.1	89.9	
40	0.025	11.8	16.3	19.8	27.9	38.8	61.9	78.8	95.2	
50	0.02	12.6	17.3	21	29.5	40.9	64.9	82.4	99.2	
60	0.017	13.2	18.1	22	30.8	42.7	67.5	85.5	103	
80	0.013	14.3	19.6	23.7	33.1	45.6	71.6	90.3	108	
100	0.01	15.2	20.7	25	34.8	47.8	74.9	94.3	113	
250	0.004	19	25.6	30.8	42.4	57.6	88.8	111	131	

- Areal Reduction Factors (ARF) for Rainfall Depth

Table 21-8: Areal Reduction Factors (ARF) for Rainfall Depth.

Area	Duration (hrs)								
(km²)	0.5	1	2	4	6	12	24	48	96
1	0.95	0.96	0.97	0.98	0.98	0.98	0.99	0.99	0.99
2	0.94	0.95	0.96	0.97	0.97	0.98	0.98	0.99	0.99

**** This project area is under 1 km2, So the ARF is 1.**

ARI	Rainfall depth (mm)
10-year	71
100-year	113

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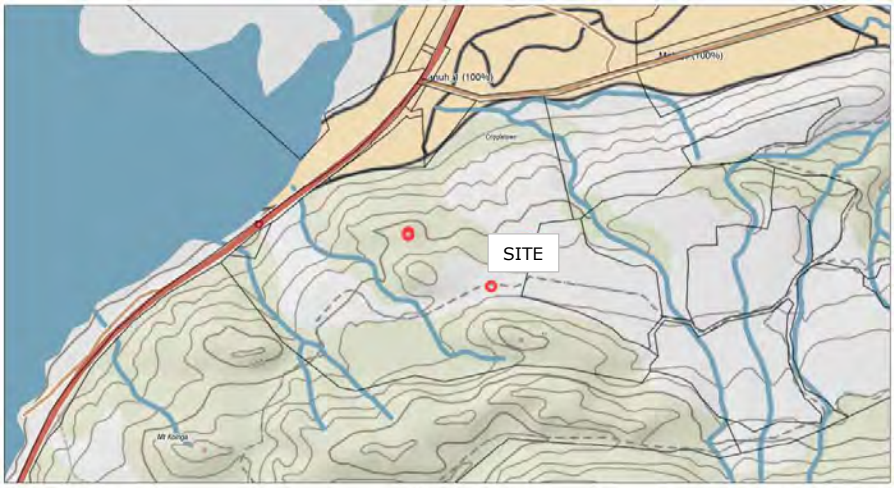
CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	3
Description:	Flood modelling and 3-water design	Designed:	PP		
Date:	10 July 2024	Checked:	-		

C.3 Soil type and CN

Soil type

-Soil type : Soil map (https://smap.landcareresearch.co.nz/maps-and-tools/app/)



SCS TR-55 Table 2-2c – Runoff curve numbers for other agricultural lands[1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Hydrologic condition	A	B	C	D
Pasture, grassland, or range – continuous	Poor	68	79	86	89
forage for graving.[2]	Fair	49	69	79	84
	Good	39	61	74	80
Meadow – continuous grass, protected from		30	58	71	78
grazing and generally mowed for hay.					
Brush – brush-weed mixture with brush	Poor	48	67	77	83
the major element.[3]	Fair	35	56	70	77
	Good	30[4]	48	65	73

SCS Curve Number Method:

	CN
Impervious surface	98
Urban pervious surface	30

Assumed

For each sub-catchments Soil Drainage: Class A-Good condition (Grass cover > 75%)

C.4 Rainfall Depths - Hydrograph Inputs
(Obtained from Guidelines for stormwater runoff modelling, TP108, April 1999)

Table 2: TP108 Normalised 24-hour temporal rainfall intensity profile

Time (hrs: mins)	Time interval (min)	TP108 normalised rainfall intensity (I/I24)	
		Existing condition	Future climate change*
0:00 – 6:00	360	0.34	0.33
6:00 – 9:00	180	0.74	0.73
9:00 – 10:00	60	0.96	0.95
10:00 – 11:00	60	1.40	1.40
11:00 – 11:30	30	2.20	2.20
11:30 – 11:40	10	3.80	3.82
11:40 – 11:50	10	4.80	4.86
11:50 – 12:00	10	8.70	8.86
12:00 – 12:10	10	16.20	16.65
12:10 – 12:20	10	5.90	5.95
12:20 – 12:30	10	4.20	4.24
12:30 – 13:00	30	2.90	2.92
13:00 – 14:00	60	1.70	1.70
14:00 – 15:00	60	1.20	1.19
15:00 – 18:00	180	0.75	0.75
18:00 – 24:00	360	0.40	0.39

* Assuming 2.1°C increase in temperature

*Source: Auckland Council Code of Practice for Land Development and Subdivision, Chapter 4: Stormwater, Version 3.0), Jan 2022

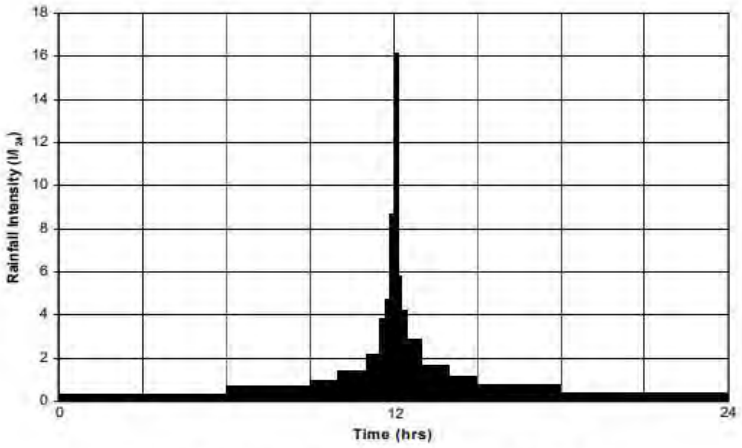


Figure 2.1 - Auckland Region 24 hour Design Storm

*TP108 24 Hour Design Storm
**Source: TP108

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CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	5
Address:	Flood modelling and 3-water design	Designed:	PP		
Env Court Ref:	10 July 2024	Checked:	-		

C.5 Rainfall Distribution for 24 hours

	10-year	100-year
01Jan2000, 00:00	0.0057	0.0091
01Jan2000, 00:05	0.0057	0.0091
01Jan2000, 00:10	0.0057	0.0091
01Jan2000, 00:15	0.0057	0.0091
01Jan2000, 00:20	0.0057	0.0091
01Jan2000, 00:25	0.0057	0.0091
01Jan2000, 00:30	0.0057	0.0091
01Jan2000, 00:35	0.0057	0.0091
01Jan2000, 00:40	0.0057	0.0091
01Jan2000, 00:45	0.0057	0.0091
01Jan2000, 00:50	0.0057	0.0091
01Jan2000, 00:55	0.0057	0.0091
01Jan2000, 01:00	0.0057	0.0091
01Jan2000, 01:05	0.0057	0.0091
01Jan2000, 01:10	0.0057	0.0091
01Jan2000, 01:15	0.0057	0.0091
01Jan2000, 01:20	0.0057	0.0091
01Jan2000, 01:25	0.0057	0.0091
01Jan2000, 01:30	0.0057	0.0091
01Jan2000, 01:35	0.0057	0.0091
01Jan2000, 01:40	0.0057	0.0091
01Jan2000, 01:45	0.0057	0.0091
01Jan2000, 01:50	0.0057	0.0091
01Jan2000, 01:55	0.0057	0.0091
01Jan2000, 02:00	0.0057	0.0091
01Jan2000, 02:05	0.0057	0.0091
01Jan2000, 02:10	0.0057	0.0091
01Jan2000, 02:15	0.0057	0.0091
01Jan2000, 02:20	0.0057	0.0091
01Jan2000, 02:25	0.0057	0.0091
01Jan2000, 02:30	0.0057	0.0091
01Jan2000, 02:35	0.0057	0.0091
01Jan2000, 02:40	0.0057	0.0091
01Jan2000, 02:45	0.0057	0.0091
01Jan2000, 02:50	0.0057	0.0091
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01Jan2000, 03:20	0.0057	0.0091
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01Jan2000, 03:40	0.0057	0.0091
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01Jan2000, 05:30	0.0057	0.0091
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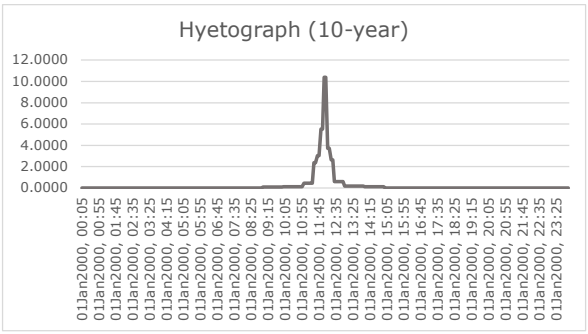
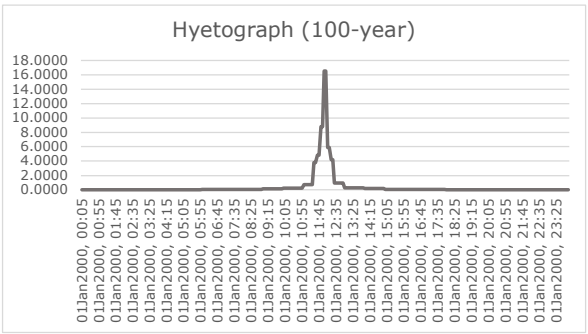
01Jan2000, 05:40	0.0057	0.0091
01Jan2000, 05:45	0.0057	0.0091
01Jan2000, 05:50	0.0057	0.0091
01Jan2000, 05:55	0.0057	0.0091
01Jan2000, 06:00	0.0253	0.0402

Rainfall (mm)	10-year	100-year
	71.00	113.00





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	71.00	**113.00**

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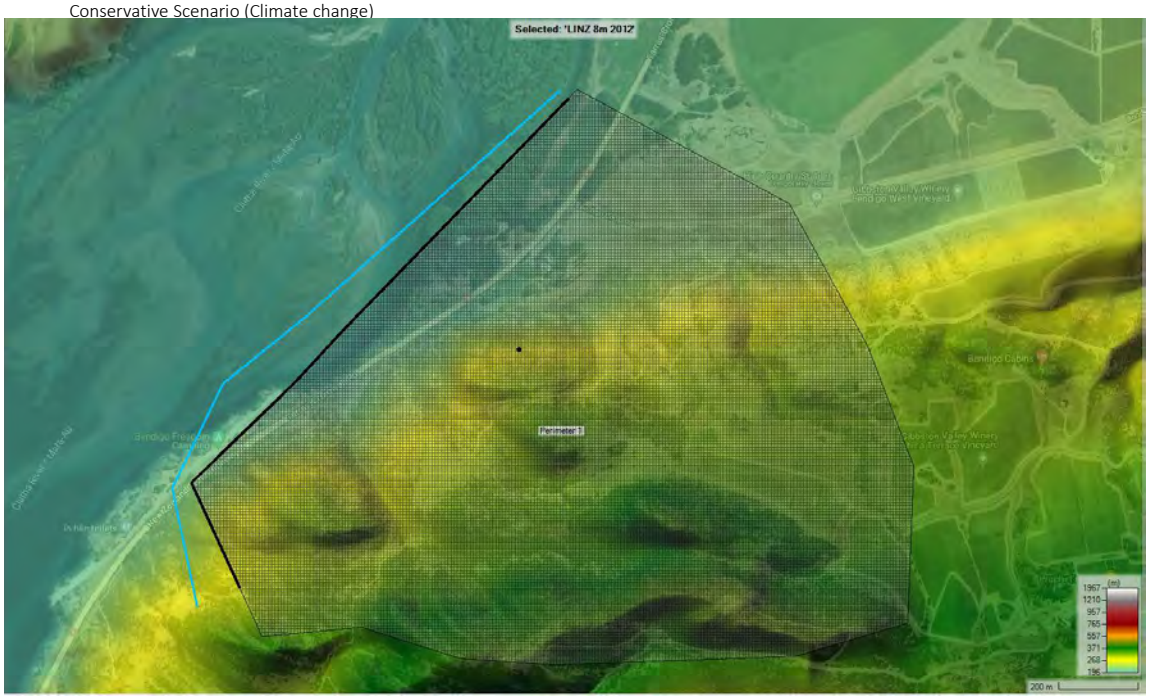
CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	6
Description:	Flood modelling and 3-water design	Designed:	PP		
Date:	10 July 2024	Checked:	-		

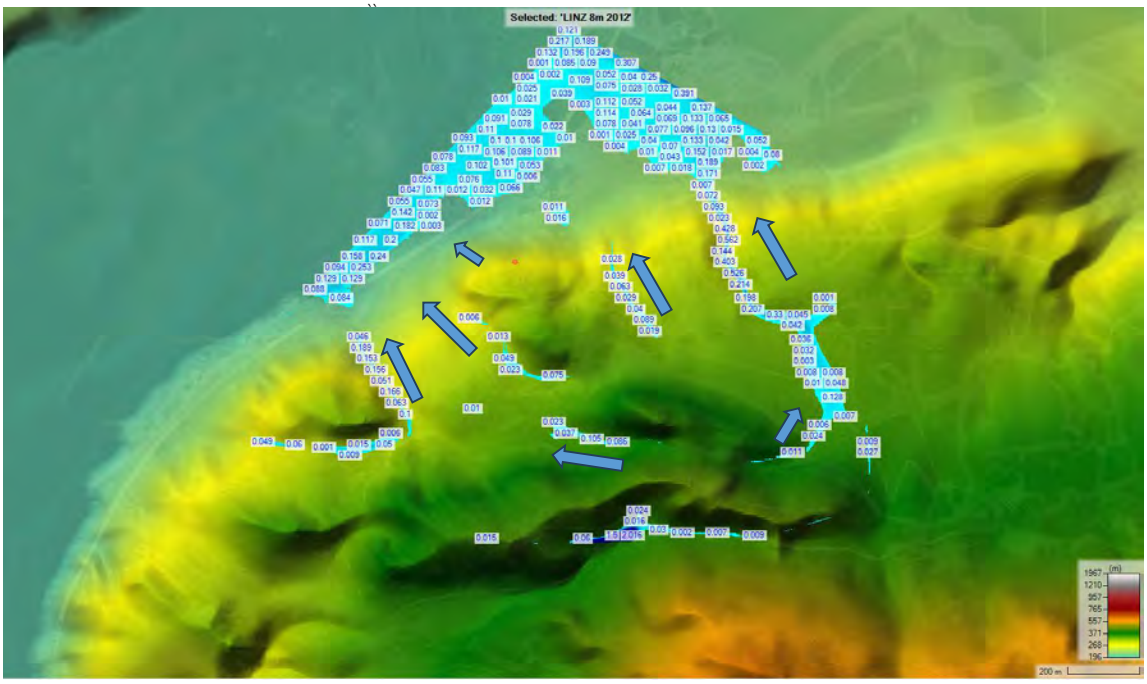
C.6 HEC-RAS for waterways delineation

Modelling Condition

Grid 8 m X 8 m
Manning 0.04 (Grassland)
Computation time 1 Sec
terrain LINZ
Conservative Scenario (Climate change)



Flow direction assessment



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Planning | Surveying | Engineering | Environmental

CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	7
Address:	Flood modelling and 3-water design	Designed:	PP		
Env Court Ref:	10 July 2024	Checked:	-		

C.7 Discharge Distribution for 24 hours

	Cardrona	Clyde point
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01Jan2000, 00:05	0.3303	0.5505
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01Jan2000, 00:15	0.3303	0.5505
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01Jan2000, 00:25	0.3303	0.5505
01Jan2000, 00:30	0.3303	0.5505
01Jan2000, 00:35	0.3303	0.5505
01Jan2000, 00:40	0.3303	0.5505
01Jan2000, 00:45	0.3303	0.5505
01Jan2000, 00:50	0.3303	0.5505
01Jan2000, 00:55	0.3303	0.5505
01Jan2000, 01:00	0.3303	0.5505
01Jan2000, 01:05	0.3303	0.5505
01Jan2000, 01:10	0.3303	0.5505
01Jan2000, 01:15	0.3303	0.5505
01Jan2000, 01:20	0.3303	0.5505
01Jan2000, 01:25	0.3303	0.5505
01Jan2000, 01:30	0.3303	0.5505
01Jan2000, 01:35	0.3303	0.5505
01Jan2000, 01:40	0.3303	0.5505
01Jan2000, 01:45	0.3303	0.5505
01Jan2000, 01:50	0.3303	0.5505
01Jan2000, 01:55	0.3303	0.5505
01Jan2000, 02:00	0.3303	0.5505
01Jan2000, 02:05	0.3303	0.5505
01Jan2000, 02:10	0.3303	0.5505
01Jan2000, 02:15	0.3303	0.5505
01Jan2000, 02:20	0.3303	0.5505
01Jan2000, 02:25	0.3303	0.5505
01Jan2000, 02:30	0.3303	0.5505
01Jan2000, 02:35	0.3303	0.5505
01Jan2000, 02:40	0.3303	0.5505
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01Jan2000, 02:50	0.3303	0.5505
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01Jan2000, 04:00	0.3303	0.5505
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01Jan2000, 04:10	0.3303	0.5505
01Jan2000, 04:15	0.3303	0.5505
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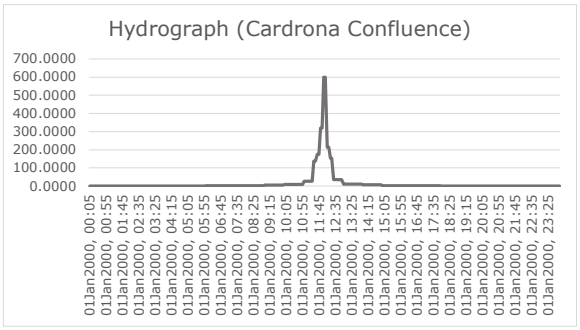
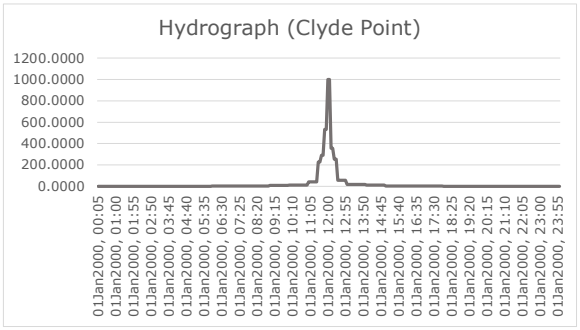
01Jan2000, 05:45	0.3303	0.5505
01Jan2000, 05:50	0.3303	0.5505
01Jan2000, 05:55	0.3303	0.5505
01Jan2000, 06:00	1.4615	2.4358
01Jan2000, 06:05	1.4615	2.4358
01Jan2000, 06:10	1.4615	2.4358

Flood Waring Discharge (CMS)

Station	Cardrona	Clyde point
	600.00	1000.00

****Reference : Otago Reginal Council's Environmental Data Portal (https://envdata.orc.govt.nz/AQWebPortal/Data)**





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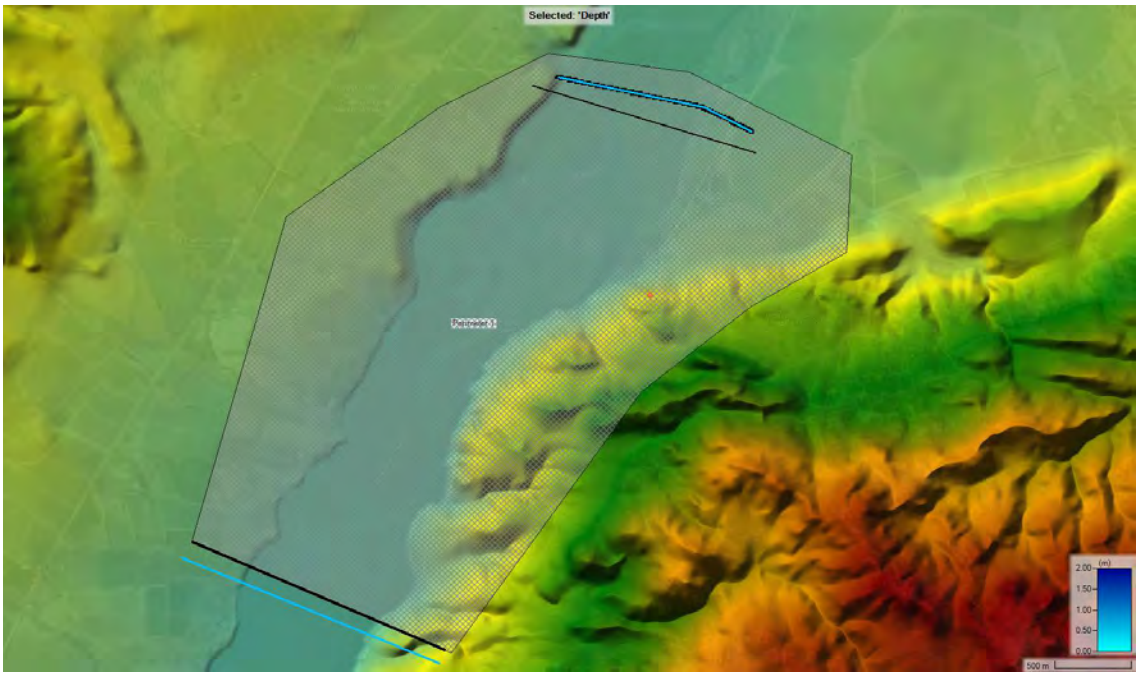
01Jan2000, 23:25	0.3904	0.6506
01Jan2000, 23:30	0.3904	0.6506
01Jan2000, 23:35	0.3904	0.6506
01Jan2000, 23:40	0.3904	0.6506
01Jan2000, 23:45	0.3904	0.6506
01Jan2000, 23:50	0.3904	0.6506
01Jan2000, 23:55	0.3904	0.6506
02Jan2000, 00:00	0.0000	0.0000
	4103.76	**6839.60**

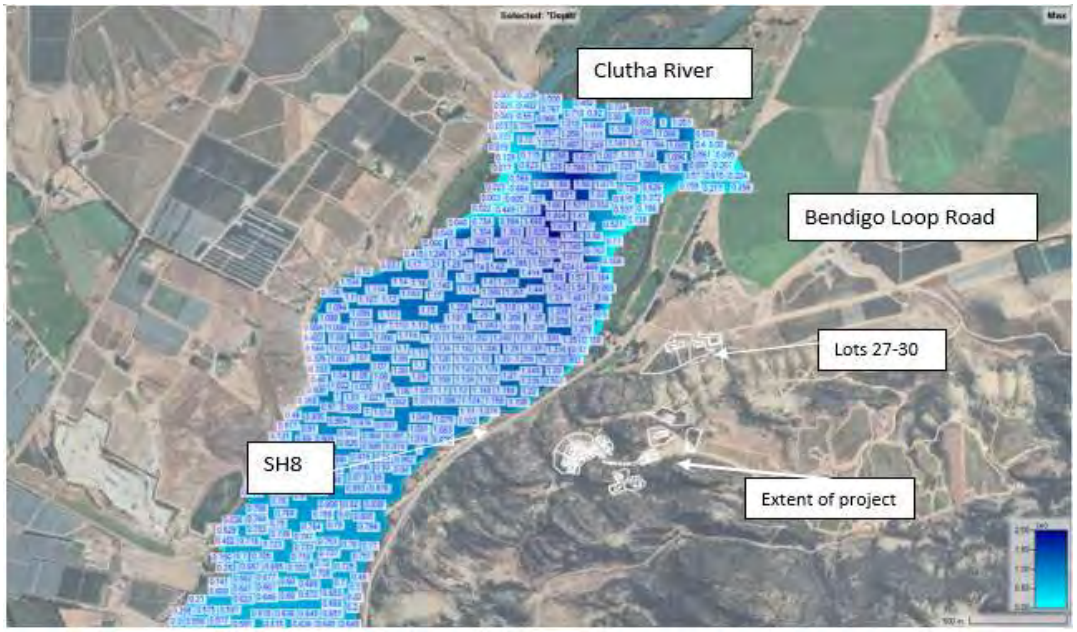
C.8 HEC-RAS for Clutha river capacity check

Modeling Condition

Grid 8 m X 8 m
Manning 0.06 (Emergent Herbaceous Wetlands)
Computation time 1 Sec
terrain LINZ
Conservative Scenario (Flood waring discharge of Clyde Point, 1000 CMS for 24hours)



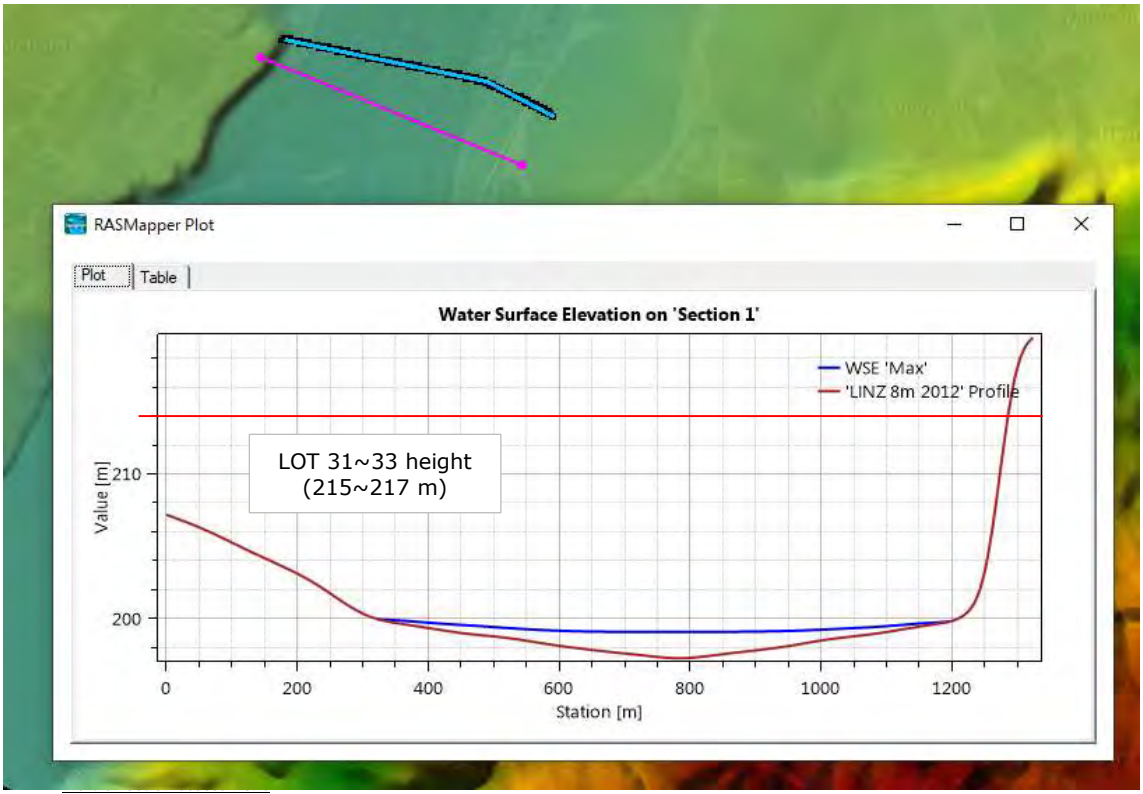
Flow direction assessment



C.9 Clutha River flow capacity check

Clutha River flow capacity check

Reference *LINZ, Lidar 8m DEM, 2012, Bendigo, Lindas Peak 2000, NZVD2016.*



Low point of Site: 215-217m (Lot 31, 32, 33)

Case #1

W(m)	1200		Assumed: Simplize (Rectangle) roughly
H(m)	10		
A(m2)	12000		
V(m/s)	2.10		
n	0.06		
R(m)	9.84	A/P	
S	0.00075	m/m	
Q	25,144.42	m3/s	

$$Q = VA = \left(\frac{1.00}{n}\right) AR^{\frac{2}{3}}\sqrt{S} \quad [SI]$$

Where:

Q = Flow Rate, (ft^3/s)
v = Velocity, (ft/s)
A = Flow Area, (ft^2)
n = Manning's Roughness Coefficient
R = Hydraulic Radius, (ft)
S = Channel Slope, (ft/ft)

Case #2 for modelling

W(m)	884		Assumed: Simplize (triangle) roughly
H(m)	3		
A(m2)	1326		
V(m/s)	0.72		
n	0.05		
R(m)	1.50	A/P	
S	0.00075	m/m	
Q(m3/s	951.68		OK

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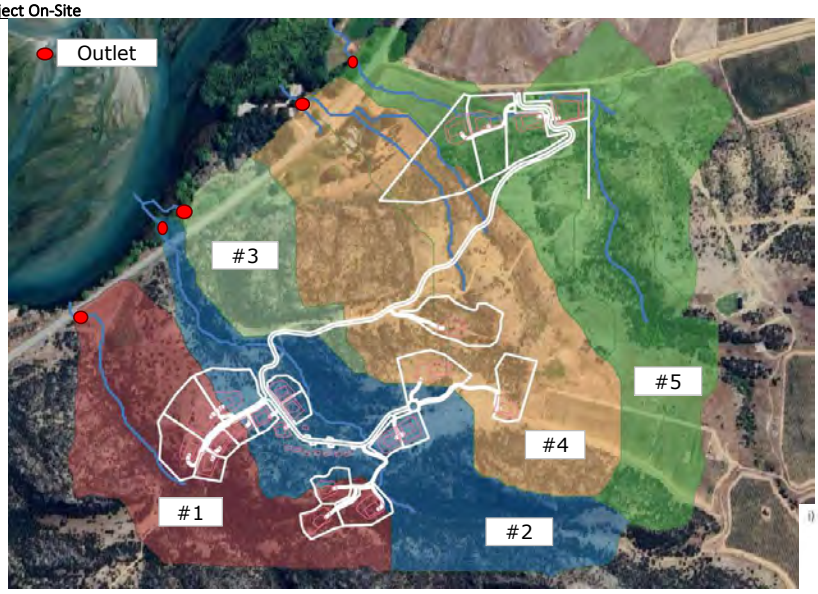
CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	10
Description:	Flood modelling and 3-water design	Designed:	PP		
Date:	10 July 2024	Checked:	-		

D Stormwater Peak flow asessment (Rational method)

D.1 Catchment Delineation

Project On-Site



Reference *Coterra, Lidar 1m DEM, 2024, Ground, Lindas Peak 2000, NZVD2016.*

i) the time of overland flow shall be determined by the formula:

$t = 100\ nL^{0.33}/s^{0.2}$

where

t = time (minutes).

L = length of overland flow (m).

D.2 Rainfall (HIRDS Version 4, RCP 8.5, Intensity, mm/hr)

- Rainfall intensities (mm/hr) :: RCP8.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h
1.58	0.633	22.1	15.9	13.3	9.76	7.06	4.01	2.66	1.7
2	0.5	25.2	18.1	15	11	7.95	4.48	2.97	1.87
5	0.2	36.9	26.1	21.5	15.6	11.1	6.12	4.01	2.49
10	0.1	46.8	32.8	26.9	19.3	13.6	7.41	4.81	2.96
20	0.05	58.1 ``		32.9	23.4	16.4	8.81	5.66	3.44
30	0.033	65.5	45.3	36.8	26	18.1	9.67	6.18	3.74
40	0.025	71	48.9	39.7	27.9	19.4	10.3	6.57	3.97
50	0.02	75.6	51.9	42.1	29.5	20.5	10.8	6.87	4.14
60	0.017	79.4	54.4	44	30.8	21.3	11.3	7.13	4.28
80	0.013	85.9	58.7	47.4	33.1	22.8	11.9	7.53	4.51
100	0.01	91	62	50	34.8	23.9	12.5	7.86	4.7
250	0.004	114	76.9	61.6	42.4	28.8	14.8	9.21	5.44

D.3 Peak Flow

Slope= average slope of catchment determined from GIS maps,

Catchment #1

Scenario	A (m^2)	C	CA	I_{10yr} (mm)	I_{100yr} (mm)	Q_{10} (m^3/s)	Q_{100} (m^3/s)	Tc	Suface
Pre	183600	0.300	55080	32.2	60.8	**0.493**	**0.930**	21	grass
Post	183600	0.309	56691	32.2	60.8	**0.507**	**0.957**	21	Grass+Roof
						0.014	0.027		

Catchment #2

Scenario	A (m^2)	C	CA	I_{10yr} (mm)	I_{100yr} (mm)	Q_{10} (m^3/s)	Q_{100} (m^3/s)	Tc	Suface
Pre	207800	0.306	63558.58	30.4	57.2	**0.537**	**1.010**	24	grass
Post	207800	0.324	67297.53	30.4	57.2	**0.569**	**1.069**	24	Grass+Roof
						0.032	0.059		

Catchment #3

Scenario	A (m^2)	C	CA	I_{10yr} (mm)	I_{100yr} (mm)	Q_{10} (m^3/s)	Q_{100} (m^3/s)	Tc	Suface
Pre	70100	0.300	21030	38.4	73.6	**0.224**	**0.430**	16	grass
Post	70100	0.300	21030	38.4	73.6	**0.224**	**0.430**	16	Grass+Roof
						0.000	0.000		

Catchment #4

Scenario	A (m^2)	C	CA	I_{10yr} (mm)	I_{100yr} (mm)	Q_{10} (m^3/s)	Q_{100} (m^3/s)	Tc	Suface
Pre	297370	0.303	90124.935	32.2	60.8	**0.806**	**1.522**	21	grass
Post	297370	0.309	91791	32.2	60.8	**0.821**	**1.550**	21	Grass+Roof
						0.015	0.028		

Catchment #5

Scenario	A (m^2)	C	CA	I_{10yr} (mm)	I_{100yr} (mm)	Q_{10} (m^3/s)	Q_{100} (m^3/s)	Tc	Suface
Pre	294400	0.303	89233.935	28.1	52.4	**0.696**	**1.299**	28	grass
Post	294400	0.310	91196.4	28.1	52.4	**0.711**	**1.327**	28	Grass+Roof
						0.015	0.029		

** Each rainfall intensity data was calculated by the regression method from HIRDS

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CALCULATION SHEET

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D Stormwater Peak flow asessment (Rational method)

D.4 Weighted C (adjusted C due to catchment slope)

Catchment #1

Scenario	A (m^2)	Natural-_A	roof _A	road_A	C_Natural	C_roof	C_road		Weighted C
Pre	183600	183600	0	0.0	0.30	0.90	0.55		0.300
Post	183600	180915	1630	1055.0	0.30	0.90	0.90		0.309

Catchment #2

Scenario	A (m^2)	Natural-_A	roof _A	road_A	C_Natural	C_roof	C_road		Weighted C
Pre	207800	207800	0	2215.6	0.30	0.90	0.55		0.306
Post	207800	199537	2162.55	6100.0	0.30	0.90	0.90		0.324

Catchment #3

Scenario	A (m^2)	Natural-_A	roof _A	road_A	C_Natural	C_roof	C_road		Weighted C
Pre	70100	70100	0	0.0	0.30	0.90	0.55		0.300
Post	70100	70100	0	0.0	0.30	0.90	0.90		0.300

Catchment #4

Scenario	A (m^2)	Natural-_A	roof _A	road_A	C_Natural	C_roof	C_road		Weighted C
Pre	297370	297370	0	1661.7	0.30	0.90	0.55		0.303
Post	297370	293070	730	3570.0	0.30	0.90	0.90		0.309

Catchment #5

Scenario	A (m^2)	Natural-_A	roof _A	road_A	C_Natural	C_roof	C_road		Weighted C
Pre	294400	294400	0	1661.7	0.30	0.90	0.55		0.303
Post	294400	289606	1400	3394.0	0.30	0.90	0.90		0.310

** Assumed for natural surface C value: Medium Soakage soil types (Bush and scrub cover,0.25) plus slope correction coefficients (0.05)
C value was determined based on the data from S-map and the provided Mt. Iron Drill Geotech report.
In mountainous areas, c-values typically range from 0.3 to 0.6 or even higher, depending on factors like slope steepness, soil type, land cover, and rainfall intens
The decision to use a C value of 0.3 was made considering these circumstances for the first setting.(0.25+0.05=0.3)

D.5 Coverage

Lot	Building Platform (m2)	Coverage of RBP		Curtilage Area (m2)
1	400	0.55		1900.0
2	450	0.49		2449.0
3	450	0.49		1603.0
4	421	0.52		1411.0
5	393	0.56		1104.0
6	392	0.56		1191.0
7	400	0.55		985.0
8	360	0.56		1313.0
9	373	0.54		1084.0
10	279	0.54		718.0
11	84	1.00		
12	84	1.00		
13	84	1.00		
14	84	1.00		
15	84	1.00		
16	84	1.00		
17	84	1.00		
18	84	1.00		
19	272	0.92		1080.0
20	395	0.63		1813.0
21	508	0.49		1666.0
22	400	0.63		1424.0
23	385	0.65		1612.0
24	499	0.50		2059.0
25	339	0.65		1440.0
26	465	0.56		1675.0
27	714	0.49		2207.0
28	575	0.61		2035.0
29	611	0.57		1671.0
30	1494	0.23		3123.0

**Descprition

Catchment #1
Catchment #2
Catchment #3
Catchment #4
Catchment #5

Table 1: Run-off Coefficients
Paragraphs 2.0.1, 2.1.1, 2.1.3

Description of surface	C
Natural surface types	
Bare impermeable clay with no interception channels or run-off control	0.70
Bare uncultivated soil of medium soakage	0.60
Heavy clay soil types:	
– pasture and grass cover	0.40
– bush and scrub cover	0.35
– cultivated	0.30
Medium soakage soil types:	
– pasture and grass cover	0.30
– bush and scrub cover	0.25
– cultivated	0.20
High soakage gravel, sandy and volcanic soil types:	
– pasture and grass cover	0.20
– bush and scrub cover	0.15
– cultivated	0.10
Parks, playgrounds and reserves:	
– mainly grassed	0.30
– predominantly bush	0.25
Gardens, lawns, etc.	0.25
Developed surface types	
Fully roofed and/or sealed developments	0.90
Steel and non-absorbent roof surfaces	0.90
Asphalt and concrete paved surfaces	0.85
Near flat and slightly absorbent roof surfaces	0.80
Stone, brick and precast concrete paving panels:	
– with sealed joints	0.80
– with open joints	0.60
Unsealed roads	0.50
Railway and unsealed yards and similar surfaces	0.35
Land use types	
Industrial, commercial, shopping areas and town house developments	0.65
Residential areas in which the impervious area is less than 36% of gross area	0.45
Residential areas in which impervious area is 36% to 50% of gross area	0.55

Note:
Where the impervious area exceeds 50% of gross area, use method of Paragraph 2.1.2.

2.0 Estimation of Surface Water Run-Off

2.0.1 *Surface water* run-off for the catchment shall be calculated using the Rational Method. The formula to be used is:

$Q_p = CIA_p/360$

where

Q_p = catchment run-off (m^3/s).
C = run-off coefficient (see Table 1).
I = rainfall intensity (mm/hr).
A_p = area (hectares) of catchment above the point being considered.

i) the time of overland flow shall be determined by the formula:

$t = 100\ nL^{0.39}/s^{0.2}$

where

t = time (minutes).
L = length of overland flow (m).
s = slope (%).
n = Manning's 'n' (roughness coeffiecient).

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CALCULATION SHEET

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D.6 Each lots, SW design

Rainfall: 10-year

Lot	Building Platform (m2)	Site Coverage of RBP	C_Pre (Assumed)	C_Post (Assumed)	I_{10} -10min	Peak Q_{10} (L/s) Pre	Peak Q_{10} (L/s) Post	Peak Q_{10} (L/s) Post-Pre	Suface
1	400	0.55	0.30	0.63	46.8	**1.6**	**3.3**	1.7	Low density areas, Tc 10mins
2	450	0.49	0.30	0.59	46.8	**1.8**	**3.5**	1.7	Low density areas, Tc 10mins
3	450	0.49	0.30	0.59	46.8	**1.8**	**3.5**	1.7	Low density areas, Tc 10mins
4	421	0.52	0.30	0.61	46.8	**1.6**	**3.4**	1.7	Low density areas, Tc 10mins
5	393	0.56	0.30	0.64	46.8	**1.5**	**3.2**	1.7	Low density areas, Tc 10mins
6	392	0.56	0.30	0.64	46.8	**1.5**	**3.2**	1.7	Low density areas, Tc 10mins
7	400	0.55	0.30	0.63	46.8	**1.6**	**3.3**	1.7	Low density areas, Tc 10mins
8	360	0.56	0.30	0.63	46.8	**1.4**	**3.0**	1.6	Low density areas, Tc 10mins
9	373	0.54	0.30	0.62	46.8	**1.5**	**3.0**	1.6	Low density areas, Tc 10mins
10	279	0.54	0.30	0.62	46.8	**1.1**	**2.3**	1.2	Low density areas, Tc 10mins
11	84	1.00	0.30	0.90	46.8	**0.3**	**1.0**	0.7	Low density areas, Tc 10mins
12	84	1.00	0.30	0.90	46.8	**0.3**	**1.0**	0.7	Low density areas, Tc 10mins
13	84	1.00	0.30	0.90	46.8	**0.3**	**1.0**	0.7	Low density areas, Tc 10mins
14	84	1.00	0.30	0.90	46.8	**0.3**	**1.0**	0.7	Low density areas, Tc 10mins
15	84	1.00	0.30	0.90	46.8	**0.3**	**1.0**	0.7	Low density areas, Tc 10mins
16	84	1.00	0.30	0.90	46.8	**0.3**	**1.0**	0.7	Low density areas, Tc 10mins
17	84	1.00	0.30	0.90	46.8	**0.3**	**1.0**	0.7	Low density areas, Tc 10mins
18	84	1.00	0.30	0.90	46.8	**0.3**	**1.0**	0.7	Low density areas, Tc 10mins
19	272	0.92	0.30	0.85	46.8	**1.1**	**3.0**	2.0	Low density areas, Tc 10mins
20	395	0.63	0.30	0.68	46.8	**1.5**	**3.5**	2.0	Low density areas, Tc 10mins
21	508	0.49	0.30	0.60	46.8	**2.0**	**3.9**	2.0	Low density areas, Tc 10mins
22	400	0.63	0.30	0.68	46.8	**1.6**	**3.5**	2.0	Low density areas, Tc 10mins
23	385	0.65	0.30	0.69	46.8	**1.5**	**3.5**	2.0	Low density areas, Tc 10mins
24	499	0.50	0.30	0.60	46.8	**1.9**	**3.9**	2.0	Low density areas, Tc 10mins
25	339	0.65	0.30	0.69	46.8	**1.3**	**3.0**	1.7	Low density areas, Tc 10mins
26	465	0.56	0.30	0.64	46.8	**1.8**	**3.8**	2.0	Low density areas, Tc 10mins
27	714	0.49	0.30	0.59	46.8	**2.8**	**5.5**	2.7	Low density areas, Tc 10mins
28	575	0.61	0.30	0.67	46.8	**2.2**	**5.0**	2.7	Low density areas, Tc 10mins
29	611	0.57	0.30	0.64	46.8	**2.4**	**5.1**	2.7	Low density areas, Tc 10mins
30	1494	0.23	0.30	0.44	46.8	**5.8**	**8.6**	2.7	Low density areas, Tc 10mins
Total						**43.9**	**91.8**	**47.9**	

Rainfall: 100-year

Lot	Building Platform (m2)	Site Coverage of RBP (%)	C_Pre (Assumed)	C_Post (Assumed)	I_{100} -10min	Peak Q_{100} (L/s) Pre	Peak Q_{100} (L/s) Post	Peak Q_{100} (L/s) Post-Pre	Suface
1	400	0.55	0.30	0.63	91.0	**3.0**	**6.4**	3.3	Low density areas, Tc 10mins
2	450	0.49	0.30	0.59	91.0	**3.4**	**6.7**	3.3	Low density areas, Tc 10mins
3	450	0.49	0.30	0.59	91.0	**3.4**	**6.7**	3.3	Low density areas, Tc 10mins
4	421	0.52	0.30	0.61	91.0	**3.2**	**6.5**	3.3	Low density areas, Tc 10mins
5	393	0.56	0.30	0.64	91.0	**3.0**	**6.3**	3.3	Low density areas, Tc 10mins
6	392	0.56	0.30	0.64	91.0	**3.0**	**6.3**	3.3	Low density areas, Tc 10mins
7	400	0.55	0.30	0.63	91.0	**3.0**	**6.4**	3.3	Low density areas, Tc 10mins
8	360	0.56	0.30	0.63	91.0	**2.7**	**5.8**	3.0	Low density areas, Tc 10mins
9	373	0.54	0.30	0.62	91.0	**2.8**	**5.9**	3.0	Low density areas, Tc 10mins
10	279	0.54	0.30	0.62	91.0	**2.1**	**4.4**	2.3	Low density areas, Tc 10mins
11	84	1.00	0.30	0.90	91.0	**0.6**	**1.9**	1.3	Low density areas, Tc 10mins
12	84	1.00	0.30	0.90	91.0	**0.6**	**1.9**	1.3	Low density areas, Tc 10mins
13	84	1.00	0.30	0.90	91.0	**0.6**	**1.9**	1.3	Low density areas, Tc 10mins
14	84	1.00	0.30	0.90	91.0	**0.6**	**1.9**	1.3	Low density areas, Tc 10mins
15	84	1.00	0.30	0.90	91.0	**0.6**	**1.9**	1.3	Low density areas, Tc 10mins
16	84	1.00	0.30	0.90	91.0	**0.6**	**1.9**	1.3	Low density areas, Tc 10mins
17	84	1.00	0.30	0.90	91.0	**0.6**	**1.9**	1.3	Low density areas, Tc 10mins
18	84	1.00	0.30	0.90	91.0	**0.6**	**1.9**	1.3	Low density areas, Tc 10mins
19	272	0.92	0.30	0.85	91.0	**2.1**	**5.9**	3.8	Low density areas, Tc 10mins
20	395	0.63	0.30	0.68	91.0	**3.0**	**6.8**	3.8	Low density areas, Tc 10mins
21	508	0.49	0.30	0.60	91.0	**3.9**	**7.6**	3.8	Low density areas, Tc 10mins
22	400	0.63	0.30	0.68	91.0	**3.0**	**6.8**	3.8	Low density areas, Tc 10mins
23	385	0.65	0.30	0.69	91.0	**2.9**	**6.7**	3.8	Low density areas, Tc 10mins
24	499	0.50	0.30	0.60	91.0	**3.8**	**7.6**	3.8	Low density areas, Tc 10mins
25	339	0.65	0.30	0.69	91.0	**2.6**	**5.9**	3.3	Low density areas, Tc 10mins
26	465	0.56	0.30	0.64	91.0	**3.5**	**7.5**	3.9	Low density areas, Tc 10mins
27	714	0.49	0.30	0.59	91.0	**5.4**	**10.7**	5.3	Low density areas, Tc 10mins
28	575	0.61	0.30	0.67	91.0	**4.4**	**9.7**	5.3	Low density areas, Tc 10mins
29	611	0.57	0.30	0.64	91.0	**4.6**	**9.9**	5.3	Low density areas, Tc 10mins
30	1494	0.23	0.30	0.44	91.0	**11.3**	**16.6**	5.3	Low density areas, Tc 10mins
Total						**85.3**	**178.4**	**93.2**	

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CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	13
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Date:	10 July 2024	Checked:	-		

D.7 Soakage Design (Stormwater management)

Infiltration capacity test from Mt, Iron Geodrill's Geotech report

239	DR1	mm/hr
438	DR2	mm/hr
167	DR3	mm/hr
281.33	Average	mm/hour
4.689		L/min

Porosity 0.38

Soakage design based on New Zealand Building Code Clase, E1 Surface water

9.0.5 The volume of storage required in the soak pit, V_{stor} (m^3), shall be calculated by:

$V_{stor} = R_c - V_{soak}$

where

R_c = run-off discharged from catchment to soak pit in 1 hour (m^3).

V_{soak} = volume disposed of by soakage in 1 hour (m^3).

and

$R_c = 10CIA$

where

C = run-off coefficient (see Table 1).

I = rainfall intensity (mm/hr) based on 1 hour duration of an event having a 10% probability of occurring annually.

A = area (hectares) of the catchment discharging to the soak pit.

and

$V_{soak} = A_{sp}S_r/1000$

where

A_{sp} = area of the base of the soak pit (m^2).

S_r = soakage rate (mm/hr) determined from 9.0.2.

Lot	Building Platform (m2)	C_Post	I_{10} (1hour)	Rc (m3) Post	Soakage Area (m2) Assumed	V (soak), m3	V (stor) m3
1	400	0.63	19.3	**4.864**	1	0.281	**5.0**
2	450	0.59	19.3	**5.153**	1	0.281	**5.0**
3	450	0.59	19.3	**5.153**	1	0.281	**5.0**
4	421	0.61	19.3	**4.985**	1	0.281	**5.0**
5	393	0.64	19.3	**4.823**	1	0.281	**5.0**
6	392	0.64	19.3	**4.817**	1	0.281	**5.0**
7	400	0.63	19.3	**4.864**	1	0.281	**5.0**
8	360	0.63	19.3	**4.400**	1	0.281	**5.0**
9	373	0.62	19.3	**4.476**	1	0.281	**5.0**
10	279	0.62	19.3	**3.352**	1	0.281	**4.0**
11	84	0.90	19.3	**1.459**	1	0.281	**2.0**
12	84	0.90	19.3	**1.459**	1	0.281	**2.0**
13	84	0.90	19.3	**1.459**	1	0.281	**2.0**
14	84	0.90	19.3	**1.459**	1	0.281	**2.0**
15	84	0.90	19.3	**1.459**	1	0.281	**2.0**
16	84	0.90	19.3	**1.459**	1	0.281	**2.0**
17	84	0.90	19.3	**1.459**	1	0.281	**2.0**
18	84	0.90	19.3	**1.459**	1	0.281	**2.0**
19	272	0.85	19.3	**4.470**	1	0.281	**5.0**
20	395	0.68	19.3	**5.182**	1	0.281	**5.0**
21	508	0.60	19.3	**5.836**	1	0.281	**6.0**
22	400	0.68	19.3	**5.211**	1	0.281	**5.0**
23	385	0.69	19.3	**5.124**	1	0.281	**5.0**
24	499	0.60	19.3	**5.784**	1	0.281	**6.0**
25	339	0.69	19.3	**4.510**	1	0.281	**5.0**
26	465	0.64	19.3	**5.703**	1	0.281	**6.0**
27	714	0.59	19.3	**8.187**	1	0.281	**8.0**
28	575	0.67	19.3	**7.382**	1	0.281	**8.0**
29	611	0.64	19.3	**7.591**	1	0.281	**8.0**
30	1494	0.44	19.3	**12.703**	1	0.281	**13.0**

** Assumed soakage area 1m2 for making calculation sheet, but it will be changed by each site conditons during RC.

CKL
Planning | Surveying | Engineering | Environmental

CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	14
Address:	Flood modelling and 3-water design	Designed:	PP		
Env Court Ref:	10 July 2024	Checked:	0		

D.8 Discharge Distribution during 24 hours for each catchment-Post condition

100-yr peak flow rate

100-yr peak flow rate (m3/sce)

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0.957	1.069		0.430	1.550	1.327

	#1	#2	#3	#4	#5
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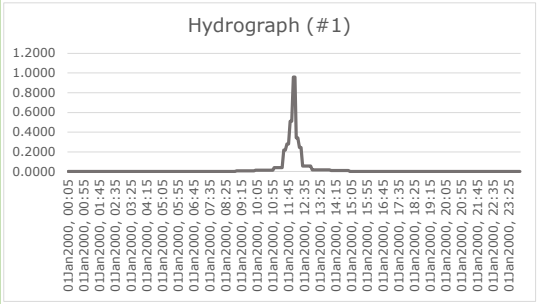

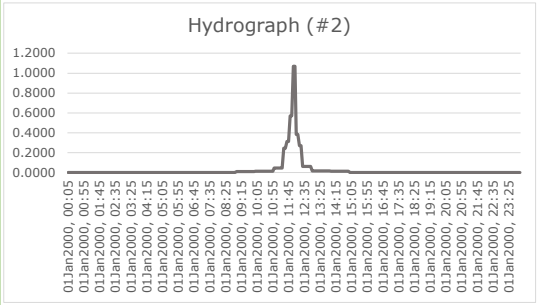

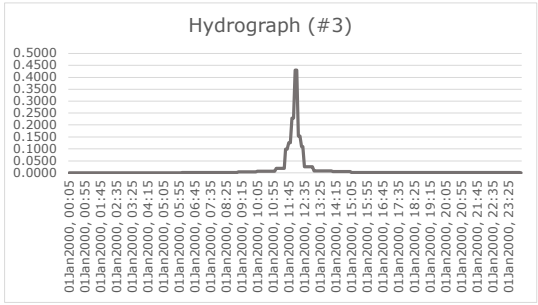

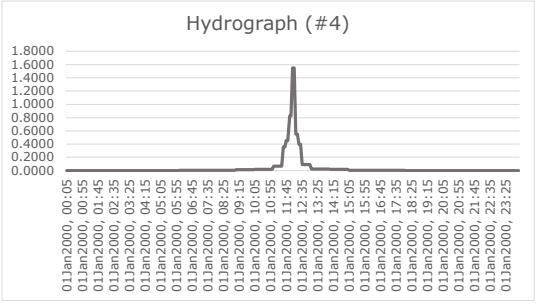

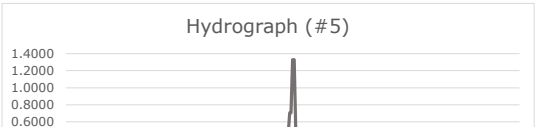

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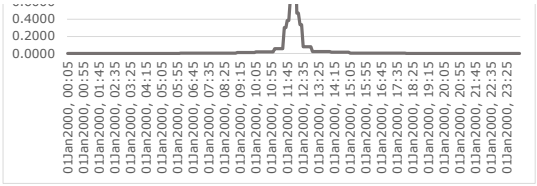

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02Jan2000, 00:00	0.0000	0.0000	0.0000	0.0000	0.0000

D.9 HEC-RAS for Post-development

Modeling Condition

Grid 3 m X 3 m
Manning 0.04 (Grassland) for watercourses
Based on the results of the initial survey conducted to identify watercourses, it was observed most of the channels are vegetated. Therefore, the n value was assumed according to the referenced table.
Computation time 0.5 Sec
terrain Coterra Ground DEMs
Conservative Scenario (using each catchment peak flow rate to top of catchment)

Flood Depth

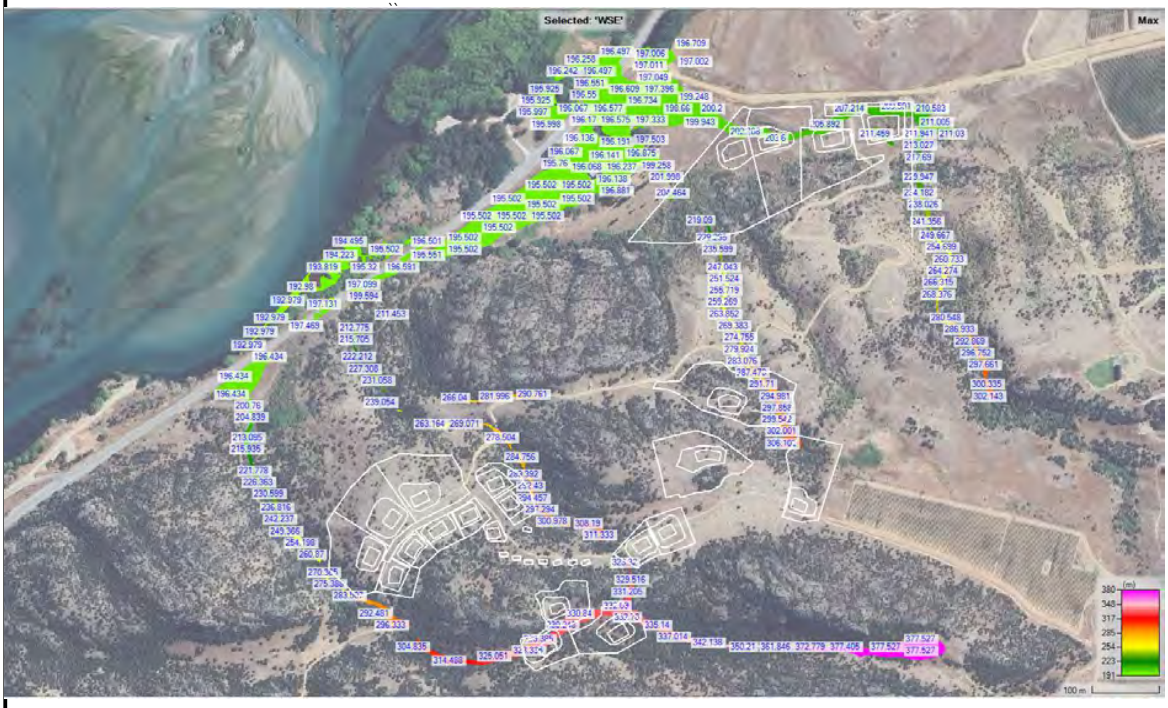
CKL
Planning | Surveying | Engineering | Environmental

CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	16
Description:	Flood modelling and 3-water design	Designed:	PP		
Date:	10 July 2024	Checked:	-		

Velocities

WSE



CKL
Planning | Surveying | Engineering | Environmental

CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	17
Address:	Flood modelling and 3-water design	Designed:	PP		
Env Court Ref:	10 July 2024	Checked:	-		

D.10 Discharge Distribution during 24 hours for each catchment-Pre condition

100-yr peak flow rate

100-yr peak flow rate (m3/sce)

#1	#2	#3	#4	#5
0.930	1.010		0.430	1.522	1.299

	#1	#2	#3	#4	#5
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01Jan2000, 02:20	0.0005	0.0006	0.0002	0.0008	0.0007
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01Jan2000, 02:40	0.0005	0.0006	0.0002	0.0008	0.0007
01Jan2000, 02:45	0.0005	0.0006	``	0.0008	0.0007
01Jan2000, 02:50	0.0005	0.0006	0.0002	0.0008	0.0007
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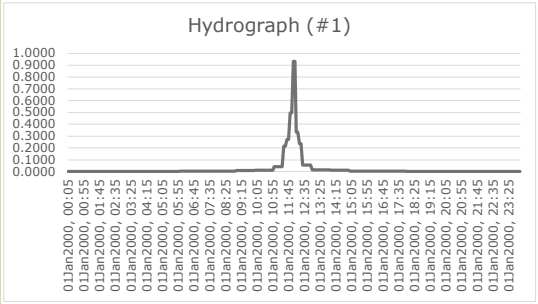

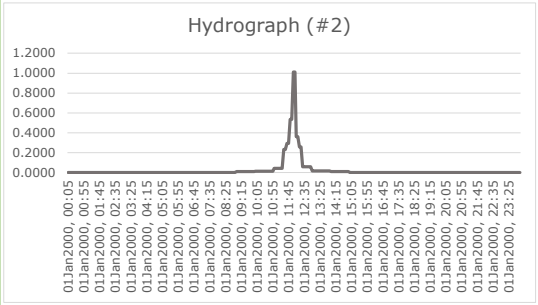

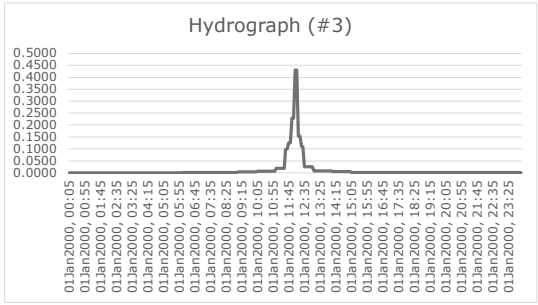

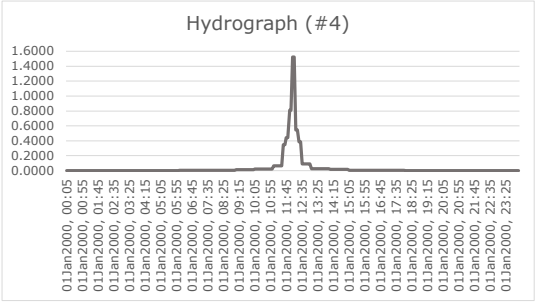

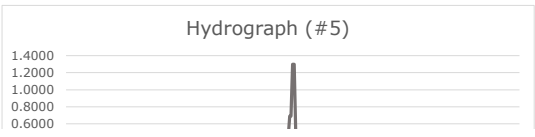

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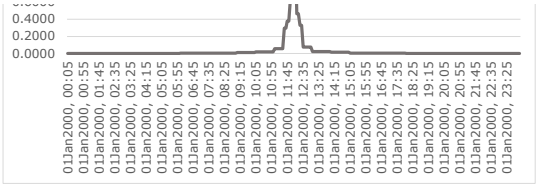

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Planning | Surveying | Engineering | Environmental

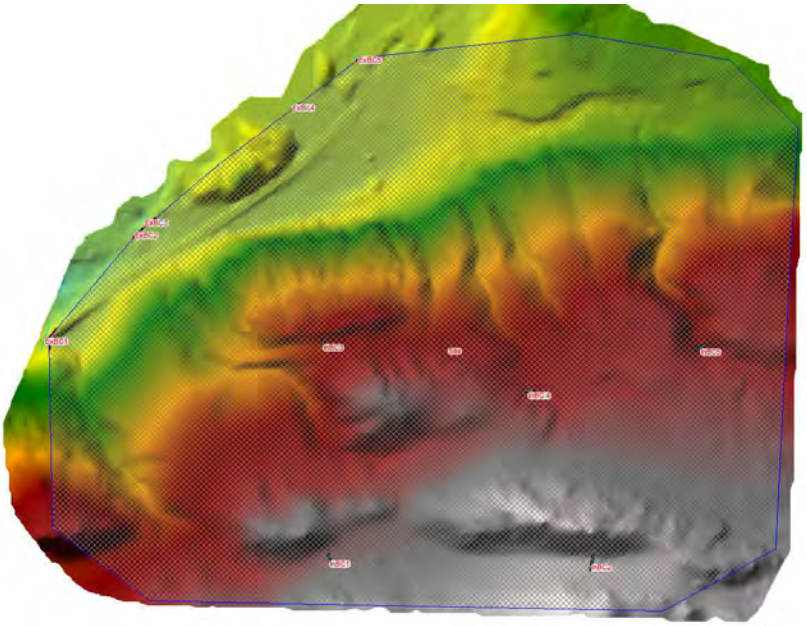
CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	18
Description:	Flood modelling and 3-water design	Designed:	PP		
Date:	10 July 2024	Checked:	-		

D.11 HEC-RAS for pre-development

Modeling Condition

Grid 3 m X 3 m
Manning 0.04 (Grassland) for watercourses
Based on the results of the initial survey conducted to identify watercourses, it was observed most of the channels are vegetated. Therefore, the n value was assumed according to the referenced table.
Computation time 0.5 Sec
terrain Coterra Ground DEMs
Conservative Scenario (using each catchment peak flow rate to top of catchment)



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Flood depth

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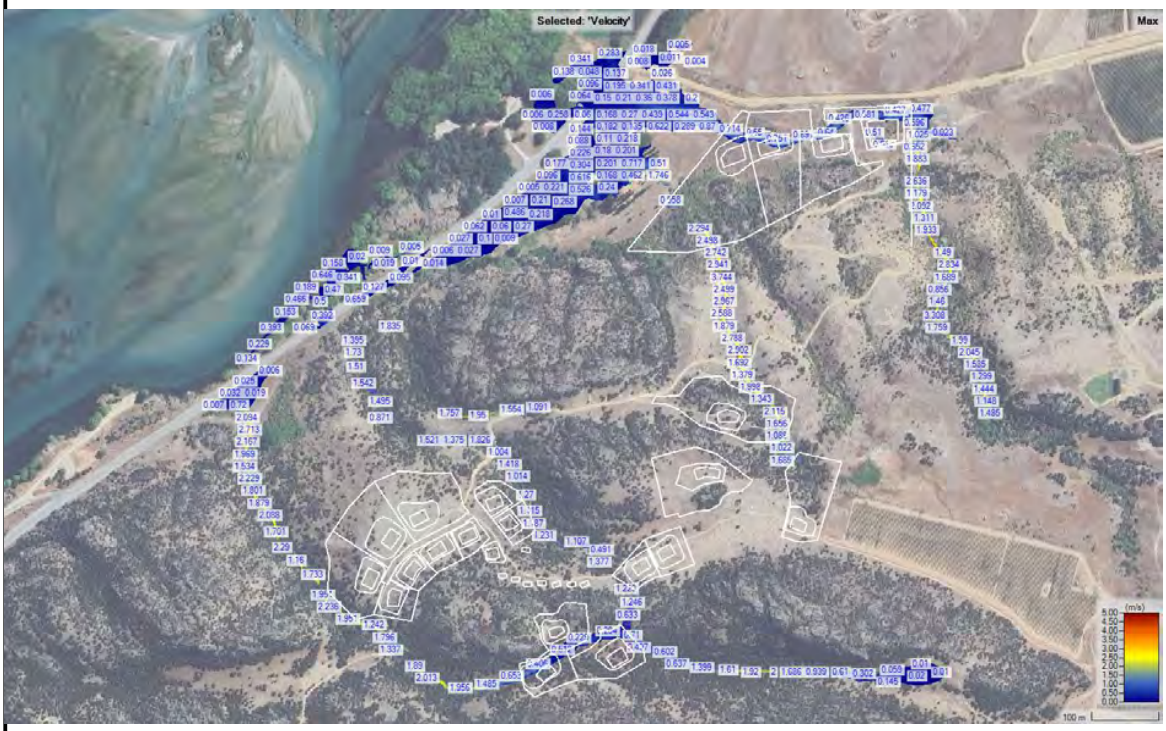
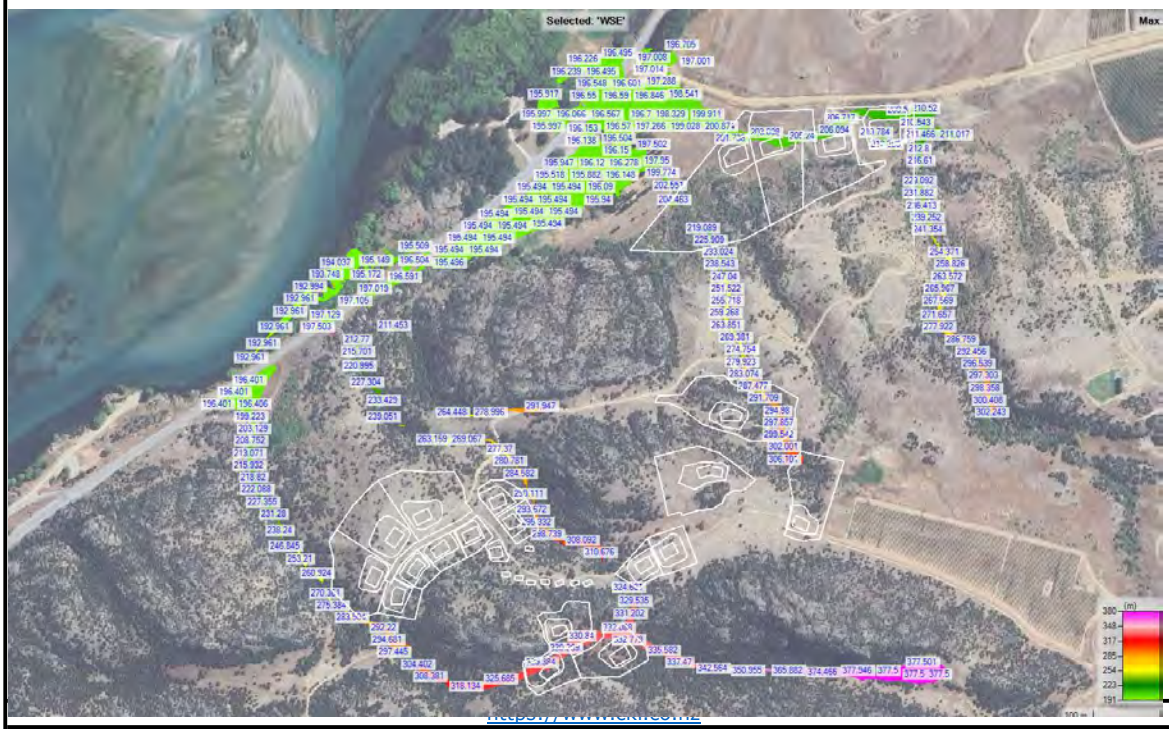
CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	19
Description:	Flood modelling and 3-water design	Designed:	PP		
Date:	10 July 2024	Checked:	-		

Velocities



WSE

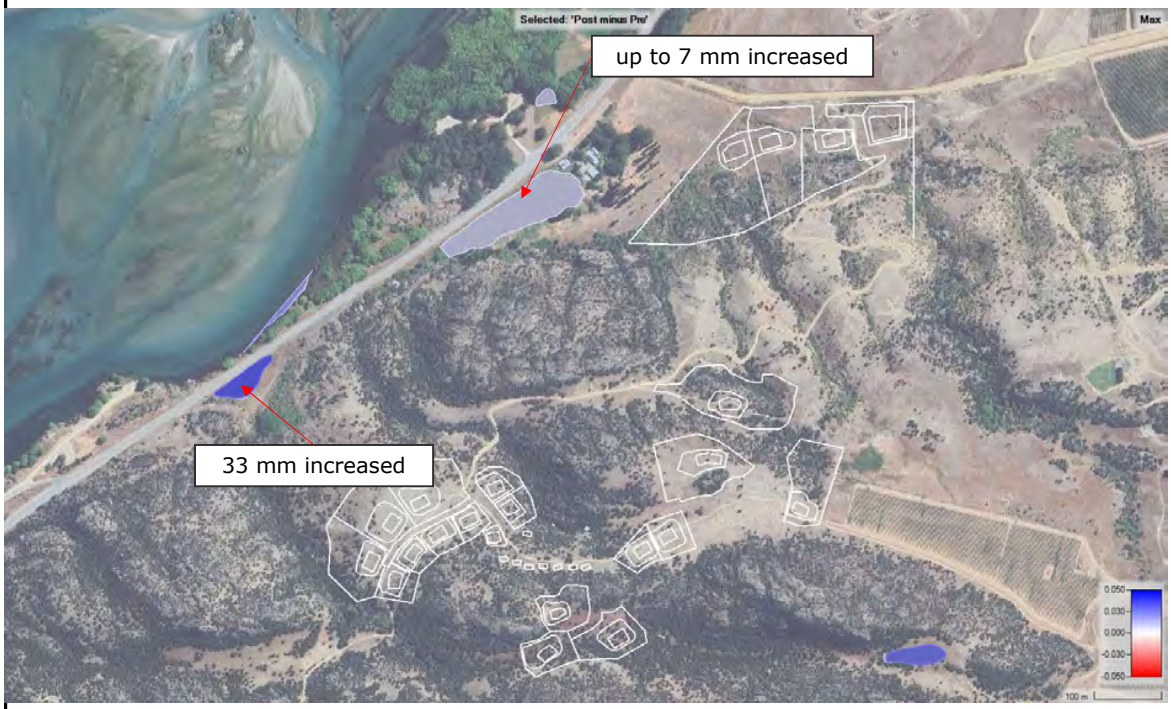


CKL
Planning | Surveying | Engineering | Environmental

CALCULATION SHEET

Project:	Rocky Point, Bendigo	Job No:	A23205	Sheet:	20
Description:	Flood modelling and 3-water design	Designed:	PP		
Date:	10 July 2024	Checked:	-		

D.12 Flood gap map (Post minus pre-development)



WILDFIRE MANAGEMENT NZ
Wildfire Management Specialist
027 5580545
jamie@wildfirenz.nz
PO Box 2775, Wakatipu, Queenstown 9349

26/07/2024

Infracon Ltd.

Rocky Point Development

Wildfire Management NZ has assessed the risk to the proposed Rocky Point development at Bendigo associated with wildfires.

An initial Wildfire Threat Assessment (WTA) was completed to determine the potential for a wildfire to impact on this site, and the mitigating factors to reduce a wildfires impact to an acceptable level.

These mitigation recommendations have for the most part been built into the current development proposal. As the development progresses these will need to be reviewed and refined.

The developers are committed to ensuring that fire risk management is a key component of this project with a large investment in vegetation and ember attack suppression sprinklers proposed. It should be noted that suppression systems of this type are new to NZ and that the Rocky Point Development proposal is leading the way from a national perspective.

Wildfire Management NZ is happy with the proposal in general terms, acknowledging that this is early in the process and revisions are expected.

Yours sincerely,

Jamie Cowan
Wildfire Management Specialist
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COTERRA.

Surveying, Planning and
Land Development
Central Otago

Rocky Point

Report on property and consent history

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1 BACKGROUND AND PURPOSE

This report is written in support of the subdivision consent by TKO Properties Ltd for the Rocky Point site at Bendigo.

Coterra (Matt Suddaby and Jack Lister) have been engaged by TKO to provide surveying and advisory services in respect of TKO's proposed development. Matt Suddaby was also engaged by the prior owner of the property to provide surveying and planning services. We have been involved in several iterations of consenting for the neighbouring "Bendigo Hills" property, both for TKO and for the prior owner, Brett Larsen.

We are familiar with the Bendigo Station property and its surrounds. We have a long history of working throughout the Wanaka/Central Otago area.

In preparing this report we have reviewed the land titles, current and past, extending back prior to the 1993-4 tenure review process which was the catalyst for establishing the Rocky Point special zone. We have read the Bendigo Station Pastoral Lease PO 221/223 Report, dated 1 Sept 2023 (attached).

We have been asked to provide a description of how the relevant land titles, covenants and consent rules have evolved over the period from tenure review until today.

It is acknowledged that there are now limited Council records available relating to the creation of the Rocky Point special zone. Some of the background referred to here is based on discussion from people involved, including the Perriam family, and other property professionals working at that time.

2 PROPERTY ORIGINS

2.1 Property history

Pre 1947, Bendigo was run by Mr A C Begg.

Brothers R F & A E Lucas took over the property in 1947. It was then considered to be in a very run down condition, with low lambing percentages, low wool weights and high death rates. Rabbits were a very serious problem causing widespread, extreme depletion on all areas below 610m. A fine-wool flock was run on the hill country with Romneys grazing the limited areas under irrigation. No winter feed was grown.

R F Lucas became the sole lessee from October 1953 and until 1978.

In 1979 J C Perriam purchased the lease to Bendigo Station. Mr Perriam was considered to be very progressive and innovative. He managed the property primarily for the continued production of fine merino wool (for which he has held an intensive, lifelong interest), and for lucrative hogget sales. Working within the constraints of the Pastoral Lease, Mr Perriam established a Game Park / Safari business. He also established an outlet for Merino Wool products produced on the property.

From the early 2000's up until 2023, John Perriam /Bendigo Station has undertaken a programme of subdivision, creating and selling down smaller land parcels for both viticulture and residential use. This has extended from Blue Mines Road in the north through to Devils Creek (neighbouring Northburn Station) in the south. Chinaman's Terrace to the north of Rocky Point has been developed though the establishment of the Chinaman's Terrace water scheme, which also serves Rocky Point.

To the south, predominantly in the area encompassing the RuRA(1) zoning, a number of 'super lots' were created and sold-down, enabling others to further subdivide into the rural lifestyle lots that exist today. This intensification and land use change incorporates the recent Scapegrace development to the south.

2.2 Tenure review Process Background

Tenure review was a voluntary process that gave lessees an opportunity to buy land capable of economic use, while land with conservation values was protected and restored to full Crown ownership as conservation land.

The Bendigo Station tenure review was concluded over 1993 and 1994. This is described more fully in the attached 1993 Bendigo Station Pastoral Lease Report. Survey plans for the Tenure Review were approved as to survey n 1998.

It is understood that John Perriam was generally supportive of the Crown's desire to protect areas of conservation significance within the then Bendigo Station and reached an agreement with the Crown, in cooperation with Landcorp, DoC and the newly reformed Central Otago District Council, to establish a range of conservation areas, conservation covenants and to enable public access.

This tenure review process and the corresponding changes to titles and District Plan zoning has been the catalyst for the significant programme of land development that has occurred across Bendigo Station since. Further detail on this is provided in Section 3.1 below

At the time of tenure review Bendigo Station was a land holding of 11,284.3 hectares that was held as a Pastoral Lease from the Crown by JC and HL Perriam. The rights of the lease included a 33-year lease with rights to renew and an annual rent of $8025.00. The carrying capacity of Bendigo Station at the time was in the region of 10000-15000 stock units.

The changes resulting for this process, as summarised in the abovementioned report were (abridged text):

- To surrender the pastoral leases
- To transfer ~1920ha to DoC with provision for continued farming/grazing, and with provision for public access
- To transfer ~1372ha to DoC as recreation reserve with no provision for grazing
- To freehold ~7992ha
- To establish two conservation covenants in favour of DoC to protect landscape and botanical values (as well as a further covenant in favour of DoC across the entire freehold area to protect historic mining sites)
- To provide public walking access at four locations.

Today's 64.3ha Rocky Point title was part of the freeholded area.

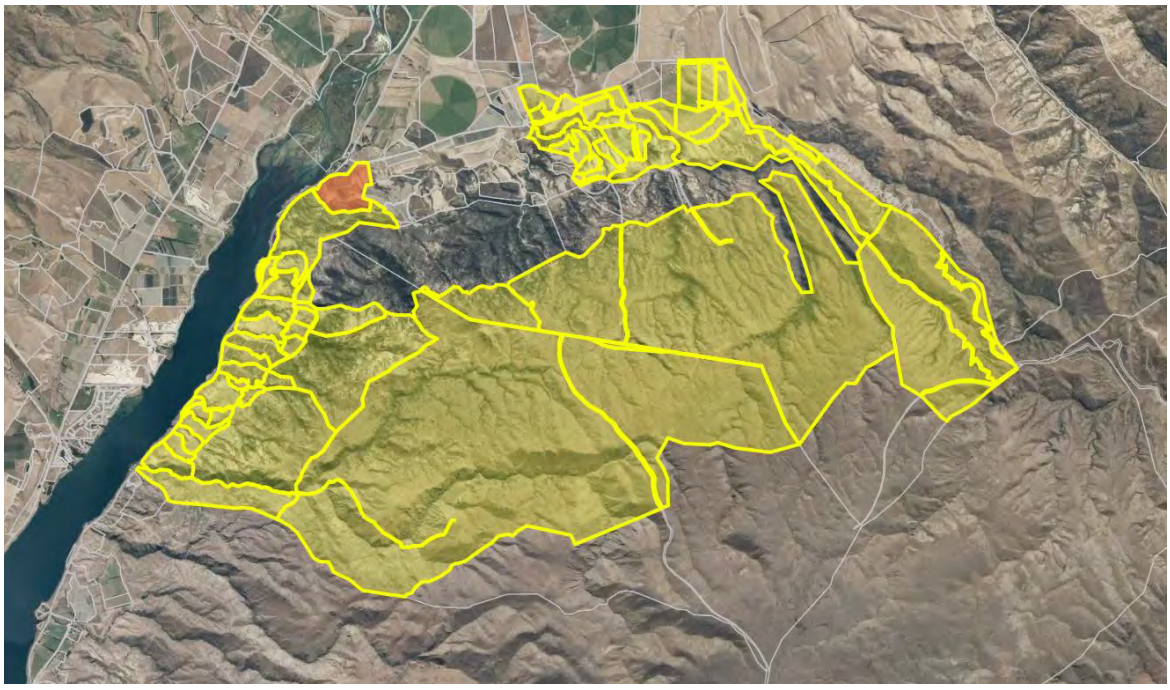
2.2.1 Conservation Covenant 5009824.9

Conservation Covenant 5009824.9 was established as part of the tenure review process and registered over all of the former Bendigo Station. It is important to note that multiple obligations are recorded in this document.

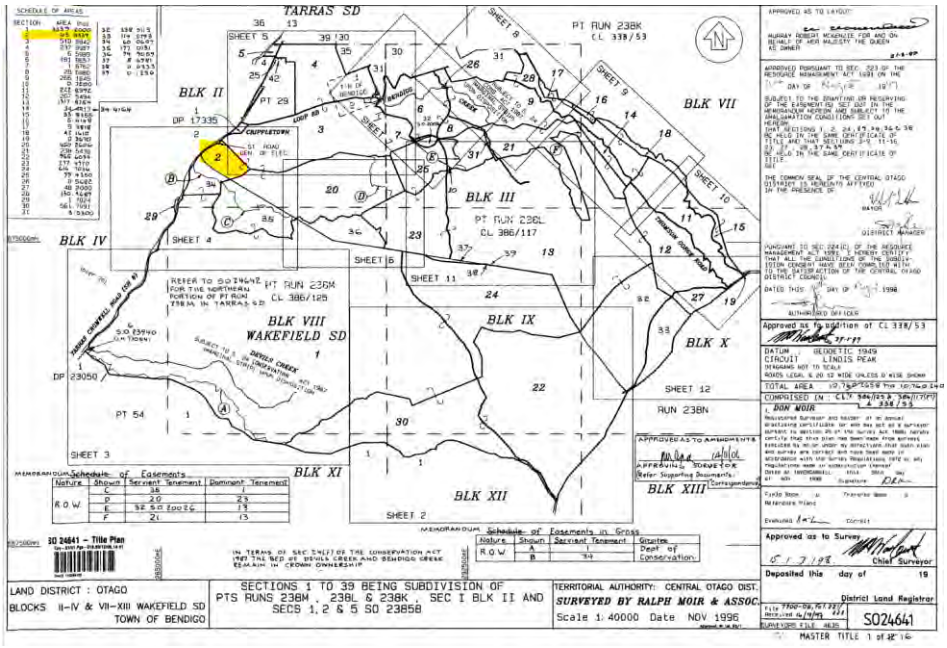
- Section 1 – Maintain all fences and gates to a good stockproof standard
- Section 2 – Keep land free of noxious plants, vermin and rubbish

- Section 3 (1) Not allow cultivation near historic areas
- Section 3 (3) The landowners may at any time remove some woody vegetation on the land **secondly described in the schedule** but only after receiving the Ministers' prior approval.
- Section 3 (4) The Minister will have regard to the objectives of this Deed when considering any request for approval under this clause and will not unreasonably decline approval.
- Section 4 The Minister may object to any mining licence application conflicting with the objectives
- And others…

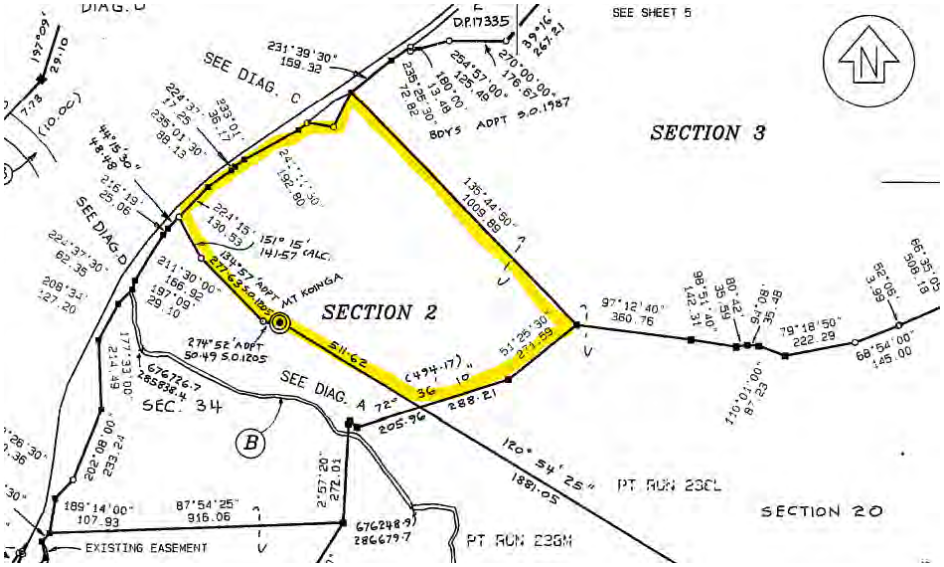
As above, this conservation covenant was initially registered over the entire freehold land resulting from the tenure review survey. This covenant, in it's original form, has since been removed from the titles for some areas of Bendigo station on either side of the Bendigo Loop Road. Currently the conservation covenant 5009824.9 remains registered on 45 titles, as shown below, bordered yellow. The applicants' titles are highlighted pink for reference:



Relevant to the applicant's current application for subdivision of Rocky Point is that the Second schedule as described in Section 3 (3) only includes **Section 2 SO 24641** containing 68.0339ha more or less. This title is shown in yellow in the title diagrams below. It extends from the State Highway up to the DoC scenic reserve. It now straddles the southern quarter of the Rocky Point site and extends into the northern end of the neighbouring Bendigo Hills site to the south. The only difference between the second schedule land (Section 2 SO 24641) and the rest of the vast covenant area is that removal of woody vegetation requires ministers' prior approval.



A close-up diagram from SO 24641 is below, this shows the 1000m long northern boundary of Section 2. This boundary has no occupation and appears to have been calculated between two posts on different fencelines.



The plan image below shows the extents of the former Section 2 SO 24641 as it relates to the proposed Rocky Point subdivision. It is shaded in red and encroaches approximately 200m into the applicant title.

The following is observed in relation to the 68ha "Schedule" area of the DoC covenant:

- The northern boundary of Section 2 SO 24641 is drawn on the plan without reference to any notable landmarks or features. The north boundary does not follow any terrain or fencelines. It is a 1009.89m long straight line on the plan that has been laid out between two fence posts from separate fencelines 1km apart. This suggests that the northern extent of the Sections, and subsequently the covenant, is based on a somewhat arbitrary line.
- The severance boundary between Section 2 and Section 34 on SO 24641, that forms the southern boundary of the covenant has handwritten bearings and distances, and the appellation reference for Section 34 is also hand drawn, this is suggestive that it has been added to the title plan at a late stage, potentially following a submission for commissioner or survey approval. This severance boundary follows adoptions from SO 1205 circa 1909 for the lower section and is a straight line between survey trigs for the upper section. Again, this boundary does not follow any fences or prominent features.
- The Schedule area runs parallel to, but does not include, the walking access that was established to enable public access from the State Highway to the DoC reserve. The Schedule area is over freeholded (private) land and incorporates no access right.

It appears that the covenant boundary has been tied to that of Section 2 SO 24641 as recognition of the general area requiring the covenant, but does not specifically follow any notable features.

The covenant's function can be inferred to be the preservation of an natural corridor between the lake and Scenic Reserve.

Landscape preservation may also have been a goal. Though this would seem secondary as the Schedule area does not include prominent or notable nearby landscape features.

3 LAND OWNERSHIP HISTORY

3.1 Perriam / Bendigo Station Developments Ltd

Following the completion of the tenure review process and the issue of title on 2 October 2000, JC & HL Perriam undertook multiple subdivisions to rearrange and subdivide their freehold land. A key subdivision which created the underlying parcel was DP 396297. This was an extensive subdivision spanning some 1646ha which created 11 titles, which were marketed as 'development blocks'. Irrigation infrastructure was installed and easements registered to supply irrigation to the lots.

The current Rocky Point parcel is indicated in yellow below.

The boundary between Lots 8 and 11 DP 396297 followed the northern edge of the title created to contain the Schedule covenant area.

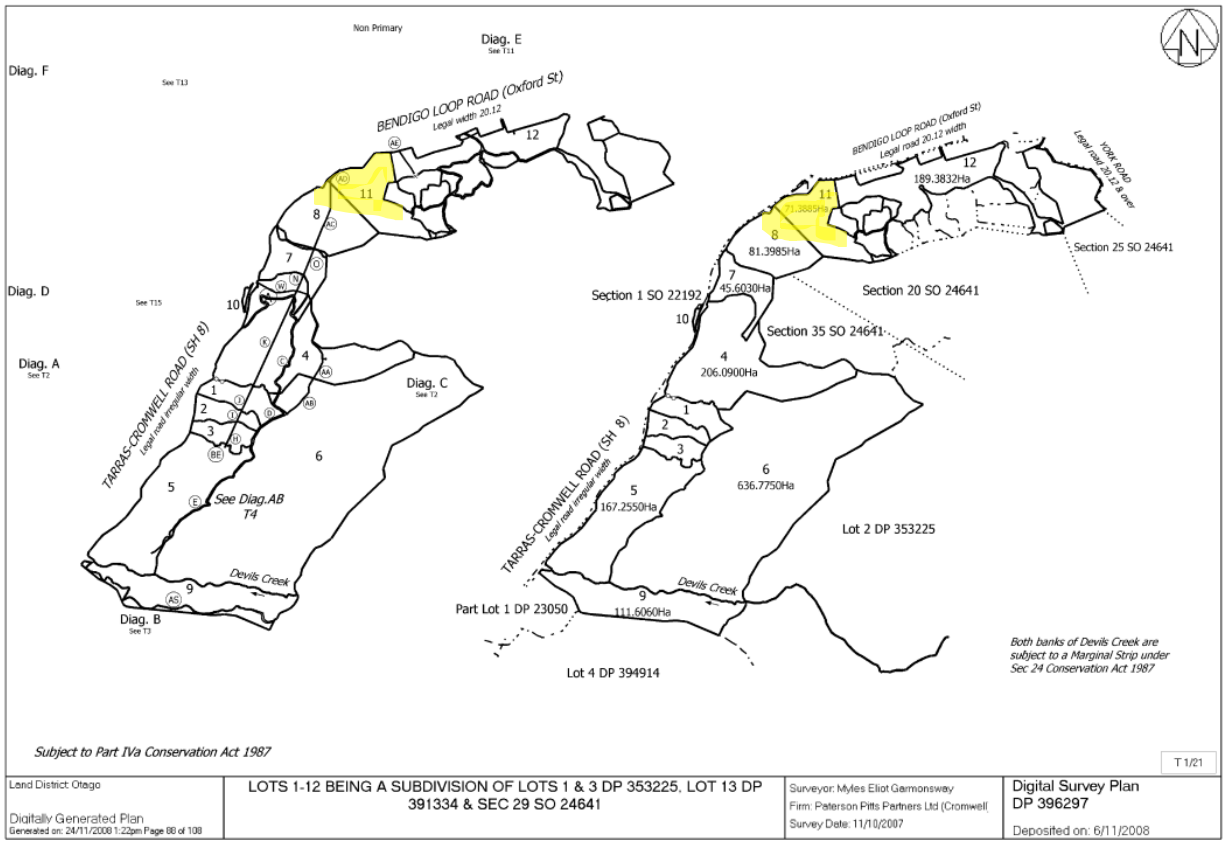


Figure 1. DP 396297

3.2 GB Water Ltd

GB Water Ltd acquired from Bendigo Station a number of the land parcels across the southern half of the scheme referenced above, spanning from Devils Creek/Northburn up to and including Rocky Point. This included undertaking the Bendigo Downs development to the south of Rocky Point. RC200406

A subdivision of Lots 7, 8 and 11 was executed by GB Water Limited in 2021 to separate the northern portion of the property (referred to as 'Rocky Point') from the southern area (referred to as 'Bendigo Hills'). Consent RC200404 was issued, and DP 561457 created Lots 1 (Rocky Point) and 2 (Bendigo Hills).

On 15 December 2021 ownership of Lots 1 and 2 DP 561457 transferred to GB Water Ltd.

Appendix 1: Subdivision Plan for RC200406

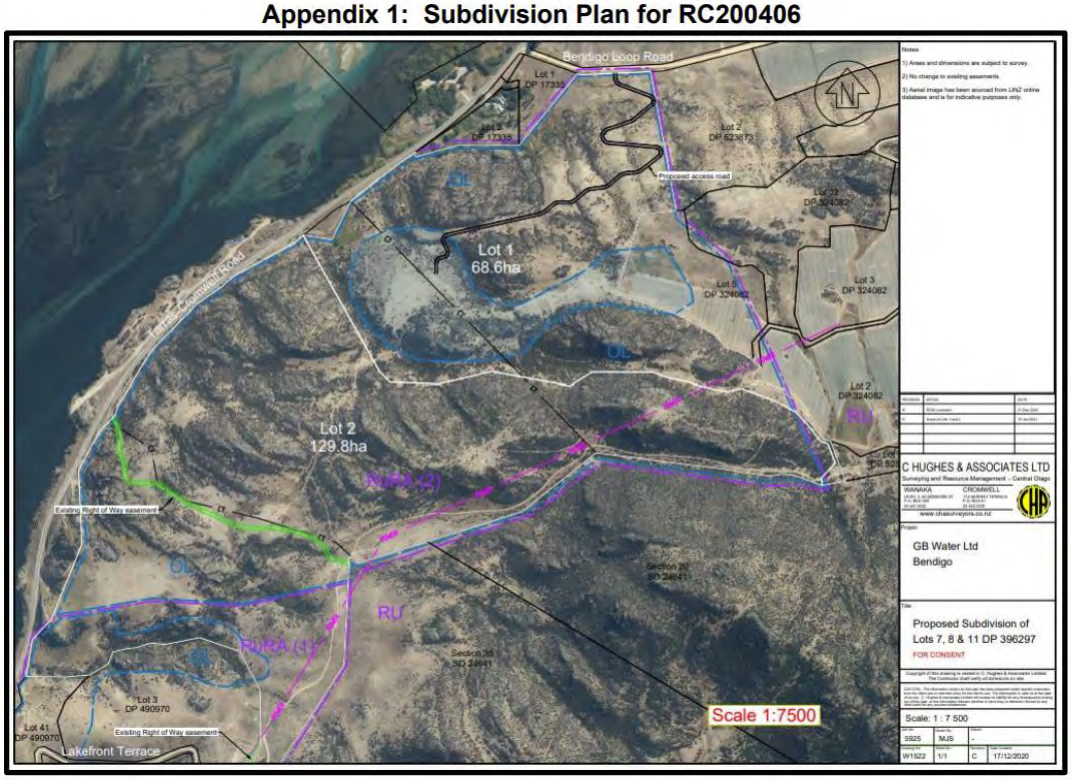


Figure 2. RC200406 Approved Plan

3.2.1 RM210203

RM210203 is a resource consent issued to GB Water Ltd to construct the access to Rocky Point (Lot 1 DP 561457) from Bendigo Loop Road. This earthworks application was made to

construct a new driveway to access the RuRA(2) Development Area as identified on Map41d. An indicative route was shown on CODC planning map 41d, and on Schedule 19.16.

This consent was given effect to in 2022. Construction was completed by Harliwich Earthmoving Ltd.

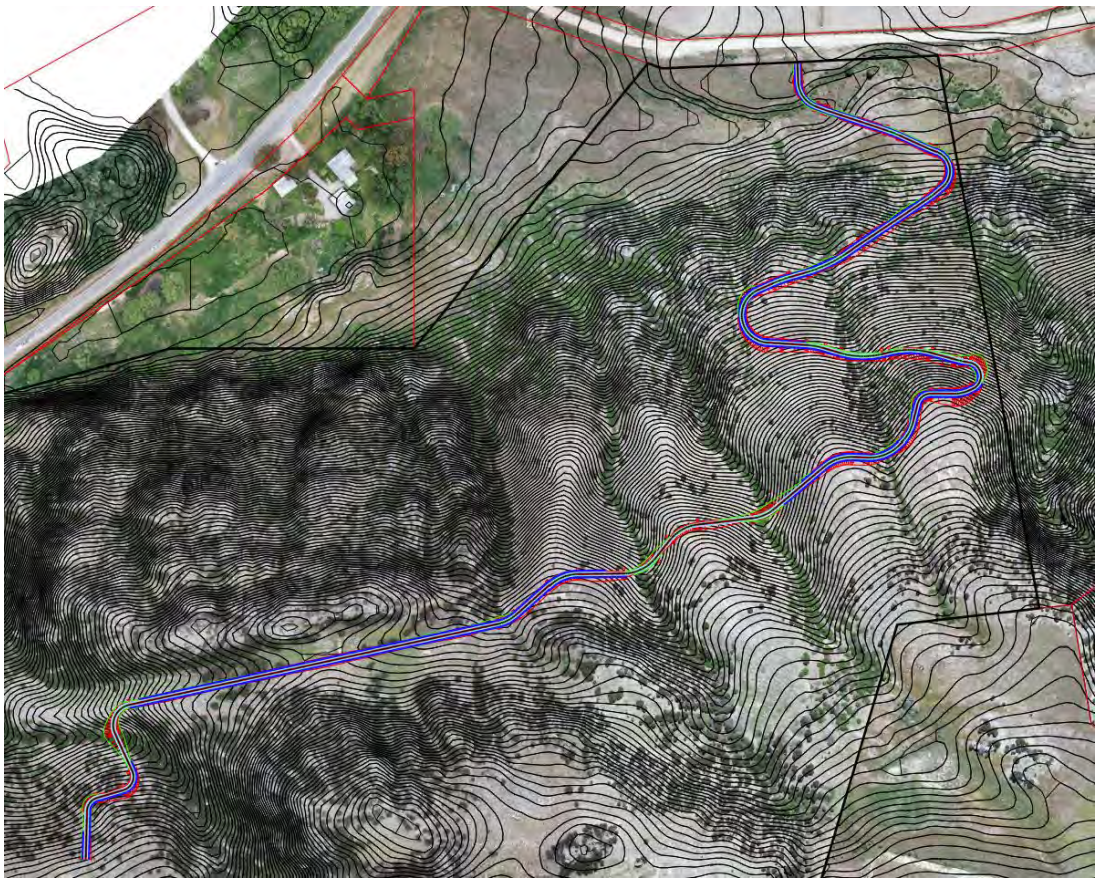


Figure 3. Approved plan showing new road alignment

3.2.2 RC210148

RC210148 is a yet to be given effect to consent obtained by GB Water to subdivide Bendigo Hills into six lots, with a seventh lot as shred access. Each lot has an identified building platform. This consent was issued on 13 December 2021 on a non-notified basis. The consent comes with a comprehensive suite of development and land use conditions.

Information provided to Council during the consenting process included:

- Archaeological survey
- Assessment of landscape and visual effects
- Consultation with Department of Conservation
- Ecologist report
- Saline Soil assessment, including testing

TKO acquired this Bendigo Hills parcel (with consent in place), alongside its acquisition of Rocky Point, in 2022.

A minor variation to this consent was issued on 21 June 2023 to facilitate staging. RC210148V1.

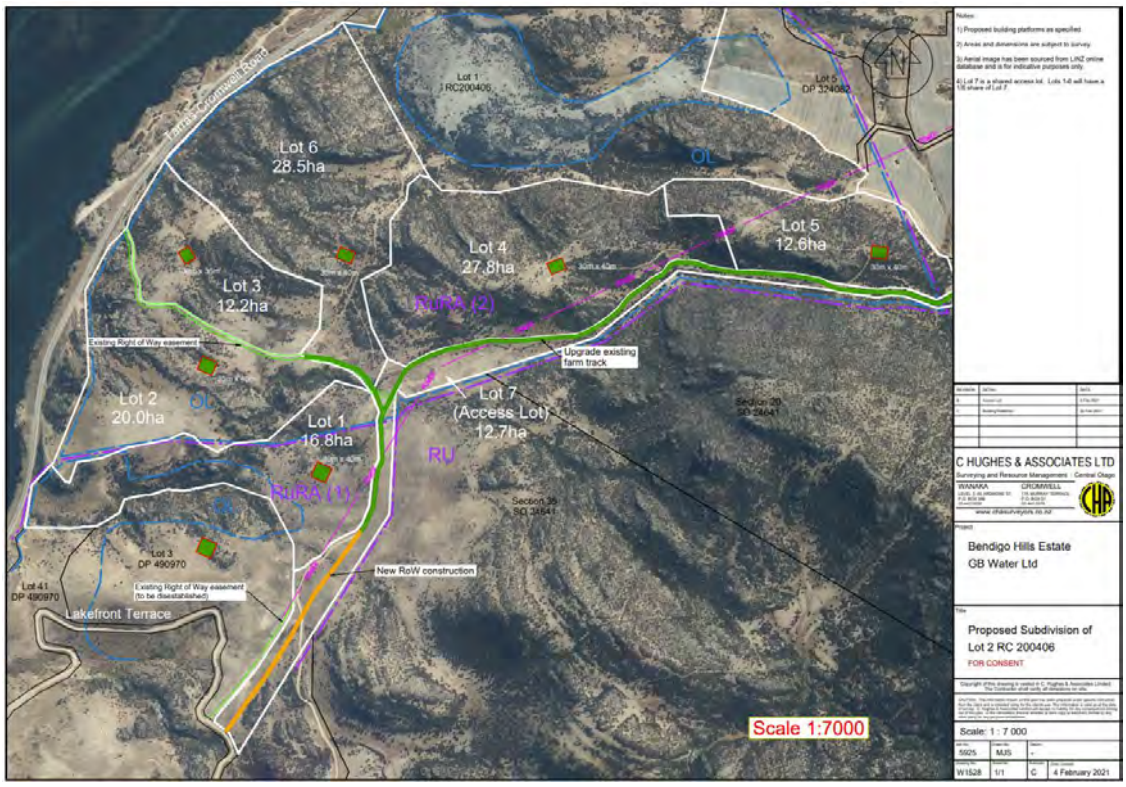
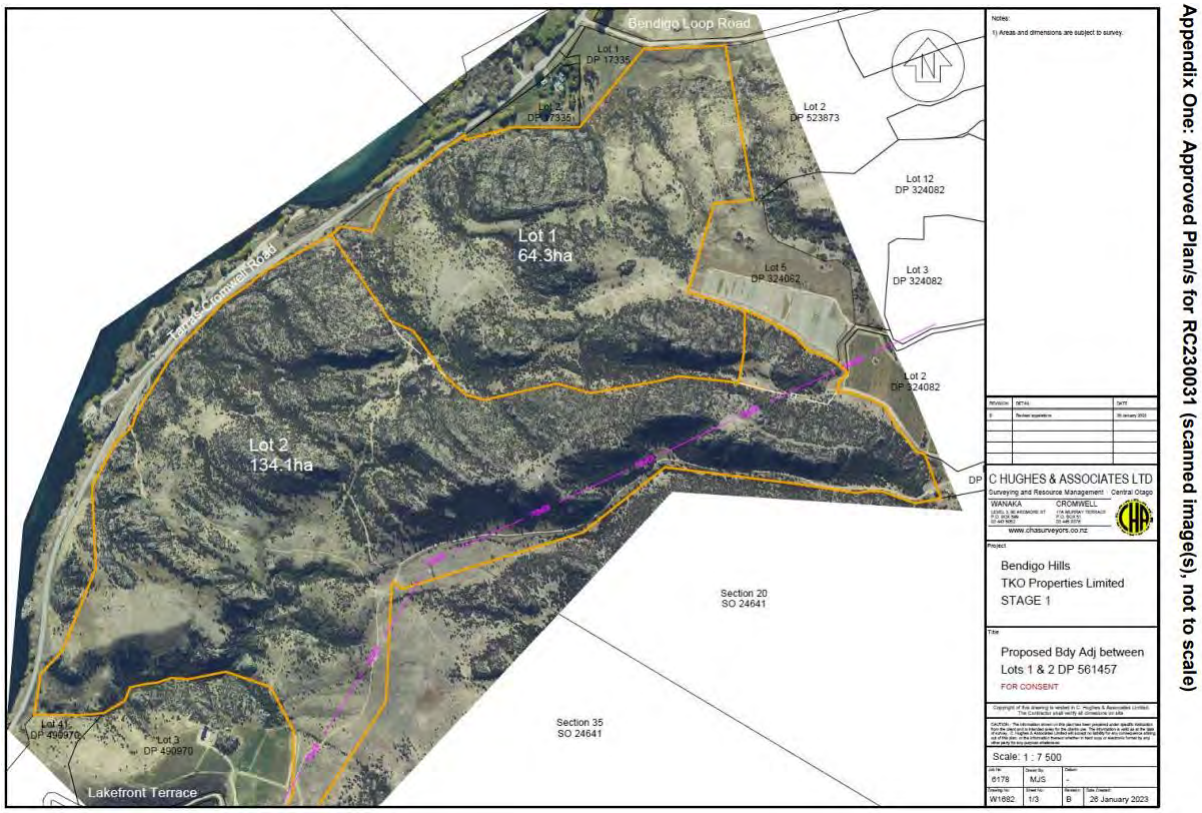


Figure 4. Approved plan, RC210148

On 5 December 2022 ownership of Lots 1 and 2 DP 561457 transferred to TKO Properties Limited.

3.3 TKO Properties Ltd

TKO Properties have applied for and completed a boundary adjustment between Lots 1 and 2 DP 561457. This was authorised by RC230031 in May 2023. The 224c certificate for this boundary adjustment was signed on 22 January 2024 and once deposited, Rocky Point will be contained within Lot 1 DP 596985, and Bendigo Hills Lot 2 DP 596985. [As at June 2024, those new titles have been issued.]



Appendix One: Approved Plan/s for RC230031 (scanned image(s), not to scale)

Figure 5. RC 230031 Approved Plan

4 ZONING

4.1 District Plan zones

The Rocky Point subdivision is contained within Rural Resource Area (2) (RuRA(2)) zoned land. The extent of the RuRA(2) zone is shown on Planning Map 41D.

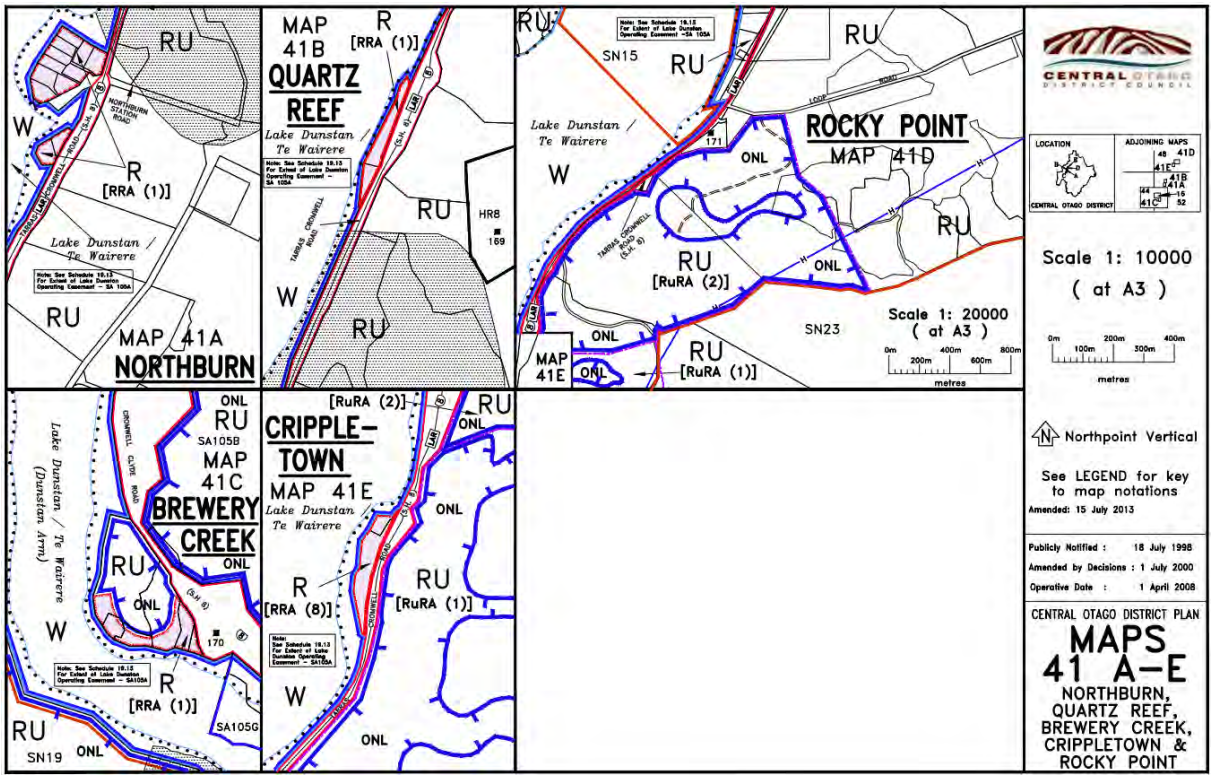


Figure 6. CODC Map 41D

4.2 Origins of zoning

The CODC District Plan was Publicly notified on 18 July 1998. It was amended by decisions in July 2000, and was made fully operative on 1 April 2008.

Anecdotally we understand that the RuRA(2) Rocky Point special zone was conceived around the same time as the tenure review process, and coinciding with the completion of the Clyde Dam and filling of Lake Dunstan, the enactment of the RMA and establishment of early District Plans, and as a consideration of how to enable appropriate residential, tourism and accommodation land uses around the new lake.

It created a unique piece of zoning within Central Otago.

4.3 Zone maps and area determination

The extent of the RuRA(2) zone is shown on a hardcopy plan on CODC Map 41D. The majority of the zone is designated as Outstanding Natural Landscape (ONL), but there is a kidney shape near the middle which is not ONL.

Further detail is provided in Schedule 19.16. This shows the Landscape Protection Area, now referred to as Outstanding Natural Landscape, and shows the Development Area within this. The schedule also shows the alignment of an access from Bendigo Loop Road to the Development Area.

The only document to specifically reference the area of the 'Development Area' is the map on Schedule 19.16. This states the area is **21 hectares.**

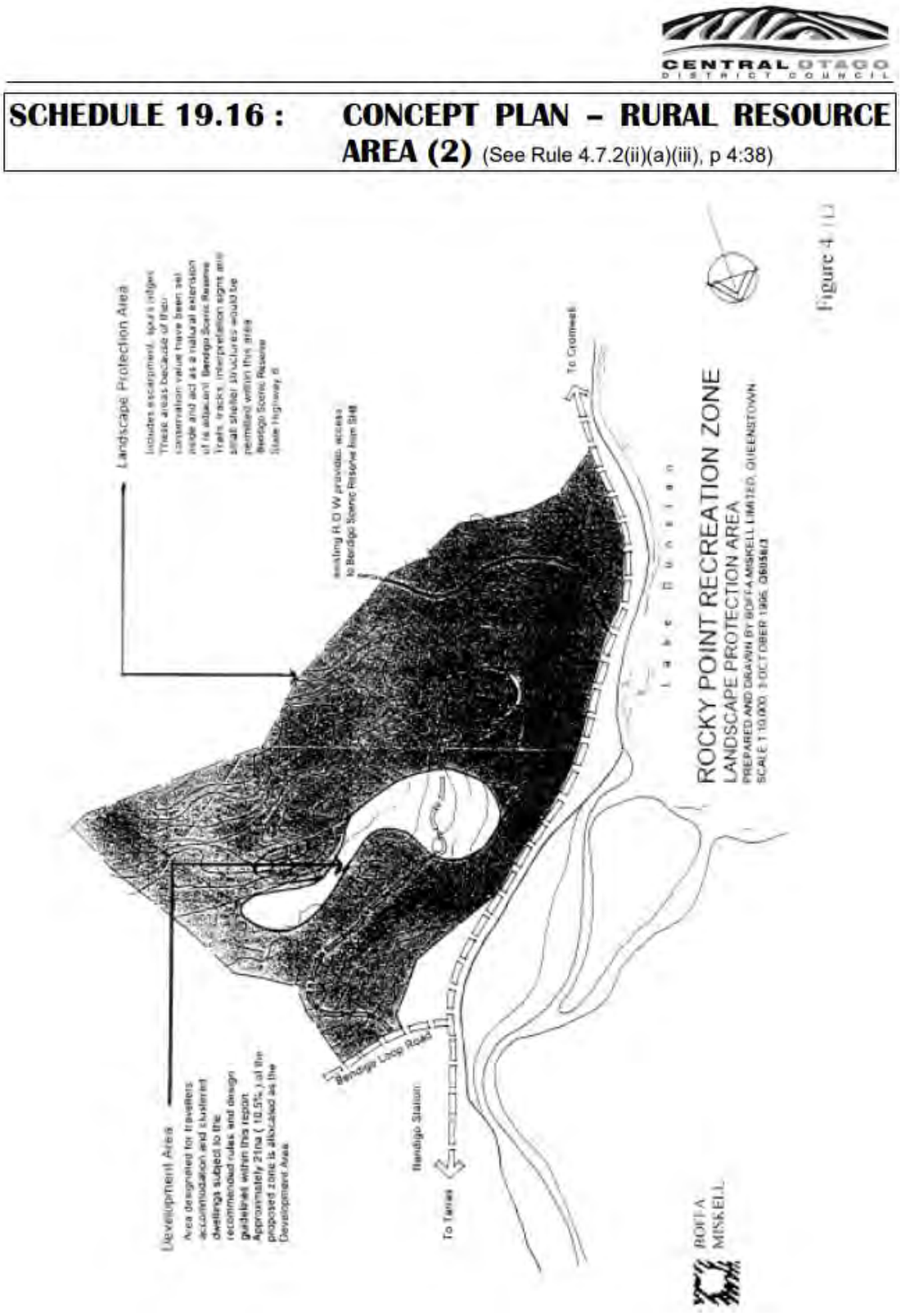


Figure 7. CODC District Plan Schedule 19.16

4.3.1 Ambiguity and conflict

The extent of the kidney shape on the hardcopy plan of 41D is 18.1ha. The boundaries on the Map align well with the cadastral boundaries. The scale of CODC Map 41D is such that the width of the lines scale to approximately 24 metres.

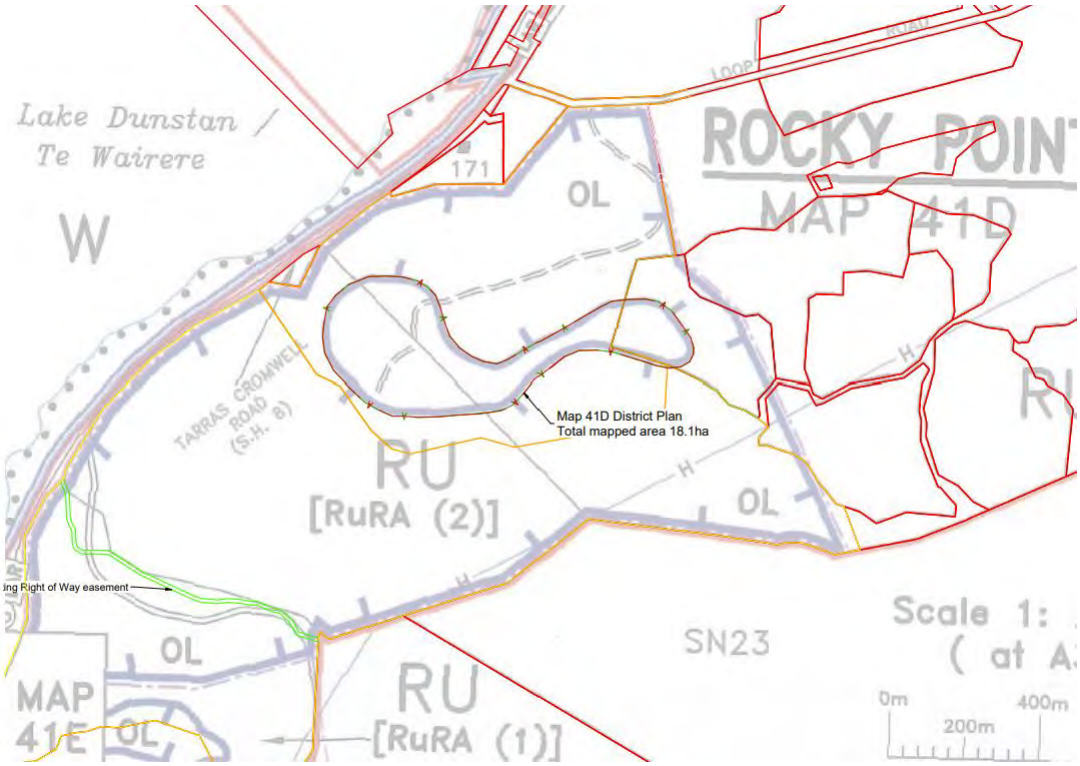


Figure 8. Boundary overlay on Map 41D

The extent of the kidney shape when viewed on the CODC GIS is in a slightly different location and has an area of 15.8ha

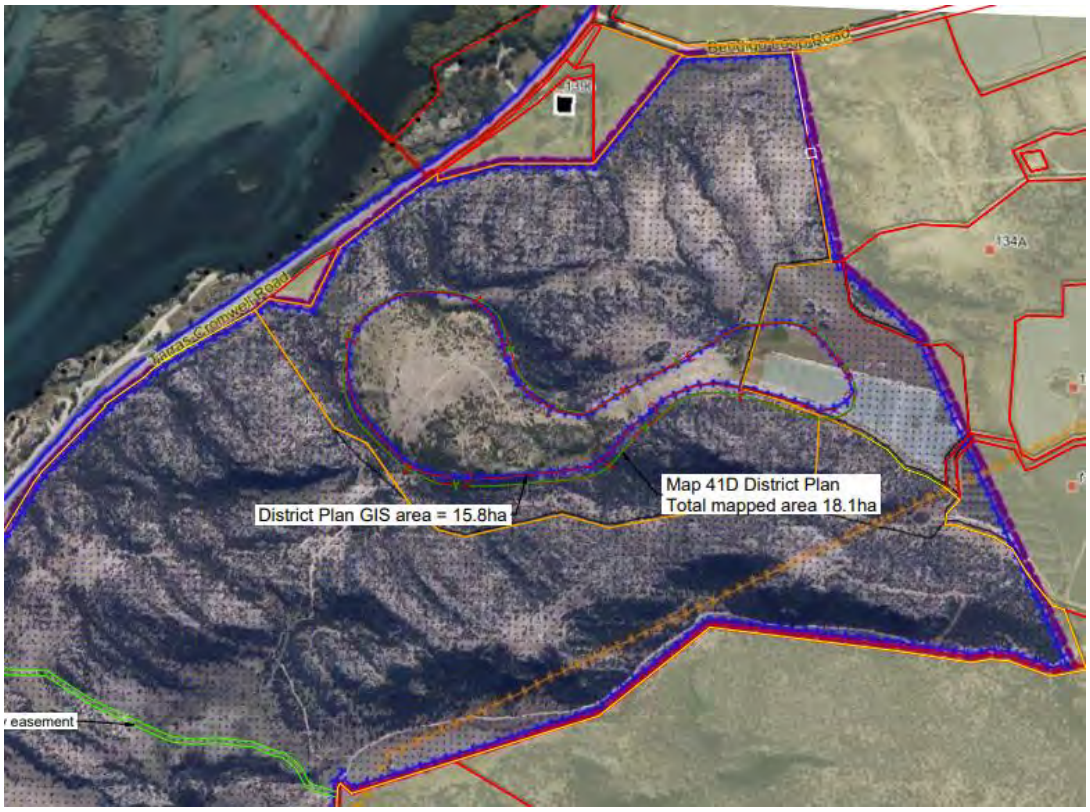


Figure 9. RuRA(2) with boundary overlay

The extent of the kidney shape when mapped from the originating plan contained within Schedule 19.16 is 16ha. This is significantly north of the other two plots, although admittedly the match onto the existing cadastral boundaries is not as tight.

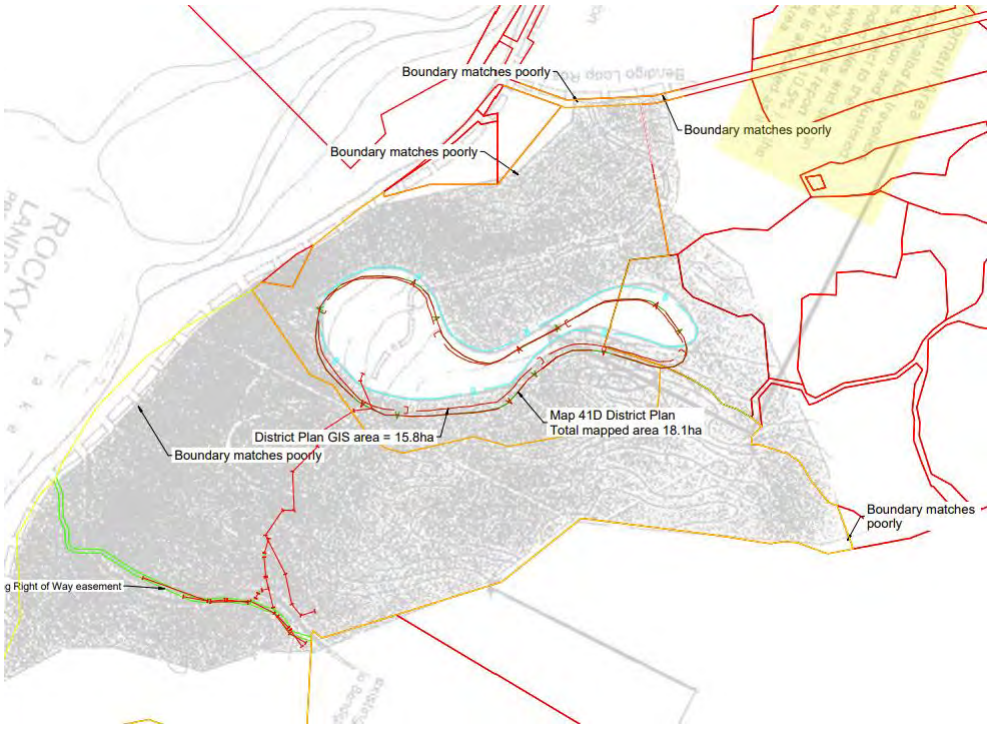


Figure 10. Schedule 19.16 with boundary overlay

4.3.2 Overlay on Aerial Photo

When the three plots are overlaid onto a current aerial photo, t is apparent that no hard features have been used to define the development area. It possibly could be considered an area with less kanuka, but the terrain is quite varied. Some is flat, while other areas within the development area are rocky outcrops.

Figure 11. All three CODC Development Areas on a current aerial photo

BEFORE THE HEARINGS COMMISSIONERS
APPOINTED BY THE CENTRAL OTAGO DISTRICT COUNCIL

UNDER	the Resource Management Act 1991
IN THE MATTER	of RC230179 an application for a 33-lot subdivision at Rocky Point on Tarras-Cromwell Road (SH8)
BY	**TKO PROPERTIES LIMITED**
	Applicant

MEMORANDUM OF COUNSEL FOR THE APPLICANT

Dated: 26 July 2024

TODD & WALKER law
LAWYERS | NOTARY PUBLIC

Solicitor acting
R E M Hill / B B Gresson
PO Box 124 Queenstown 9348
P: 03 441 2743
rosie.hill@toddandwalker.com
ben@toddandwalker.com

MAY IT PLEASE THE COMISSIONERS:

Introduction

[1] This memorandum of counsel is lodged alongside the Applicant's package of further information, being:

(a) Amended Assessment of Environmental Effects (**AEE**) prepared by Jeff Brown (July 2024); and

(b) Ecological impact Assessment prepared by Beal Consultants (July 2024).

[2] The purpose of this memorandum is to assist the Commissioners and the Council's s 42A author in understanding the instructions upon which the Applicant's experts have prepared further information and supporting assessments, particularly as relevant to the interrelationship between various planning instruments referred to in s104(1)(b) of the RMA.

[3] This memorandum expresses general principles of interpretation rather than any detailed application of the law to expert assessments and conclusions. The Appellant will address the latter in opening legal submissions.

Hierarchy between planning instruments in s104(1)(b) RMA

[4] S104(1)(b) of the RMA lists the relevant planning instruments that must be 'had regard to' by a decision maker under s104, as:

(a) any relevant provisions of—

(i) a national environmental standard:

(ii) other regulations:

(iii) a national policy statement:

(iv) a New Zealand coastal policy statement:

(v) a regional policy statement or proposed regional policy statement:

(vi) a plan or proposed plan; and

[5] At the time of writing, there are various proposed and operative instruments in play, with various policies and objectives relevant to the application. Those include the following of most relevance (in the same order as expressed in s104(1)(b):

(a) National Policy Statement for Indigenous Biodiversity 2023 (**NPS-IB**) and the National Policy Statement for Urban Development 2020 (**NPS-UD**).

(b) Otago Regional Policy Statement 2019 (made fully operative on 4th March 2024 (**ORPS**)), and the proposed Otago Regional Policy Statement 2021 (currently under appeal on both freshwater and non-freshwater parts (**PRPS**)).

(c) Central Otago District Plan (**District Plan**).

[6] In terms of the current state of flux between these instruments, the District Plan precedes later national direction (the NPS-IB and the NPS-UD). It also precedes the ORPS and the PRPS.

[7] The PRPS has some 14 appeals lodged in respect of non-freshwater matters, which are yet to be case managed and are in the very early stages of Environment Court proceedings.

[8] The current Coalition Government has signalled impending changes to the NPS-UD and the NPS-IB, though there are no specific consultations live on those at present.

[9] Following various recent Supreme Court decisions (*King Salmon*[1]*, Port Otago,*[2] and the *East West Link*[3] case), the Applicant's evidence and further information has been prepared consistent with the following principles (in terms of s 104(1)(b) policy assessment):

---

1 *Environmental Defence Society Incorporated v The New Zealand King Salmon Company Limited & Ors* [2014] NZSC 38 (**King Salmon**).

2 *Port Otago Limited v Environmental Defence Society Incorporated* [2023] NZSC 112 (**Port Otago**).

3 *Royal Forest and Bird Protection Society of New Zealand Incorporated v New Zealand Transport Agency* [2024] NZSC 26 (**East West Link**).

(a) Higher order documents should be regarded as being particularised in a district plan unless there is a problem with the relevant plan (one of the three caveats of invalidity, uncertainty or incompleteness) or the relevant plan precedes the higher level documents in which case more weight may need to be accorded to the higher level documents than would otherwise be the case. In this case, given the District Plan precedes national and regional direction, its provisions have been read in light of those.

(b) The matter of weighting between the ORPS and the PRPS is to be determined at the discretion of the decision maker. The Applicant's counsel will be submitting that, given the PRPS has numerous provisions under early stages of merits appeals, it should be given very limited weight compared to the ORPS and national direction. A number of the provisions relevant to the Application (such as to biodiversity offsetting and compensation methods) cannot yet be said to have been prepared duly in accordance with, or tested against, national direction and Part 2 of the Act and it would be highly uncertain to rely on those as having greater weight.

Interpretation of policies and objectives themselves

[10] As with construing the objectives and policies of plans, the appropriate approach is to undertake a fair appraisal of the NPS-IB, read as a whole.[4] In other words, isolating and de-contextualising individual provisions in a manner that does not fairly reflect the broad intent of the drafters must be avoided.

[11] Attention must be paid to relevant objectives and policies both on their own terms and as they relate to one another in the overall policy statement or plan. Some policies will, in context, be more important than others.[5]

[12] Tension between stronger and weaker policies will not always be resolved in favour of the stronger. Ecosystems are complex and dynamic, as is the impact of human communities located within them.

4 East West Link, at [79], [93].
5 At [80].

Fact and context will be important in determining how tensions between policies will be resolved.[6]

[13] Where conflict arises between equally directive provisions within a planning instrument, those must be addressed through a 'structured analysis' of interpretation.[7] In context, enabling policies (such as to 'recognise and provide for') may be equally as directive as avoidance policies.[8]

[14] Though policies may be expressed in very directive terms (such as 'avoidance' language) they are still policies (rather than rules) and as such must be exercised with a residual discretion and not implemented unlawfully / in a way inconsistent with the purpose of the Act.[9]

[15] Context is important and general avoidance of a broad subject matter (such as biodiversity) may be of a higher level of generality and therefore involve fine judgments in particular cases.[10]

[16] A genuine, on-the-merits exception, by its nature, will not subvert a general policy, even a directive one.[11] Whether any particular proposal is such an exception requires an assessment of the whole proposal, including its benefits and adverse effects and its remedial or mitigatory aspects.[12]

[17] Offsetting of adverse effects is a legitimate way of potentially satisfying an avoidance policy. Whether the impact of the offset must be in situ or can be deployed elsewhere will be context specific.[13]

Summary of Applicant's revised position against principles of interpretation

[18] The Applicant's revised information and assessment takes particular guidance from the NPS-IB as the most directive instrument on the

6 Ibid.
7 Port Otago, at [78] – [79].
8 At [69].
9 East West Link, at [101].
10 At [105].
11 At [109].
12 At [111].
13 At [176].

subject matter. As the site is not within an identified Significant Natural Area (**SNA**) in the District Plan, the relevant provisions are those relating to indigenous biodiversity outside of SNAs. A full assessment of all of the provisions of the NPS-IB is included in the updated AEE.

[19] It finds support for a consenting pathway in the NPS-IB, the ORPS, and the District Plan.

[20] The District Plan non-complying pathway (objective test) has been prepared with 'one eye' on the NPS-IB and NPS-UD,[14] and the Applicant position is that a fair appraisal overall of the provisions, leads to a conclusion the Application is not contrary to those.

[21] Offsetting is available through the NPS-IB and the PRPS should be given limited weight in terms of any interpretation that otherwise restricts access to offsetting. Applying the East West Link decision, offsetting can legitimately be a method deployed to overcome avoidance policies.

[22] Factoring in these methods, the conclusions from further assessment are that:

(a) Overall, the proposal will result in low adverse effects on the environment when taking into account the permitted baseline and what the Rocky Point Recreation Zone provides for.

(b) Biodiversity offset measures are proposed to address the residual adverse effects of the development that cannot be avoided, minimised or remediated. Proposed offsets will achieve an overall net gain in biodiversity.

(c) Significant positive effects additional to the offset and formal protection measures proposed by TKO. For example, the proposal includes a covenant to protect the indigenous vegetation and habitats outside the area subject to development, and four specific enrichment planting areas. This will result in the restoration of forest and shrubland communities that are not present at Rocky

[14] East West Link, at [92].

Point and that will not establish within the next half century without human intervention.

(d) The proposal therefore achieves the NPS-IB direction of recognising and providing for the importance of maintaining indigenous biodiversity outside SNAs, and in fact goes beyond this through positive measures.

(e) the proposal passes both tests in Section 104D of the Act (as to effects, and policies and objectives).

[23] Detailed submissions will be provided in opening by the Applicant which further addresses these matters of interpretation relevant to the evidence, as well as remaining s104 elements of the Act.

Application of the permitted baseline

[24] The Assessment of Environmental Effects has correctly noted that a relevant permitted baseline exists for this proposal in respect of the ability for permitted farming activities to be carried on the Site which could reasonably include cultivation, grazing, fertilising, cropping and shelterbelt planting.

[25] The permitted baseline allows the consent authority to disregard adverse effects which are permitted by a rule or a national environmental standard. An activity which is permitted but "fanciful" may be a reason not to apply the permitted baseline in assessing effects.[15]

[26] The AEE has addressed applicable district plan rules for the Site, concluding no prohibitions on farming activities which could involve significant modifications to land management practices.

15 *Smith Chilcott Ltd v Auckland City Council* [2001] 3 NZLR 473.

Relevance of Covenant 5009824 referred to in DOC submission

[27] The DOC submission places weight on Covenant 5009824 to this Application, including an approval process for certain activities on the Site by the Minister of Conservation.

[28] Conservation Covenant 5009824.9 was established as part of the tenure review process and registered over all of the former Bendigo Station. Land covenants are private arrangements, and as such Councils do not have jurisdiction to consider, interpret, or enforce those in any section 104 assessment. Covenants may be modified or extinguished by order of the court. An applicant to modify or extinguish a covenant must establish one or more of the various grounds set out in s 317 of the Property Law Act 2007.

[29] The consent authority is not the dominant owner of the covenant. Thus, it has no ability in law to enforce it, or contest any application to modify or extinguish it.

[30] In this particular case, the historic nature of the covenant, its ambiguity in wording and application to land areas, and its uncertain purpose / objectives all further suggest that no weight should be placed on the application of the covenant in any effects or policy assessment. To otherwise place weight on the covenant to the Application, and interpret its meaning and effect, would be contrary to established principles under s104 of the RMA.

Dated: 26 July 2024

……

R E M Hill / B B Gresson
Counsel for the Applicant

PARTIES

ROCKY POINT SERVICES LIMITED

AND

[DEVELOPER]

DRAFT SERVICES CONTRACT

DRAFT

CONTRACT DATED **2021**

PARTIES

1. **ROCKY POINT SERVICES LIMITED** a duly incorporated company with its registered office at [ ] (Service Provider).

2. **[DEVELOPER]** together with its successors and permitted assigns is the owner and proprietor of the Property (Owner).

BACKGROUND

A. The Owner is the owner and proprietor of the Property.

B. The Service Provider provides and manages Services to the Property and properties within the vicinity including:

   a. Supplying water for domestic needs

   b. Fire sprinklers and other fire-fighting infrastructure; and

   c. Maintaining common areas and shared rights of way

   d. Holding and maintaining resource consents, the Water User Agreement and easements as required to provide the Services.

C. The Service Provider and the Owner wish to enter into this contract to record the terms on which the Service Provider will provide the Services to the Owner.

THE PARTIES AGREE THAT:

DEFINED TERMS

Best Industry Practice means, in relation to any activity or service, the exercise of that degree of skill, care, diligence, prudence (including good, safe and prudent practice) for that type of activity or service (in terms of quality, productivity, effectiveness and performance), adopted by a skilled and experienced service provider;

Business Day means any day on which registered banks are open for business in Otago excluding a Saturday or a Sunday or a statutory public holiday;

Commencement Date means the date of this contract;

Contract means this contract including the background and schedules to this contract;

Default Rate means the late charge recorded at clause 5.3 of the Service Provider's Constitution

Fees means the amount(s) that the Owner will pay the Service Provider for the provision of the Services as described in Schedule 2;

Force Majeure means an event or circumstance which is beyond the reasonable control of the Service Provider, but does not include any event or circumstance which could have been avoided, prevented or circumvented by the exercise, by the Service Provider, of Best Industry Practice;

GST means goods and services tax payable under the Goods and Services Tax Act 1985, at the rate prevailing at the time of supply;

Law means any rules of common law, statute, regulation, by-law, ordinance or subordinate legislation in force from time to time and, in the case of the Service Provider, includes any industry codes of conduct, plans or policies issued by a relevant territorial authority, standards and rules applicable to the supply of the Services;

Mortgage means a mortgage registered over the record of title to the Property;

Mortgagee means the registered owner of a Mortgage;

Property means the property legally described as set out in Schedule 1;

Services means the services described in Schedule 1;

Subcontractor means any third party, other than the Service Provider and its employees, appointed by the Service Provider to perform any of the Services;

Term has the meaning given to that term in clause 0;

Water User Agreement means the Water User Agreement between the Service Provider and [Chinaman's Terrace Water Scheme] attached as [Schedule 3].

INTERPRETATION

In this contract, unless the context requires otherwise:

Monetary Amounts: all monetary amounts are stated exclusive of GST and in New Zealand dollars;

GST: GST is payable at the same time and in the same manner as is any other amount payable under this contract, where that amount is subject to GST under the GST Act;

Expressions: expressions defined in the main body of this contract have the defined meaning in the whole of this contract including the background;

Headings: section, clause and other headings are for ease of reference only and will not affect the interpretation of this contract;

Reference to Party: references to any party are to a party to this contract and include that party's successors and permitted assigns including any person taking by way of novation (as the case may be);

Singular and Plural: the singular includes the plural and vice versa;

References to Documents: references to any document (however described) are references to that document as modified, novated, supplemented, varied or replaced from time to time;

Statutory Provision: references to any statutory provision include any statutory provision which amends or replaces it and any subordinate legislation made under it;

Approvals: where there is any reference in this contract to something being subject to the approval or consent of a party, unless expressly stated otherwise, such approval or consent will not be unreasonably withheld or delayed.

DRAFT

APPOINTMENT

The Owner appoints the Service Provider to supply the Services during the Term and the Service Provider agrees to provide the Services on the terms set out in this contract.

TERM

Subject to clause 11 (Termination as a Result of Force Majeure), this contract commences on the Commencement Date until the contract is terminated in accordance with clause 14 (Termination) (the Term).

SERVICES

The Service Provider will provide the Services to the Owner during the Term subject always to the terms and conditions set out in the Water User Agreement.

In providing the Services, the Service Provider will:

A) comply with all Law relevant to the provision of the Services;

B) comply with Best Industry Practice;

C) not knowingly, by any act or omission, cause the Owner to breach any Law, any applicable consent, approval or licence or do anything that would or could cause any adverse effect on the environment;

D) at all times deal, and fully co-operate, with the Owner in good faith, and do such things and sign such documents as are required for the provision of the Services;

E) comply with its obligations in Schedule 1;

F) notify the Owner as soon as possible after it becomes aware of any matter which could increase the price of the Services, or impair the performance of the Services; and

G) promptly notify the Owner of any breach of the Service Provider's obligations under this contract or any matter which may impact on the Service Provider's ability to perform its obligations under this contract.

No guarantee: The Owner acknowledges that the supply of water is subject to the terms and conditions set out in the Water User Agreement and that the Service Provider cannot and does not guarantee the supply of water. While the Owner is required to install no less than 30,000 litres onsite storage, the Owner may wish to install additional storage to mitigate the risk of any interruption in the supply of water pursuant to the Water User Agreement.

DRAFT

PERFORMANCE

Performance of Services: The Service Provider will, at all times during the Term, provide the Services in accordance with Best Industry Practice and any manufacturer's or supplier's stated or recommended instructions or requirements.

OWNER'S OBLIGATIONS

In relation to the provision of the Services by the Service Provider, the Owner:

A) agrees to co-operate with the Service Provider in relation to the provision of the Services as reasonably required;

B) allows the Service Provider to access the Property at reasonable times and to the extent necessary for the proper provision of the Services;

C) will comply with all Law;

D) will, to the extent permitted by Law, provide to the Service Provider such information and assistance as the Service Provider reasonably requires to fulfil its obligations under this contract and any other contract related to the provision of the Services, and including such information and assistance as is expressly required by this contract;

E) complies with its obligations set out in the schedules of this contract;

F) uses reasonable endeavours to bring to the Service Provider's attention on a timely basis any incident or circumstance, an awareness of which will or might reasonably be expected to assist, to a material extent, the performance by the Service Provider of its obligations under this contract;

G) does not knowingly, by any act or omission, cause the Service Provider to breach any Law; and

H) agrees and covenants to comply with the terms and conditions of [any other agreement relating to the provision of services].

I) Subcontracting

SUBCONTRACTOR

The Service Provider may subcontract the performance of any part of the Services or any other of its obligations under this contract to any suitably experienced person. The Service Provider shall ensure any Subcontractor performs the relevant Services in accordance with the terms of this contract (as applicable).

FEES

This contract is conditional on the Owner paying the Service Provider a [connection fee] to meet some or all of the capital costs of providing the Services as set out in [Schedule 2].

Except as expressly set out in this contract, the Fees include all costs and expenses relating to, and represent the total amount payable by the Owner for:

A) the Services; and

B) the Service Provider's performance of its obligations under this contract.

DRAFT

The Owner will pay the Service Provider the Fees including as set out in [Schedule 2] and adjusted from time to time in accordance with this contract to take account of the actual costs incurred by the Service Provider in performing the Services.

The Service Provider shall in each year prior to the balance date determine and fix Fees for the following financial year. Fees shall be invoiced to the Lot Owner on a monthly basis or at such other times or intervals as the Service Provider may require. The Fees shall include all charges payable by the Service Provider on behalf of the Owner for water under the [Water User Agreement].

The Service Provider may at its discretion vary the Fees for that year to "pass through" any increase or decrease in the prices charged to the Service Provider in respect of any of the components of the Fees.

The decision by the Service Provider on the allocation and recovery of Fees shall be final and binding on the Owner.

Fees may be reviewed annually and may increase by such sum as the Service Provider may determine.

The Service Provider may require the Owner to pay all Fees by direct debit from the bank account specified by the Owner and the parties will sign all forms necessary to enable Fees to be paid by this method.

If the Owner does not make payment of Fees by the due date then (provided written demand has been made) the Service Provider shall be entitled to charge the Owner interest on any amount outstanding from the due date until payment in full at the Default Rate. Such sum may be recovered as a liquidated debt due by the Owner to the Service Provider and will be a secured payment under any encumbrance.

The Owner acknowledges that Fees shall be payable by the Owner notwithstanding that:

the Owner may not have consumed or taken any water during the relevant period for charging the Owner;

for any reason whatsoever, the Service Provider was unable to supply water to the Owner for all or part of the relevant period for charging the Owner (provided that such non-supply was not due to the wilful default of the Service Provider);

All Fees shall be on a plus GST basis; and

All amounts due shall be paid in full without set-off or deduction of any kind.

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LIMITATION OF LIABILITY

Nothing express or implied in this contract or under the law of contract, tort or otherwise will confer any liability on either party in respect of any indirect or consequential loss, damage, cost or expense of any kind suffered or incurred by the other party under or in connection with this contract.

Notwithstanding any contrary provision contained in this contract, the maximum liability of the Service Provider to the Owner under or in connection with this contract (whether in contract, tort or otherwise) in respect of all or any events or breaches occurring within any period of 12 consecutive months will be the amount of the management fee (if any) included in the Fees received by the Service Provider in that 12 month period.

OWNER'S ACKNOWLEDGEMENTS

The Owner acknowledges:

A) that if the Service Provider defaults on any of the terms and conditions of the Water User Agreement, the Dairy Creek LP may cease supplying water to the Service Provider, and that the Dairy Creek LP shall not be liable to the Owner in the event the Dairy Creek LP ceases supplying the Water;

B) that the water may not be suitable for drinking and that the Owner will take all necessary precautions to ensure that the water is suitable and of sufficient quality for its intended use before using the water

INDEMINTY

The Owner agrees and covenants that the [Chinaman's Terrace Water Scheme] shall have no liability or any duty of care to the Owner whatsoever and the Owner waives all liability and rights of action against the [Chinaman's Terrace Water Scheme] in relation to the supply of water to the Service Provider from that scheme, for supply of that water to the Owner. The parties acknowledge and agree that this clause confers benefits on, and is enforceable by, the [Chinaman's Terrace Water Scheme] for the purposes of Part 2, Subpart 1 of the Contracts and Commercial Law Act 2017.

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FORCE MAJEURE

If and to the extent to which the Service Provider is unable to carry out any of its obligations under this contract because of any Force Majeure, the Service Provider will have no liability to the Owner in respect of the non-performance by the Service Provider of such obligations, provided that:

A) the Service Provider will, as soon as reasonably practicable after becoming aware of the Force Majeure, notify the other party in writing accordingly, describing the event or circumstance of Force Majeure, including:

   (i) the date of the commencement of the Force Majeure; and

   (ii) the expected effect or duration of the Force Majeure; and

   (iii) where reasonably practicable, the Service Provider's proposal for mitigating the effect or duration of the Force Majeure and, if applicable, the amount of any cost that may be incurred by the other party as a result of such alternative means of performance,

B) and, where reasonably practicable, the Service Provider will continue to provide to the Owner reports with respect to such Force Majeure for so long as the Force Majeure continues to prevent the Service Provider from carrying out its obligations under this contract;

C) neither party will be released from any liability which accrued before the Force Majeure;

D) the Service Provider will, by the exercise of Best Industry Practice, endeavour to overcome or avoid the effect of the Force Majeure, to mitigate the effects of the Force Majeure and to complete the Service Provider's obligations under this contract on time;

E) the Service Provider will, as soon as reasonably practicable after becoming aware of the cessation of the Force Majeure, notify the other party in writing accordingly; and

F) this contract will otherwise remain in effect in all respects.

If any Force Majeure is of such magnitude or will be of such duration that it is, or is reasonably likely to be, impossible or impractical for the Service Provider to comply, to a material extent, with the Service Provider's obligations under this contract for a period of four consecutive months or longer, either party may terminate this contract by written notice to the other party and this contract will terminate on the date which is 60 Business Days (or such longer period as may be specified in that notice) after the date on which the notice is received by the other party.

If this contract is terminated pursuant to clause 11.2 and the Force Majeure subsequently ceases so it becomes possible for the Service Provider, to a material extent, to be able to comply with the Service Provider’s obligations under this contract then the parties shall enter into a new services contract on the same terms as this contract with any changes necessary to take into account the Force Majeure event.

ASSIGNMENT

The Lot Owner shall not transfer or assign any of its rights or obligations under this contract to any other person without the Service Provider prior written approval (whose consent shall not be unreasonably withheld). The Service Provider may transfer or assign its rights under this contract to a third party and the Lot Owner agrees to do or execute any necessary documents reasonably required by the Service Provider to effect any such assignment, or transfer.

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DISPUTE RESOLUTION

A) Either party (**First Party**) claiming that a dispute has arisen under this contract will give written notice to the other party (**Second Party**) notifying the Second Party of the dispute.

B) The parties will in good faith use their reasonable endeavours to make whatever investigations each party deems appropriate and seek to resolve the relevant dispute at the earliest reasonable opportunity.

Unless a party has first complied with (A) and (B) above (inclusive) that party may not commence court proceedings relating to any dispute arising from this contract (except where the party seeks urgent interlocutory relief, in which case that party need not comply with this clause before seeking such relief).

If the dispute is not resolved one (1) calendar month after notice is given of the dispute, then any party may refer the dispute to a suitably qualified independent expert for determination. The independent expert shall be agreed between the parties or failing such agreement within ten (10) days of the notice of referral for expert determination, the independent expert shall be appointed by the president for the time being of the New Zealand Law Society or his/her nominee. The independent expert's determination shall be final and binding.

TERMINATION

Either party (the *First Party*) may terminate this agreement immediately by giving written notice to the other (the *Second Party*) if:

(a) the Second Party commits or allows to be committed any material breach of the terms of this Agreement, and such material breach has not been remedied within a reasonable period (having regard to the nature of the breach and remediation required);

provided that the Owner shall remain liable for any Fees payable by the Owner.

Neither party may terminate this agreement without having given each Mortgagee at least 120 days prior written notice of its intention to terminate ("Notice Period"). If a Mortgagee remedies the breach during the Notice Period then the breach shall be treated as remedied between the parties. The parties acknowledge and agree that this clause 14.2 confers benefits on, and is enforceable by, each Mortgagee for the purposes of Part 2, Subpart 1 of the Contracts and Commercial Law Act 2017.

If this contract is terminated pursuant to this agreement and the material breach is subsequently remedied then the parties shall enter into a new services contract on the same terms as this contract with any necessary changes provided that where termination follows a material breach by the Owner, then the Service Provider may require the payment of a reasonable re-connection fee by the Owner as a pre-condition of the entry into of the new services contract.

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RECORDS

The Service Provider will maintain records in accordance with prudent business practice and all applicable laws.

All documents held by the Service Provider under this Contract, including but not limited to all reports, records, lists and manuals will be kept in a safe and secure location by the Service Provider.

The Service Provider will provide the Owner with access to such documents, records and other information relating to the Services at any time upon reasonable notice being provided by the Owner.

AUDIT

The Owner may carry out an audit of the Service Provider strictly for the purpose of reviewing relevant information relating to the Fees so as to ensure the Fees invoiced are accurate. The parties shall in good faith agree the process for any such audit. The Owner may not request an audit more than once per year.

GENERAL

Meetings: The parties will agree a regular meeting regime for the purposes of reporting and administering this Contract.

Entire arrangement: This Contract:

(A) records the entire arrangement between the parties relating to the matters dealt with in this Contract; and

(B) supersedes all previous arrangements, understandings or representations whether written, oral or both, relating to these matters.

Amendment: Subject to any other provision of this contract expressly providing for the updating or amendment of any particular plan or document, no amendment to this Contract will be valid unless it is in writing and executed by both parties.

No Waiver: Any waiver by either party of any of its rights or remedies under this Contract will be effective only if it is recorded in writing and signed by a duly authorised representative of that party. If the waiver relates to a breach of any provision of this contract this will not (unless stated otherwise) operate as a waiver of any other breach of that provision.

Governing Law and Jurisdiction: This Contract is governed by New Zealand law. The parties submit to the non-exclusive jurisdiction of the New Zealand courts in respect of all matters relating to this Contract.

Severability: If any provision contained in this contract is held to be illegal, invalid or unenforceable, it will be severable, will be deemed to be deleted from this contract and will not affect the validity or enforceability of any other provisions in this contract.

Relationship of the Parties: Nothing expressed or implied in this contract will constitute either party as the partner, agent, employee or officer of, or as a joint venturer with, the other party. Neither party will make any contrary representation to any other person. The relationship of the Service Provider to the Owner is that of an independent contractor.

Counterparts: This contract may be executed in one or more counterpart copies which, read together, will constitute one and the same instrument.

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Method of Delivery: Any written notice required under this contract will be signed by a duly authorised representative of the party giving that notice and will be deemed validly given if:

(A) delivered by hand to the intended recipient's address as set out below; or

(B) by email, is not deemed received unless (if receipt is disputed) the party giving notice produces a printed copy of the email which evidences that the email was sent to the email address of the party given notice.

Service Provider Address
[xx]

For the purposes of this contract, any notice transmitted by email or delivered after 5.00 pm New Zealand time on a Business Day, or at any time on a non-Business Day, will be deemed received at 9.00 am New Zealand time on the next Business Day (being, in each case, the time of day at the intended place of receipt of that notice).

Further Assurances: Each party will do all things and execute all documents reasonably required in order to give effect to the provisions and intent of this Contract.

Costs: Except to the extent of any express contrary provisions of this contract, each party will bear its own costs and expenses incurred in connection with the negotiation, preparation and implementation of this Contract.

EXECUTION

[ ]

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SCHEDULE 1

PROPERTY

Property Description: [xx]

SERVICES

Domestic Water:

1. Water for domestic purposes will be supplied via a reticulation system owned and managed by the Service Provider.
2. The water source is [describe]. This water is periodically tested and the supply accords with [describe applicable supply categorisation and regulation].
3. The water will be reticulated under gravity pressure and where required will be pumped to a connection point at each Owner's boundary. The connection point shall include a flow restrictor and water meter housed in a buried water toby. It is the Owner's responsibility to connect to their water connection.
4. Each dwelling will be supplied a minimum of [1,000 l/day].
5. The Service Provider will hold and maintain the Water User Agreement and resource consents necessary to take and use water for domestic purposes, and such easements as are required to convey water from the connection at the [Chinaman's Terrace Scheme] to each Owner's water connection point.
6. The Service Provider will supply the domestic water and maintain the distribution system in accordance with the Water Supply and Distribution System – Operations and Maintenance Manual adopted by the Service Provider as amended from time to time.

Common Area Land Management, including vegetation enhancement

7. [To insert]

Fire Risk Management

8. [To insert]

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SCHEDULE 2

FEES

Lot Number	Water supply	Other Services	Est. Fees per year
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
26			
27			
28			
29			
30			

The actual Fees payable for the Services shall be based on the actual reasonable costs incurred by the Service Provider, including a reasonable management fee, for providing the Services on a cost recovery basis and fairly apportioned between the Lot owners.

There should be no mark-up on materials, external hire fees or subcontracted costs.

Fees may be reviewed from time to time and varied taking into account the actual cost of providing the Services.

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SCHEDULE 3

CHINAMAN'S TERRACE WATER SUPPLY AGREEMENT

[To insert]

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CONSTITUTION

OF

ROCKY POINT SERVICES LIMITED

ROCKY POINT SERVICES LIMITED CONSTITUTION

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CONSTITUTION OF ROCKY POINT SERVICES LIMITED PURSUANT TO THE COMPANIES ACT 1993

1. Definitions

1.1 In this Constitution, the following words and expressions have these meanings:

Act means the Companies Act 1993 together with any statutory provision, which amends or replaces it and any subordinate legislation made under it.

annual meeting means a meeting of shareholders held pursuant to clause 11.1.

associated person has the meaning given to that term in Subpart YB Income Tax Act 2007.

balance date means the date adopted by the Company as the end of its financial year for the purpose of its annual financial statements.

board means directors who number not less than the required quorum acting together as the board of directors of the Company or, if the Company only has one director, that director.

company means Rocky Point Services Limited.

company facilities means the following facilities that are owned, maintained, administered, or operated by the Company:

(a) All water distribution infrastructure from the point of take to and including the toby, flow restrictor and water meter servicing each Lot

(b) Any area designated as land common to the developed properties (including areas over which right of way easements are registered); and

(c) Associated utilities.

contract for Services means the contract for services to be entered into by the Landowner(s) with the Company in the form of the Land Covenant (as defined herein).

constitution means this constitution and all amendments to it from time to time.

contribution means any contributions determined in accordance with this Constitution.

controlling entity means a person that-

(a) is the Developer or an associated person, or agent, of the Developer; and

(b) has the power, directly or indirectly, to-

(i) exercise, or control the exercise of, the rights to vote attached to 50% or more of the voting securities of the Company; or

(ii) effectively control the activities of the Company in respect of the

Development and/or the Company facilities (or both).

developer means [Insert] [to be updated to allow for transfer prior to development]

development means the property development undertaken by the Developer comprising the staged subdivision of the underlying titles.

director means a person appointed and continuing in office for the time being, in accordance with this Constitution, as a director of the Company.

general meeting means any meeting of shareholders.

interests register means a register kept by the Company at its registered office as required by section 189(1)(c) of the Act.

Land Covenant means the land covenant comprising the Contract for Services, registered as a covenant in gross over the land within the Development and includes any registered variation thereof.

Operational and Maintenance Manuals means the operational and maintenance manuals in respect of operations of the Company facilities as amended from time to time.

ordinary resolution means a resolution approved by a simple majority of the votes of those shareholders entitled to vote and voting on the question.

ordinary share means a share which confers on the holder:

(a) the right to vote at meetings of shareholders and on a poll to cast one vote per Property;

(b) subject to the rights of any other class of shares, the right to an equal share in distributions made by the Company; and

(c) the right to an equal share in the distribution of the surplus assets of the Company on its liquidation.

Landowner means a registered owner of a fee simple estate in a Property.

Property means each of the properties created by the subdivision of the underlying titles (which benefit from the Company facilities).

register means the register of shares required to be kept by clause 6 of this Constitution and section 87 of the Act.

share means a share in the Company.

shareholder means a person holding one or more shares in the Company.

For the purpose of this definition "**debts**" and "**liabilities**" have the meaning given to those terms in section 52(4) of the Act .

special meeting means any meeting (other than an annual meeting) of shareholders

entitled to vote on an issue, called at any time by the director(s).

special resolution means a resolution of shareholders approved by a majority of 75 per cent of the votes of those shareholders entitled to vote and voting on the question.

underlying titles means records of title 1156487 & 1156488

utilities" means the domestic water supply, roading and common areas within the Development.

water infrastructure assets means the following assets that are owned, maintained, administered, or operated by the Company:

(a) The benefit of any easements in gross;
(b) The water pump(s) and associated infrastructure that comprise Company facilities;
(c) all pipes and fittings from the water pump to the boundary of each shareholder's lot.

working day means a day of the week other than:

(a) Saturday, Sunday, Good Friday, Easter Monday, Anzac Day, the Sovereign's Birthday, Labour Day, Otago Anniversary Day and Waitangi Day;
(b) a day in the period commencing with the 25th day of December in any year and ending with the 2nd day of January in the following year;
(c) if the first day of January in any year falls on a Friday, the following Monday; and
(d) if the first day of January in any year falls on a Saturday or Sunday, the following Monday and Tuesday.

writing includes all modes of representing or reproducing words, figures or symbols in a visible form including reproduction by facsimile machine .

1.2 Words importing the singular include the plural and vice versa.

1.3 A reference to a person includes any firm, Company or other body corporate.

1.4 Words importing one gender include the other gender.

1.5 Subject to this clause, expressions contained in this Constitution bear the same meaning as specified in the Act.

1.6 A reference to a clause means a clause of this Constitution.

1.7 The clause headings are included for convenience only and do not affect the construction of this Constitution.

2. Company Activities.

2.1 The Company is only permitted to carry out the following activities:

(a) Owning, leasing, licensing, maintaining, administering, or operating the Company facilities;

(b) Administering a bundle of rights and obligations to shareholders of the Company that confer rights on those shareholders to use the Company facilities and administering and enforcing those rights and obligations in accordance with the Constitution;

(c) Providing and maintaining services, utilities and benefits to properties within the Development;

(d) Within the parameters of this Constitution, to make, establish, amend or repeal and re-enact the Constitution, and such company rules as it deems proper covering any and all aspects of its functions, including the use and occupancy of the Company facilities .

(e) To carry out and enforce all duties of the Company set forth in the Constitution and the Land Covenant; and

(f) Any incidental activities that the Company considers beneficial for the shareholders of the Company .

2.2 All Contributions paid to the Company by its shareholders are to be applied only for the activities referred to in clause 2.1.

2.3 The Company is prohibited from carrying out the following activities:

(a) The carrying on of trading activities;

(b) The carrying on of business for profit;

(c) Operating an overdraft;

(d) Raising funds by way of a loan; and

(e) Mortgaging any of the Company's land or assets.

2.5 All provisions included in this Constitution conferring rights and powers on the controlling entity in its capacity as controlling entity will expire or terminate no later than the earlier of the completion of the Development [or 1 December 2024]

3. Issue of shares

3.1 All shares shall initially be issued to the Developer. The Developer shall transfer 10 shares to the owner of each Property on settlement of the relevant agreement for sale and purchase in respect of the relevant property or anytime thereafter.

3.2 The owners of a Property will transfer the shares that they hold in the Company, in respect to that record of title on settlement of the sale of that Property.

3.3 Only an owner of a Property within the Development may be a shareholder of the Company.

3.4 If there is more than one owner of a Property all registered owners must hold the shares jointly.

3.5 No shareholders may hold more than an equal proportion of shares such that every owner of a Property shall hold the same number of shares per Property.

4. Contributions

4.1 The Company shall be entitled to recover from each shareholder such amounts as the Board may determine from time to time ("Contributions") on the basis set out in the Contract for Services.

5. Use of Contributions

5.1 Contributions levied by the Board shall be used exclusively for the purpose of carrying out the Company's activities in clause 2.1.

5.2 Any expenses or costs incurred by the Company in respect of a particular Property or arising from the action or inaction of a particular shareholder shall be levied as a Contribution against that Property and be payable by the shareholder who is the registered owner of that Property.

5.3 If any Contribution (or other money owing by the shareholders to the Company) is in arrears the shareholder may be required by the Company to pay a late charge including interest at up to 2% per month compounded monthly as the Board may determine, and such late charge (plus any reasonable handling cost) shall be a charge against the certificate of title to which the Contribution relates and shall be added to and be part of that Contribution.

5.4 A Shareholder who sells his, her, their or its shares is not entitled to any refund from the Company.

6. Transfer of shares

6.1 Entry in register and evidence of transfer.

Shares shall only be transferred, and a new shareholder entered onto the register when:

(a) The registered owner of a Property within the Development or their personal representative, completes settlement (**Settlement**) of an agreement for sale and purchase or in any other manner transfers the legal ownership of their interest in that Property to a new registered owner; and

(b) Immediately upon Settlement the following must be provided to the Company :

(i) A post registration search copy of the Record of title evidencing the change in ownership of the Property; and

(ii) A signed share transfer form relating to the shares associated with the Property.

6.2 Form of transfer

The form of transfer must be signed by the transferee.

6.3 Director's right to refuse or delay registration of transfer

(a) The director may, within 30 working days of the receipt of a form of transfer of shares, refuse or delay the registration of the transfer if:

(i) the holder of the shares has failed to pay an amount due to the Company in respect of those shares;

(ii) the director considers that to effect the transfer would result in a breach of the law;

(iii) the form of transfer has not been properly executed or does not comply with clause

(b) A resolution by the director to refuse or delay a transfer of shares must set out in full the reason for doing so, and a copy of the resolution and proposal to rectify the basis for refusal to register must be sent to the transferor and transferee within 5 working days of the date of the resolution being passed.

6.4 Registration of transfer. Subject to clauses 6.2 and 6.3, on receipt of a duly completed form of transfer, the Company must enter the name of the transferee on the register as holder of the shares, unless the Board has resolved in accordance with clause 6.3 to refuse or delay the registration of the transfer of the shares.

7. Share register

7.1 Maintain register

(a) The Company must maintain a register which records all shares issued by the Company and which states :

(i) whether, under this Constitution or the terms of issue of any shares, there are any restrictions or limitations on their transfer; and

(ii) where any document that contains the restrictions or limitations may be inspected.

(b) The Company may appoint an agent to maintain the register.

7.2 Contents of register. The register must state, with respect to each class of shares:

(a) the names (alphabetically arranged) and the latest known address of each person who is, and each person who has been within the last 10 years, a shareholder;

(b) the number of shares held by each shareholder within the last 10 years; and

(c) the date of any:

(i) issue of shares to; or

(ii) transfer of shares by or to;

each shareholder within the last 10 years; and in relation to the transfer, the name of the person to or from whom the shares were transferred.

7.3 Directors' duty to supervise register. It is the duty of each director to take

reasonable steps to ensure that the register is properly kept and that the transferees' names are promptly entered on it in accordance with clause 6.4.

7.4 **Register prima facie evidence.** Subject to section 91 of the Act (power of Court to rectify register), the entry of the name of a person in the register as holder of a share is prima facie evidence that the legal title to the share is vested in that person.

7.5 **Register evidence of rights.** The Company may treat the registered holder of a share as the only person entitled to:

(a) exercise the right to vote attaching to the share;

(b) receive notices in respect of the share;

(c) receive a distribution in respect of the share; and

(d) exercise the other rights and powers attaching to the share.

7.6 **Trust not to be registered or recognised**

(a) No notice of a trust, whether express, implied, or constructive, may be entered on the Companies office register.

(b) Except as required by law, no person will be recognised by the Company as holding any share upon trust or holding any interest in a share (whether equitable, contingent, future or partial) except the absolute legal right to the entirety of the share vested in the registered holder.

(c) A personal representative of a deceased holder of shares is entitled to be entered in the register as the holder of such shares as a personal representative. The registration of a trustee, executor or administrator as a personal representative of a deceased shareholder does not constitute notice of a trust.

(d) Any change in the trusteeship of a trust that results in a change to the legal ownership of a property, must be notified to the Company immediately and the share transfer updated accordingly.

8. Transmission of shares

8.1 In the case of the death of a shareholder, the survivor (where the deceased was a joint holder) or the legal personal representative of the deceased (where the deceased was a sole holder) will be the only person recognised by the Company as having any title to the deceased's interest in the shares. Nothing contained in this clause 8.1 will release the estate of a deceased joint holder from any liability in respect of any share which had been jointly held by the deceased with other persons.

8.2 Notwithstanding clause 7.6 (a) (trust not to be registered or recognised), the assignee of the property of a bankrupt shareholder is entitled to be registered as the holder of the shares held by the bankrupt.

9. Shareholder Rights

9.1 Shareholders have right to vote

Shareholders of the Company have the right to vote at meetings of shareholders of the Company.

9.2 Shareholders personal obligation for payment of contributions

(a) Contributions shall be the personal and individual debt of the shareholder(s).

(b) Subject to sub clauses (c) and (d) below, no person or body shall be liable for any Contributions other than Contributions incurred in respect of the period during which that person or body is the registered owner of a Property.

(c) A shareholder and registered owner of a Property shall be liable for any outstanding Contributions payable in respect of any period prior to the date that shareholder becomes a registered owner of a Property, provided that this sub clause shall not apply where that registered owner has obtained written advice from the Company prior to becoming a registered owner of that Property that no outstanding levy is payable in respect of that Property.

(d) The registration of a transfer of a shareholder's interest in any property shall not relieve the transferor from any liability arising prior to that date of registration of such transfer.

9.3 Where a transfer of a share is made to a transferee the transferor agrees to indemnify and keep indemnified the Company from all actions, claims, demands, losses and other payment due and payable to the Company and for which the transferee is liable and the transferor, subject to payment of all Contributions and any other monies owed by the transferor as at the date of the transfer of the share, shall be released from any liability to the Company.

10. Exercise of powers reserved to shareholders

10.1 Powers reserved to shareholders

(a) Powers reserved to shareholders of the Company by the Act or by this Constitution may be exercised:

(i) at an annual meeting or a special meeting; or

(ii) by a resolution in lieu of a meeting pursuant to clause 11.3.

(b) Unless otherwise specified in the Act or this Constitution, a power reserved to shareholders may be exercised by special resolution.

10.2 Special resolutions. When shareholders exercise a power to approve any of the following, that power may only be exercised by a special resolution:

(a) an alteration to or revocation of this Constitution or the adoption of a new Constitution, which alteration, revocation or adoption must comply with the terms of the resource consent affecting the Development;

(b) a major transaction;

(c) an amalgamation;

(d) the liquidation of the Company.

10.3 Any decision made by special resolution pursuant to this clause may be rescinded only by a special resolution, provided that a resolution to put the Company into liquidation cannot be rescinded.

11. Meetings of shareholders

11.1 Annual meeting

(a) The Board must, in accordance with section 120 of the Act, call an annual meeting of shareholders to be held:

(i) once in each calendar year (other than in the year of the Company's incorporation);

(ii) not later than 6 months after the balance date of the Company; and

(iii) not later than 15 months after the previous annual meeting, or in respect of the first annual meeting not later than 18 months after the date of the Company's incorporation.

(b) The Company must hold the annual meeting on the date on which it is called to be held.

11.2 Special meetings. A special meeting:

(a) may be called at any time by the Board; and

(b) must be called by the Board on the written request of shareholders holding not less than 75 per cent of the votes entitled to be cast on the issue.

11.3 Resolution in lieu of meeting

(a) A resolution in writing signed by not less than 75 per cent of the shareholders who would be entitled to vote on that resolution at a meeting of shareholders, who together hold not less than 75 per cent of the votes entitled to be cast on that resolution, is as valid as if it had been passed at a meeting of those shareholders.

(b) Within 5 working days of a resolution being passed under this clause, the Company must send a copy of the resolution to every shareholder who did not sign the resolution or on whose behalf the resolution was not signed.

11.4 Chairperson of meetings of shareholders

(a) If the directors have elected a chairperson, and that chairperson is present at a meeting of shareholders, he or she must chair the meeting.

(b) If no chairperson has been elected or if, at any meeting of shareholders, the chairperson is not present within 15 minutes of the time appointed for the commencement of the meeting, the shareholders present may choose one of their number to chair the meeting.

11.5 Shareholders entitled to notice of meeting

All shareholders are entitled to receive notice of a meeting of shareholders.

11.6 **Notice of meeting.** Written notice of the time and place of a meeting of shareholders must be sent to every shareholder entitled to receive notice of the meeting, and to every director and the auditor of the Company, not less than 10 working days before the meeting.

11.7 **Contents of notice.** The notice referred to in clause 11.6 must state:

(a) the nature of the business to be transacted at the meeting in sufficient detail to enable a shareholder to form a reasoned judgment in relation to it;

(b) the text of any special resolution to be submitted to the meeting.

11.8 **Irregularities in notice**

(a) An irregularity in a notice of a meeting is waived if all the shareholders entitled to receive notice of the meeting attend the meeting and agree to the waiver.

(b) The accidental omission to give notice of a meeting to, or a failure to receive notice of a meeting by, a shareholder does not invalidate the proceedings at that meeting.

11.9 **Method of holding meeting.** A meeting of shareholders may be held either:

(a) by a number of shareholders, who constitute a quorum, being assembled together at the place, date and time appointed for the meeting; or

(b) by means of audio, or audio and visual, communication by which all shareholders participating and constituting a quorum, can simultaneously hear each other throughout the meeting.

11.10 **Adjournments.** If a meeting of shareholders is adjourned for less than 30 days, it is not necessary to give notice of the time and place of the adjourned meeting other than by announcement at the meeting which is adjourned.

11.11 **Minutes**

(a) The Board must ensure that minutes are kept of all proceedings at meetings of shareholders.

(b) Minutes which have been signed as correct by the chairperson of the meeting are prima facie evidence of the proceedings.

12. **Voting at meetings**

12.1 **Quorum**

(a) A quorum for a meeting of shareholders is present if those shareholders who are present, or their proxies who are present, are between them able to exercise a majority of the votes to be cast on the business to be transacted by the meeting.

(b) Subject to clause 12.1(c), no business may be transacted at a meeting of shareholders if a quorum is not present.

(c) If a quorum is not present within 30 minutes after the time appointed for the meeting:

(i) in the case of a meeting called pursuant to a requisition of shareholders under clause 11.2(b), the meeting is dissolved:

(ii) in the case of any other meeting, the meeting is adjourned to the same day in the following week at the same time and place, or to such other date, time and place as the directors may appoint, and if at the adjourned meeting, a quorum is not present within 30 minutes after the time appointed for the meeting, the shareholders present or their proxies are a quorum.

12.2 Voting

(a) In the case of a meeting of shareholders held under clause 12.1 (a), unless a poll is demanded, voting at the meeting shall be by whichever of the following methods is determined by the chairperson of the meeting:

(i) voting by show of hands; or

(ii) ballot.

(b) In the case of a meeting of shareholders held under clause 12.2 (a), voting at the meeting shall be by the shareholders signifying individually their assent or dissent by voice.

(c) A declaration by the chairperson of the meeting that a resolution is carried by the requisite majority is conclusive evidence of that fact.

(d) The chairperson of a shareholders' meeting is not entitled to a casting vote.

12.3 Proxies and representatives

(a) A shareholder may exercise the right to vote either by being present or by proxy.

(b) A proxy for a shareholder is entitled to attend, be heard, and vote at a meeting of shareholders as if the proxy were the shareholder.

(c) A proxy must be appointed by notice in writing signed by the shareholder, and the notice must state whether the appointment is for a particular meeting or a specified term not exceeding 12 months.

(d) No proxy is effective in relation to a meeting unless a copy of the notice of appointment is produced before the start of the meeting.

(e) A body corporate which is a shareholder may appoint a representative to attend a meeting of shareholders on its behalf in the same manner as that in which it could appoint a proxy.

13. Directors

13.1 Number of directors. The number of directors may not be fewer than one (1) nor more than four (4) [PROVIDED that the Company shall only have one (1) director, being Timothy Dermott O'Sullivan until the Development is fully completed (such that the Developer ceases to have any legal interest in any of the Property).] to

review

13.2 Appointment and removal by notice

(a) Subject to clause 13.3, the directors are the persons appointed from time to time as directors by a notice in writing signed by the holders of the majority of the ordinary shares and who have not retired or been removed or disqualified from office under this Constitution.

(b) A director may be removed from office at any time by a notice in writing signed by the holders of the majority of the ordinary shares.

(c) A notice given under clauses 13.3(a) or (b) takes effect upon receipt of it at the registered office of the Company (including the receipt of a facsimile or emailed copy) unless the notice specifies a later time at which the notice will take effect. The notice may comprise one or more similar documents separately signed by the shareholders giving the notice.

(d) A direct or holds office until his or her retirement, disqualification or removal in accordance with this Constitution.

13.3 Disqualification and removal. A person will be disqualified from holding the office of director if he or she:

(a) is removed under clause 13.3; or

(b) resigns in writing and is not reappointed in accordance with this Constitution, or

(c) becomes disqualified from being a director pursuant to section 151 of the Act;

(d) is prohibited from being a director or promoter of or being concerned with or taking part in the management of a Company under section 382 or sect ion 385 of the Act;

(e) becomes a protected person under the Protection of Personal and Property Rights Act 1988;

(f) is an undischarged bankrupt.

13.4 Shareholding qualification.

A director is not required to hold shares.

14. Powers and duties of the Director

14.1 Powers of the Director

(a) Subject to clause 14.1(b) and any restrictions in the Act or this Constitution, the business and affairs of the Company must be managed by or under the direction or supervision of the director.

(b) The director has, and may exercise, all the powers necessary for managing, directing and supervising the management of the business and affairs of the Company except to the extent that this Constitution or the Act expressly requires those powers to be exercised by the shareholders or any other person.

14.2 **Directors to act in good faith.** Subject to this clause, a director, when exercising powers or performing duties, must act in good faith and in what the director believes to be the best interests of the Company.

14.3 **Other offices with Company held by director**

(a) Any director may act by himself or herself, or by the director 's firm in a professional capacity for the Company; and the director or the director's firm will be entitled to remuneration for professional services as if the director were not a director. Nothing in this clause authorises a director or the director's firm to act as auditor for the Company.

(b) A director may hold any other office under the Company (other than the office of auditor) in conjunction with the director's office of director, for such period and on such terms (as to remuneration and otherwise) as the Board may determine.

14.4 **Financial Statements**

The director(s) must ensure that financial statements of the Company complying with the Financial Reporting Act 2013 are reviewed annually and distributed to shareholders of the Company as soon as is reasonably practicable after each review is completed and, in any event, no later than 5 months after the balance date of the Company.

14.5 The Developer does not contemplate holding Board meetings prior to the earlier of the Completion of Development or 1 December 2024. Following this date the Board meeting procedure shall be the procedure recorded at Schedule 3 of the Companies Act 1993.

15. **Indemnity and Insurance**

15.1 Indemnification and insurance of directors and employees of the Company may be affected in accordance with section 162 of the Act.

15.2 All costs associated with providing the indemnity and insurance to directors and employees as detailed in clause 15.1 will be incorporated into the fees payable in accordance with the Contract for Services.

16. **Management of Company Facilities**

The Company shall manage the Company facilities in accordance with the terms of the Contract for Services and Operations and Maintenance Manual.

17. **Dispute Resolution**

17.1 If a dispute arises out of or relates to this Constitution:

(a) A party claiming the dispute may not commence any court or arbitration proceedings relating to the dispute unless it has complied with the following paragraphs of this clause, except where the party seeks urgent interlocutory relief.

(b) The party claiming the dispute (Dispute) must notify the Board as to the nature of the Dispute.

(c) On receipt of that notice by the Board, the Board must endeavour in good faith to promptly resolve the Dispute with the relevant parties.

(d) If the Dispute cannot be resolved within 10 working days of receiving notice of the Dispute, such Dispute shall be referred to the mediation of a single mediator appointed by the chairperson or any other office holder of AMINZ (Arbitrators' and Mediators' Institute of New Zealand).

(e) If a binding agreement has not been reached as a result of that mediation process, then any party may commence court or arbitration proceedings.

18. Liquidation

18.1 Distribution of surplus assets

Subject to the terms of issue of any shares, upon the liquidation of the Company, any surplus assets of the Company remaining after payment of the debts and liabilities of the Company and the costs of liquidation shall be distributed among each of the holders of ordinary shares in proportion to their shareholding.

18.2 Distribution of assets

Upon the liquidation of the Company the liquidator may, with the sanction of special resolution and any other sanction required by law, divide amongst the shareholders in kind the whole or any part of the assets of the Company (whether they consist of property of the same kind or not). The liquidator may for that purpose set such value as the liquidator deems fair upon any assets to be divided as aforesaid and may determine how the division shall be carried out as between the shareholders.

This document is certified as being the Constitution of

ROCKY POINT SERVICES LIMITED

_____

Director

CCL Ref: 14985-050724-kean

5 July 2023

CARRIAGEWAY CONSULTING
A. PO Box 29623, Christchurch, 8540
P. 03 377 7010
E. office@carriageway.co.nz

Gemma Kean
New Zealand Transport Agency Waka Kotahi

By e-mail only: gemma.kean@nzta.govt.nz

Dear Gemma

Proposed Residential Development, Bendigo Loop Road, Cromwell (NZTA Ref 2023-1343)

Thank you for the online meeting on 4 July 2024 with yourself and Chris Harris in respect of this application. As mentioned, this letter sets out a response to the submission made on the application by NZTA (dated 12 October 2023) and a suggested way forwards.

Background

An application has been lodged for a 33-lot subdivision towards the north of Cromwell and served via Bendigo Loop Road. NZTA subsequently lodged a submission opposing the proposal.

The site is located on the eastern side of State Highway 8, around 14km north of Cromwell, as shown below.

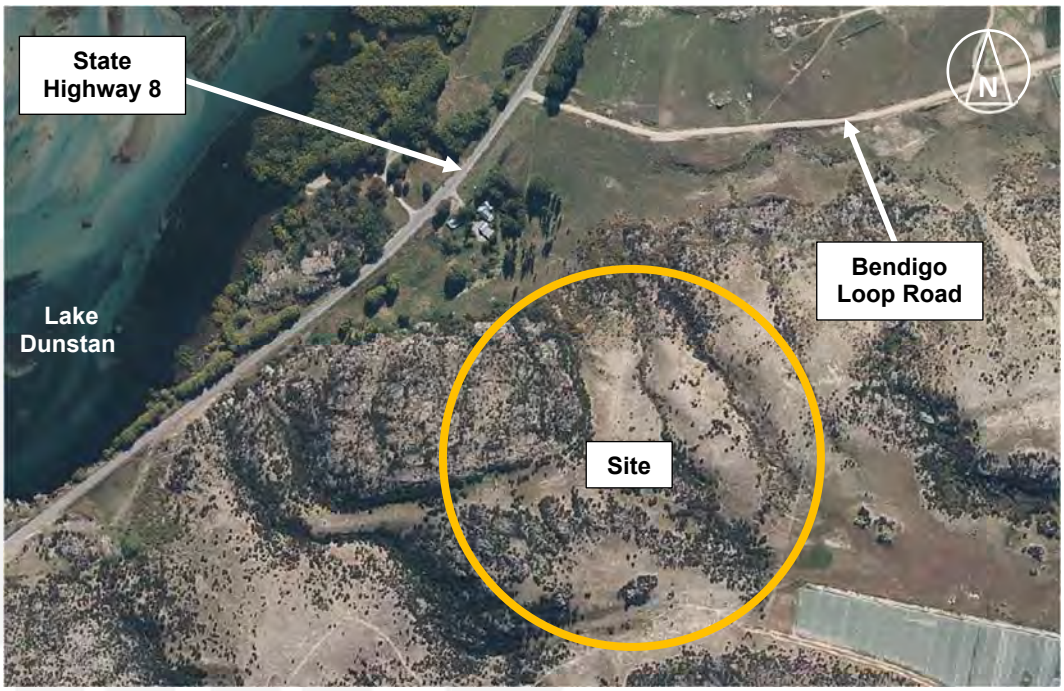


Figure 1: Site Location

In this location, State Highway 8 provides one traffic lane in each direction with a well-marked centreline and edgeline markings. There is a sealed shoulder present on both sides with a variable width, but is typically 0.5m to 1.0m. There is a culvert located around 25m north of Bendigo Loop Road, which includes a gabion wall on the western side located 3m from the edge of the northbound movement lane. This leads to a watercourse running along the western side of the highway. Other

than this however, generally the landform is relatively flat on each side of the carriageway. The speed limit on the highway is 100km/h.

Photograph 1: Typical Configuration of State Highway 8

Photograph 2: Gabion Wall Close to Movement Lane of State Highway 8

The intersection of Bendigo Loop Road with the highway is formed with slightly tapered shoulders on the eastern side but no shoulder widening on the western side. In essence, it is formed to a Diagram C arrangement (as set out in the NZTA Planning Policy Manual), albeit with very slight shoulder widening on the eastern side.

Photograph 3: Layout of State Highway 8 / Bendigo Loop Road Intersection, Looking North

The gentle curves in the highway alignment mean that the sight distances available for turning drivers in this location are excellent, and appear to be in excess of 300m.

NZTA has a number of traffic counters on State Highway 8 north of Cromwell and the closest counter on the highway is located just 200m south of Bendigo Loop Road (counter id:00800278). Recent traffic volumes on the state highway network have been adversely affected by restrictions on overseas visitors associated with Covid-19, but the most recent year for which data is available (2023) shows that traffic volumes are now in excess of those recorded pre-Covid. Consequently we have used the most up-to-date information.

Assessment of the data observed in this location shows the following general patterns of traffic flows:

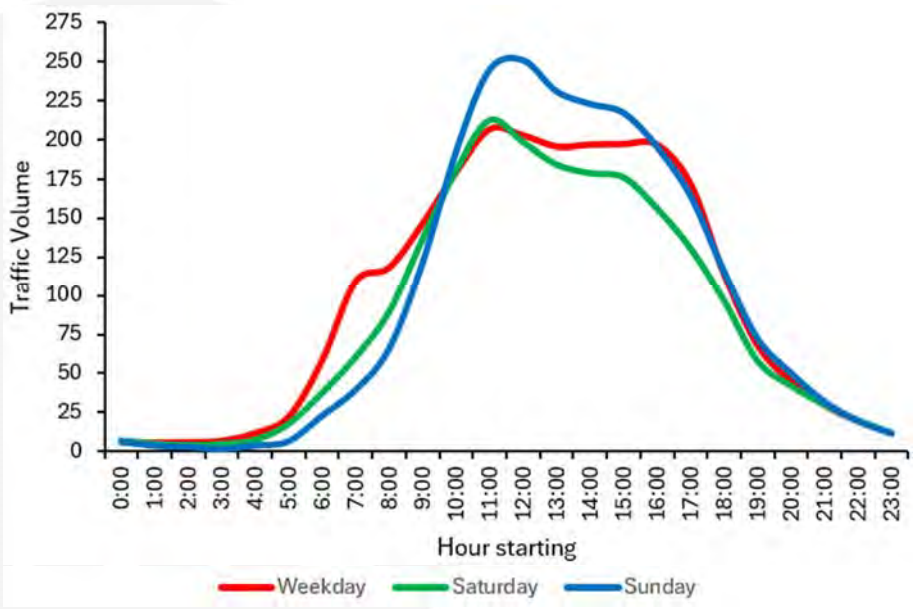


Figure 1: Average State Highway Traffic Flows at Bendigo Loop Road, 2023

The Annual Average Daily Traffic in 2023 was 2,286 vehicles, but when this is assessed further it shows:

- Annual Average Weekday Traffic: 2,330 vehicles
- Annual Saturday Traffic: 2,052 vehicles
- Annual Sunday Traffic: 2,301 vehicles

It can be seen from the graph that the highway does not have typical 'commuter' peak hours, and instead volumes rise over the course of a day and then fall in the late afternoon and evening. Further, some daytime hourly volumes on Saturday and most daytime hourly volumes on Sunday are greater than during the weekday. This pattern of traffic flows is commensurate with a highway carrying recreational and rural traffic, rather than a highway carrying commuter-type vehicles.

Further investigation shows that at the commuter peak periods there is a bias in the direction of travel:

- Weekday morning peak period (7am to 9am):
    - 82 vehicles travelling southbound
    - 146 vehicles travelling northbound
- Weekday evening peak (4pm to 6pm):
    - 221 vehicles travelling southbound
    - 148 vehicles travelling northbound

In the morning, most vehicles were observed to be travelling northbound (that is, away from Cromwell and towards Tarras) and in the evening, most vehicles were observed to be travelling southbound (that is, away from Tarras and towards Cromwell). In our view, this direction of flow is somewhat counter-intuitive and for clarity, we have not relied on it during further analyses.

The MobileRoad website indicates that Bendigo Loop Road carries 140 vehicles per day (two-way). Applying the same ratios of peak hour flow to daily flow as for the highway, this suggests that in the peak hours, the road would carry around 14 to 23 vehicles (two-way).

We have used the NZTA Crash Analysis System to identify all reported crashes within 500m of the State Highway 8 / Bendigo Loop Road intersection for the past five years (2019 to 2023, plus the partial record for 2024). However no crashes were recorded in this period.

In view of the reduced traffic volumes arising from travel restrictions during the pandemic, we also reviewed the same area for the previous five years (2013 to 2018). This showed two crashes were recorded, both on the state highway. One crash occurred 250m to the south of Bendigo Loop Road when a southbound vehicle turned right into a picnic area and was struck by another southbound vehicle. The crash did not result in any injuries. Another crash occurred around 75m north of Bendigo Loop Road when an overseas driver passed their GPS unit to a passenger, but when doing so, veered into gravel, skidded and the vehicle rolled. The crash resulted in serious injuries.

We do not consider that the crash record in the area indicates that there are any latent road safety issues on this part of the network, as the two crashes reported had different contributing factors and occurred in different locations. No crashes were reported relating to vehicles turning or slowing at the State Highway 8 / Bendigo Loop Road intersection.

NZTA Concern and Assessment

Concern Raised

In its submission, NZTA highlighted that there was insufficient information provided to show what improvements were required to the State Highway 8 / Bendigo Loop Road intersection.

There are two parts to this matter, the general form of the intersection and whether auxiliary turning lanes are justified. We address both below.

Determination of Existing Provision

Ultimately the form of an intersection depends on the traffic flows that it is anticipated to accommodate. In this regard, the NZTA Planning Policy Manual is a helpful starting point, as it provides basic information to enable the generic form to be identified. This relates the basic form of an access to the daily volume of traffic on the highway, the daily volume of traffic on the minor approach, and the amount of heavy vehicles carried by the minor road.

In this case, the traffic volume on Bendigo Loop Road is 140 vehicle movements (two-way), and we expect that there will be at least one heavy vehicle per week since the road provides access to a vineyard where agricultural and industrial vehicles will be present. As a minimum then, for the current traffic flows, an arrangement to Diagram E should be provided.

The Diagram E layout includes widened shoulders on both side of the highway over a distance of 90m in each direction, such that the total seal width is 12m (notionally a 3.5m traffic lane plus 2.5m shoulder on each side of the centreline). However this is not in place. Rather, the layout currently provided (Diagram C) is more suited to traffic flows of less than 30 vehicle movements per day on Bendigo Loop Road and with no heavy vehicle movements. Accordingly, we conclude that the current layout of the intersection falls below the expected provision of the Planning Policy Manual for the existing traffic flows that it carries.

The provision of auxiliary turning lanes is a calculation process and is set out in the Austroads Guide to Traffic Management Part 6 ('Intersections, Interchanges and Crossings'). As the proposal is for a residential development, we expect that the peak hour for the turning movements into the site will occur during the weekday afternoons, between 4pm to 6pm. The busiest period during the weekday afternoons is 3pm to 4pm, where the average peak hour volume in 2023 was 197 vehicles (two-way). Taking into account the 100km/h speed limit on the highway, an auxiliary right-turn lane is justified when more than 80 vehicles turn right into Bendigo Loop Road. An auxiliary left-turn lane is justified when more than 80 vehicles turn left within the same hour[1].

No intersection traffic count has been carried out to determine the numbers of right-turn and left-turn movements. However taking the worst case and assuming that all of the existing vehicles turn right or left into Bendigo Loop Road, the threshold of 80 vehicles is not reached.

In the absence of turning lanes, shoulder widening becomes more important. This is because without any widening, turning traffic is unable to move out of the through-traffic lane prior to undertaking the turn and instead must significantly slow down within the through-traffic lane. This then increases the risk that other drivers may fail to appreciate the difference in speed and run into the slower vehicle, especially if the drivers are not familiar with the roading layout (as is the case where a road or highway carries recreational traffic). We note that while the number of crashes on the highway is low, one crash involved a vehicle that had slowed to turn into an access and was

[1] These values of turning traffic are likely to be greater than this in practice, but the graphs used do not extend to more than 80 vehicles, and there is no research that suggests it could be extrapolated.

struck from the rear by another vehicle. It is not unreasonable in our view to assume that at least in part, this was due to the following vehicle being unable to pass the turning vehicle due to a lack of shoulder widening in that location.

In summary then, under the current traffic volumes, the existing layout of the State Highway 8 / Bendigo Loop Road does not meet the anticipated layout requirements set out in the Planning Policy Manual. We consider that a Diagram E arrangement, which includes shoulder widening, is justified for the current traffic flows.

Determination of Future Provision

The proposed development is for 33 residential lots. Given that these are located some distance from the nearest settlement, applying generic trip rates means it is likely that each lot will generate 6-8 vehicle movements per day and potentially up to 1 vehicle movement in the peak hours[2].

In terms of the general arrangement of the intersection, there is no more substantial layout than the Diagram E layout discussed above (that is, there is no 'Diagram F').

With regard to the peak hour traffic generation, the 33 lots would generate at most 33 inbound traffic movements. Even if all of these were to turn right into the site (or all were to turn left into the site), this would still not be sufficient to trigger the need for an auxiliary right-turn or left-turn lane. The peak hour trip generation rate would need to be more than twice the anticipated rate, which is highly unlikely.

On this basis, with the subdivision in place, the intersection layout would therefore continue to be Diagram E arrangement (that is, a layout with no auxiliary turning lanes, but with shoulder widening)

Discussion

The need for a Diagram E type of layout arises once the traffic flows on the minor approach reach 31 equivalent car movements per day, and the MobileRoad data shows that volumes are presently more than four times greater than this. Consequently on the basis of our assessment, we consider that there is an existing deficiency in the geometry of the State Highway 8 / Bendigo Loop Road intersection, in that shoulder widening is presently justified on each side of the movement lanes but is not provided.

In the event that this existing deficiency was resolved and a Diagram E layout was in place, the additional traffic generated by the proposed subdivision would not give rise to the need for any geometric improvements. Rather, under that scenario, the increased traffic would be able to be accommodated within the same intersection geometry.

In passing, we highlight that there is a second road safety hazard in this location, being the watercourse. The gabion wall is located close to the edge of the traffic movement lane, and the absence of a shoulder and a safety barrier means that an errant driver losing control in this location would strike the wall head-on. In our view this could result in a fatality. While it might be considered that a loss of control in this location would be rare, we note that one of the two crashes recorded involved a loss of control by a driver who left the road just north of this location.

[2] In practice, the exact traffic generation rates used do not influence the outcomes of the analysis in this case.

Although we have not carried out a full safety assessment of this situation, under the NZTA State Highway Geometric Design Manual it appears that a considerably larger clear zone is required than is presently provided, and hence that a safety barrier is required in this location (but is not in place).

Way Forwards

We have been advised that the applicant in this case recognises that the current form of the State Highway 8 / Bendigo Loop Road intersection has a sub-standard layout for the current traffic flows and therefore remains sub-standard for the increase in traffic associated with the proposed development.

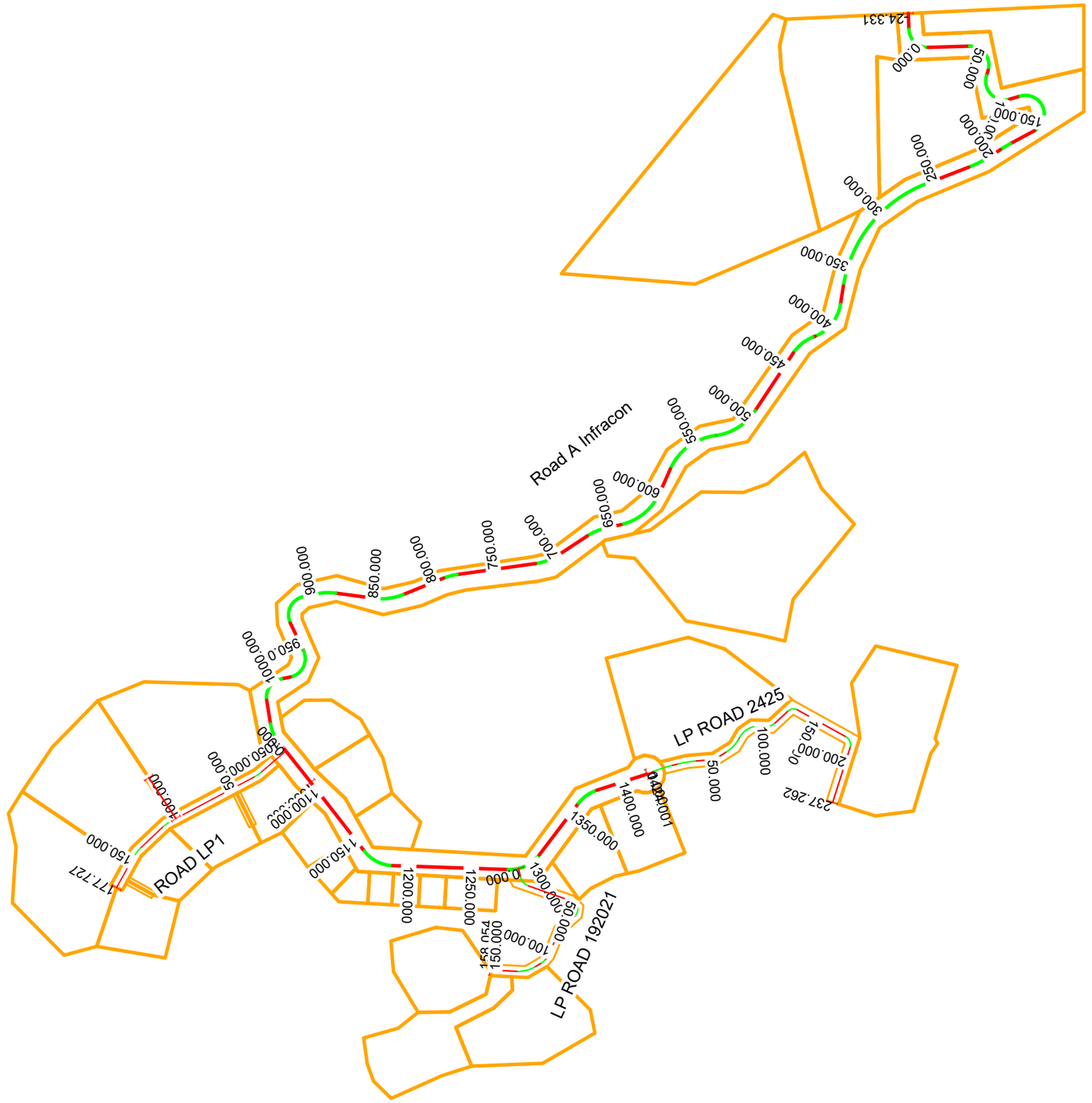
To ensure that the safety and efficiency of the highway is protected, we are advised that the applicant will propose a condition of consent on the development that "*Prior to issue of certification under s224(c), the State Highway 8 / Bendigo Road intersection shall be formed to NZTA's Diagram E standard*". In other words, lot titles will not be issued until after the intersection is improved. We consider that this will provide a suitable degree of protection to the highway.

We would be grateful for your consideration and feedback regarding the above, and in particular your views on whether the proposed condition of consent addresses NZTA's concerns in this matter. Please do not hesitate to contact me if you require any further information in respect of the above, or would like clarification of any issues.

Kind regards
Carriageway Consulting Limited

Andy Carr
Traffic Engineer | Director

Mobile 027 561 1967
Email andy.carr@carriageway.co.nz



COTERRA.

Surveying, Planning and Land Development

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LEVEL 3, 80 ARDMORE ST | P.O. BOX 599
03 443 5052

CROMWELL
17A MURRAY TERRACE | P.O. BOX 51
03 445 0376

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Project

ROCKY POINT
TKO PROPERTIES

Title

ROAD LONG SECTION

ROAD LONG SECTION

ISSUE	DETAIL	DATE

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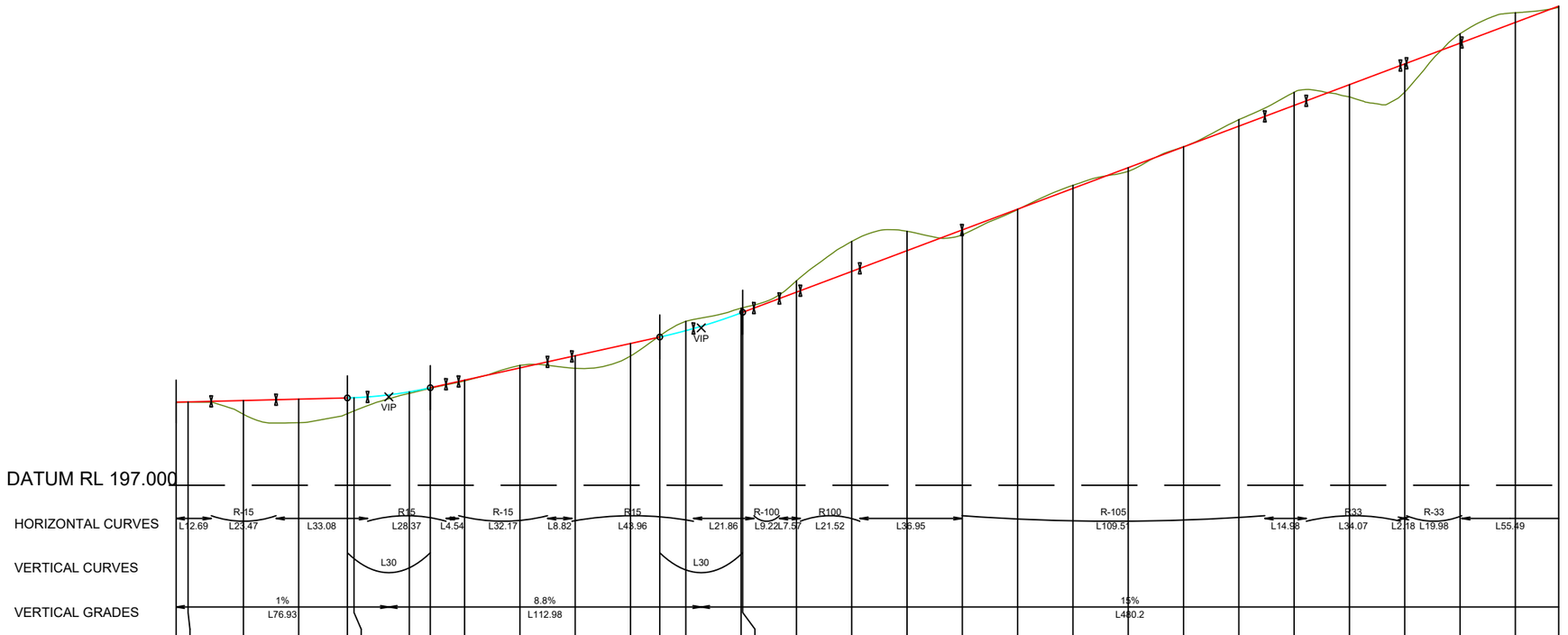
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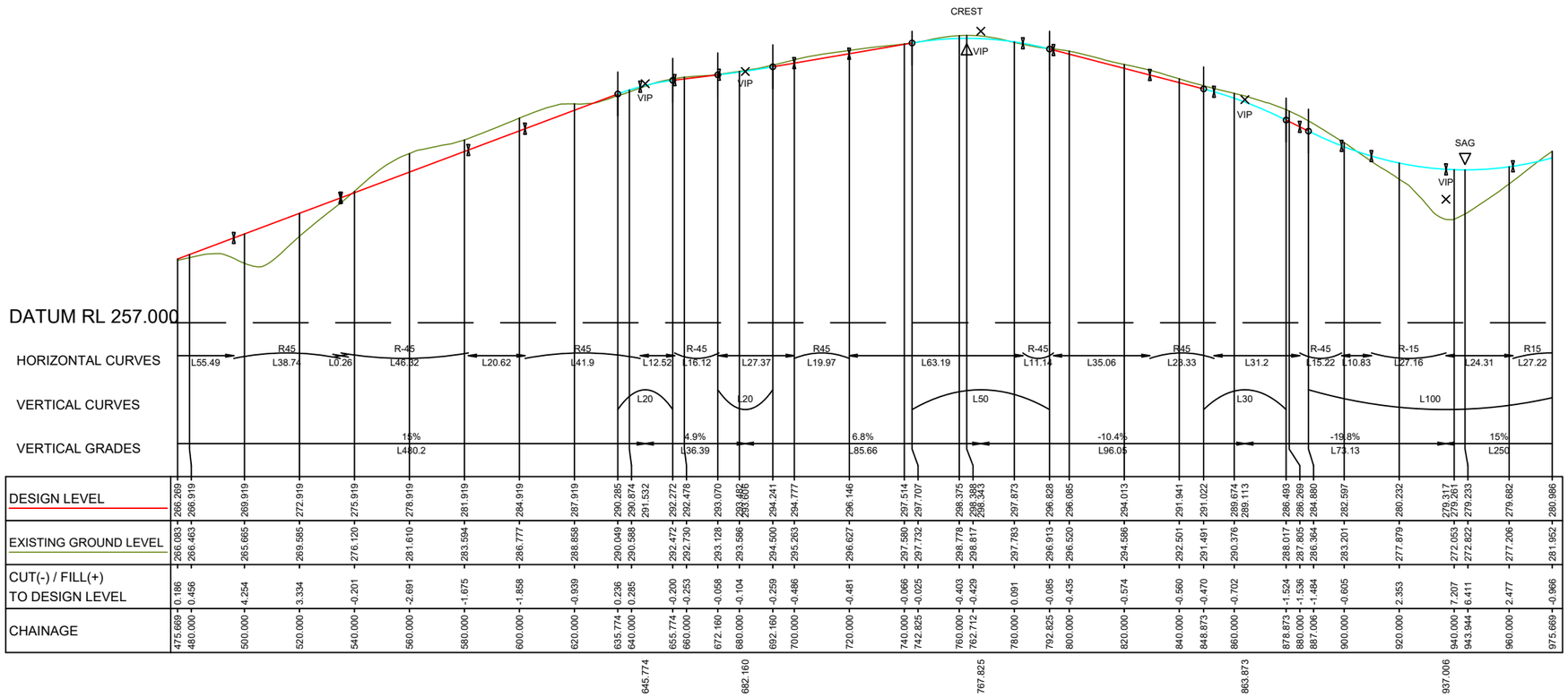
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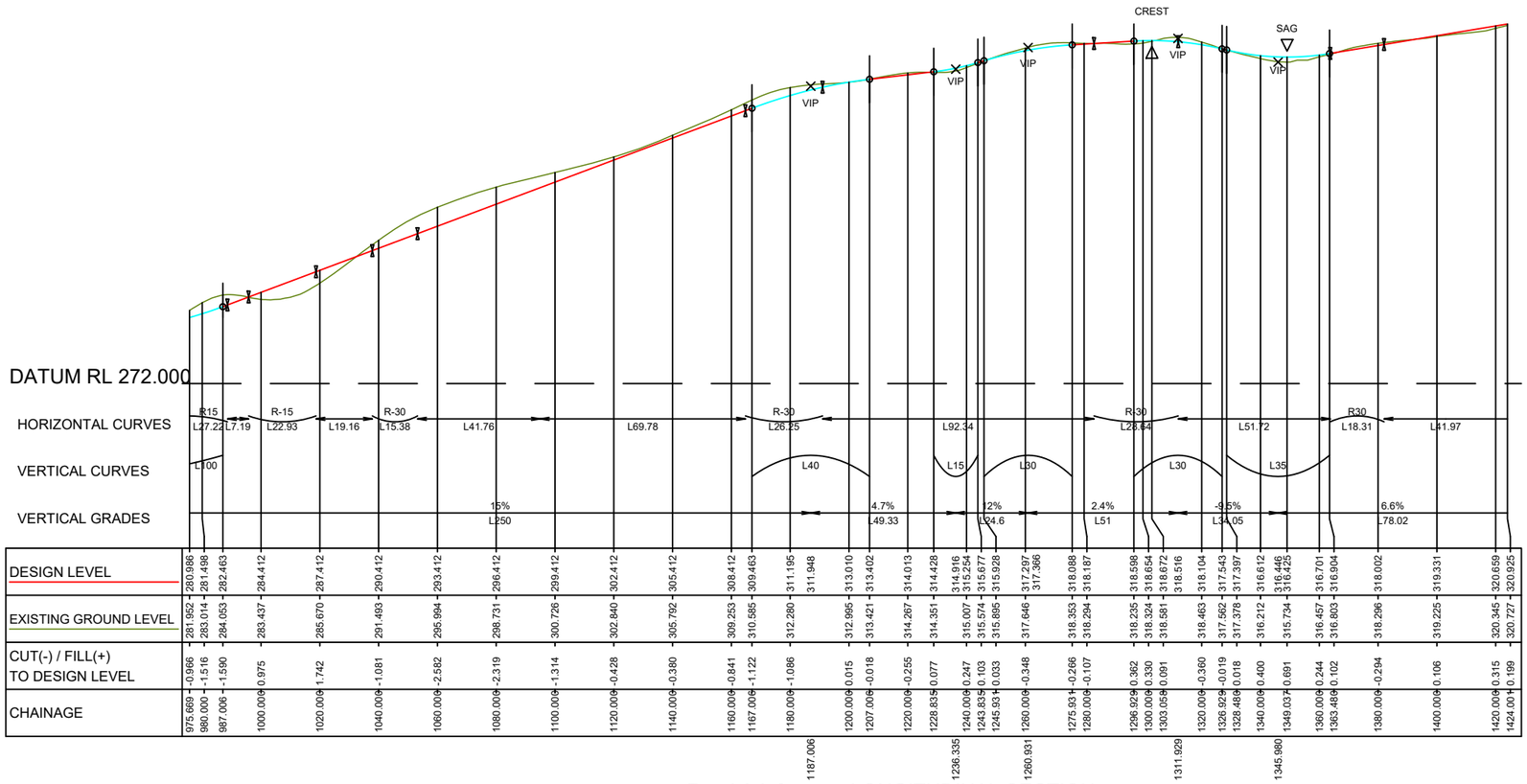
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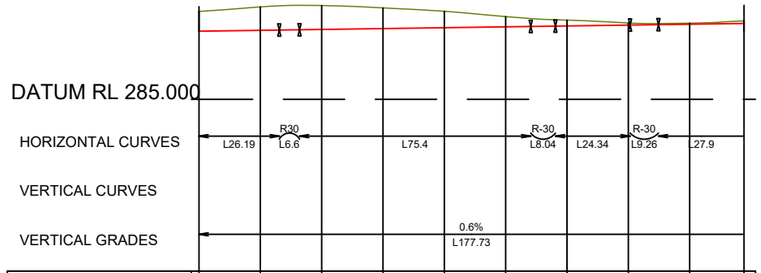

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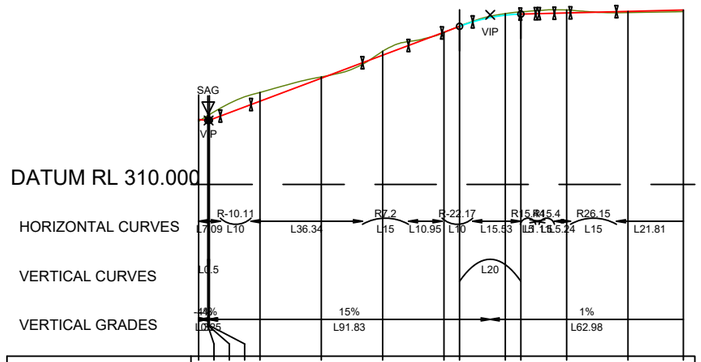

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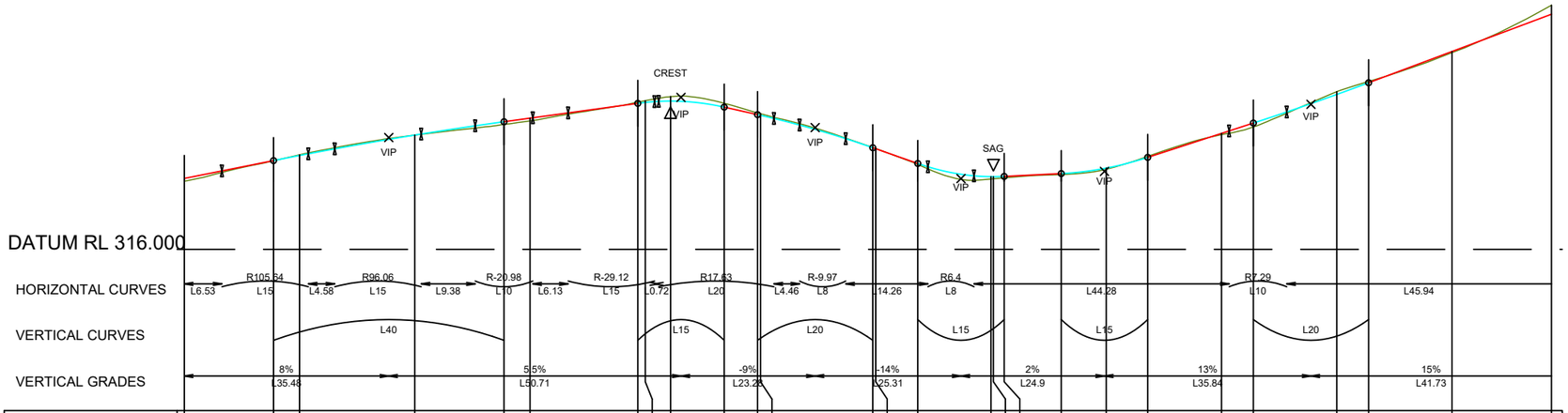
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DATUM RL 316.000
HORIZONTAL CURVES
R105.54 L6.53 L15
R96.06 L4.58 L15
R-20.98 L9.38 L10
R-29.12 L6.13 L15
R17.63 L0.72 L20
R-9.97 L4.46 L8
R6.4 14.26 L8
R7.29 44.28 L10
45.94
VERTICAL CURVES
L40
L15
L20
L15
L15
L20
VERTICAL GRADES
8% L35.48
5.5% L50.71
-9% L23.25
-14% L25.31
2% L24.9
13% L35.84
15% L41.73

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Rocky Point – Application for Subdivision Consent

Proposed Fire Risk Management Plan

Draft

Prepared by: Shanon Garden

On behalf of TKO Properties Ltd

June 2024

Status

The following text provides a framework for fire risk management at Rocky Point.

It will be fully investigated and documented as part of the consented Rocky Point development.

It is anticipated that this Fire Risk Management Plan will be reviewed and approved by a suitably qualified independent expert prior to its adoption.

It is anticipated that preparing this detailed plan and having it independently reviewed will be a condition of consent, required to be completed and evidenced to Central Otago District Council as part of the 224C sign-off.

This initial framework has been reviewed and is supported by Jamie Cowan of Wildfire NZ and also by CKL/Matai with respect to the provision of reticulated water to hydrants and to the proposed sprinkler system.

Purpose

This document covers all residents, visitors, owners and properties at Rocky Point [site reference].

It's purpose is to raise awareness of fire risk across the site, both structural and wild fire, among that group and to promote the common adoption of good and safe land use practices.

Adherence to this management plan will mitigate risk of harm to people, property and the natural environment arising from fire.

Context

This plan forms part of the services management framework delivered by Rocky Point Services Ltd on behalf of lot owners. It is to be delivered in conjunction with the Rocky Point Services Agreement and the Rocky Point Land Management Plan. The functioning of specific infrastructure (private water connections, shared hydrants, sprinklers, etc) will be set out in the Water Systems Operations and Maintenance Manual.

Roles and Responsibilities

Responsibility for maintaining this plan sits with Rocky Point Services Ltd (RPSL) and its representatives.

As fire risk management is a specialist technical field, it will be necessary for RPSL to periodically engage third party expertise to assess the suitability of this plan and to evaluate whether it is being given effect to.

Notwithstanding that RPSL and its representatives have a responsibility to maintain this plan and to periodically seek input from third party specialists, RPSL DOES NOT BEAR THE RESPONSIBILITY FOR MITIGATING FIRE RISK at Rocky Point. That responsibility lies with property owners, occupants, land users, visitors and others as is normally the case elsewhere.

It is anticipated that RPSL will also engage with local FENZ representatives on behalf of residents. FENZ representatives (possibly the local brigade) shall be made aware of this Plan. FENZ representatives should be encouraged to visit the site and to maintain some familiarity with site, access and infrastructure.

Specific responsibilities of RPSL are:

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- Periodic review and update of this plan to ensure it is fit for purpose
- Facilitating a periodic fire risk review in accordance with this plan
- Engaging the services of third party experts
- Communication with owners, residents and other stakeholders i.e. FENZ about fire risk management
- Maintaining shared infrastructure, including facilitating periodic tests of infrastructure in accordance with this plan

Common Domain and Private Domain

Rocky Point is characterised by relatively small lots surrounded by a large natural area that is owned in common by all property owners. People's own fee simple lots will, of course, be their own responsibility to manage. The common area will be managed by Rocky Point Services. Shared infrastructure will be installed to mitigate wildfire risk in the common area. All users of the common area will be expected to adhere to the fire risk management practices in place for that area. Each owner will be responsible for establishing and maintaining any fire risk mitigation infrastructure within their own lot and for protecting their own property. Each lot owner will be required to adhere to those management practices applicable to the private lot areas.

Structure Fire and Wildfire

Structure fire concerns individual buildings. Wildfire refers to vegetation fire, both across the common area and in vegetated areas of owner's private lots. This Plan seeks to minimise risk of both structure fires and wildfire.

Risk Assessment

Proactive fire risk management requires the ongoing assessment of risk. These risks will vary and so will require both periodic assessment and dynamic assessment where conditions change.

However it is possible to characterise the site and describe an inherent set of conditions and therefore risks that must be manged. These risks arise from all of the varied land uses withing and around Rocky Point, including residential activities, agriculture and viticulture, tourism, risks arising from infrastructure (power lines) and activities of the general public (traffic along the state highway and public access within Rocky Point).

A risk register shall be maintained that includes inherent site risks and also dynamic/changing/situational risks. It shall be the responsibility of RPSL to facilitate the development of that risk register among owners and residents, to facilitate its periodic review, and to publish that risk register to owners and residents.

Inherent Risks

Characteristics	**Description**
Climate	Dry
Topography	Narrow gullies sloping up through the site
Vegetation	Dominated by Kanuka scrubland with intermittent grassland. **Scrub fuels** have a high loading of fine fuels that dry out rapidly often within days after rain. Hot, dry, and windy days will dry scrub out and make it burn rapidly. Fires are easily ignited, develop, spread quickly, and burn with high intensity making control difficult.

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	Grass fuels - At low grass curing values, the proportion of dead grass fuel present is low and there is little fuel to be ignited. Potential for fire spread is also low and any fire will only spread slowly, if at all, and with lower fire intensity so that control is more easily achieved. - At high grass curing values, the proportion of dead grass fuel present is higher meaning fire will develop and spread faster with higher intensity making control more difficult. - At low FFMC (Fine fuel moisture code) values, grass fuels are moister so that the likelihood of ignition is low, and fire spread is impeded. - At high FFMC (Fine fuel moisture code) values, grasses are drier and are easily ignited, develop fast, and spread rapidly.
Infrastructure	HV Transmission lines running nearby. [eventual configuration of local power transmission TBD.] State highway and associated traffic below the site.
Activity	Typical residential activities such as lawn mowing, use of power tools, domestic fires, and recreational activities. Camping across the State Highway by the lake.

Inherent Risk Mitigations

Characteristics	**Description**
Access to water	Lake Dunstan nearby providing water source for fire fighting. Ample water supply from Chinaman's Terrace Water scheme. Stored water within subdivision infrastructure
Arid landscape	Patches of bare land with minimal fuel
Vegetation clearing	
Specific fire risk mitigation infrastructure	

Dynamic Risks

Dynamic risk evaluation and suitable response will be required in response to changes in any of the following

- Weather
- Land use
- Occupation/people accessing the site
- Infrastructure
- Vegetation
- Availability of water

Risk Reduction Actions

Risk reduction actions shall be detailed in the final Rocky Point Fire Risk Management Plan.

Fire risk reduction shall be specified in the following (or similar) groupings:

- Minimising sources of ignition

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- Lessening the propensity for fire to spread (and also lessening fire intensity)
- Lessening the effects of fire on buildings and structures
- Keeping people, animals and structures free from harm
- Responding to fire

1. **Minimising sources of ignition**

   Steps will be taken to minimise all of the following:

   a) Ignition sources outside the property
      - Campground
      - Road/Traffic
      - Power lines
      - Neighbouring agricultural and viticultural activity

   b) Ignition sources in common areas
      - Power lines
      - Machinery
      - Recreational fires/open fires/discarded cigarettes

   c) Ignition sources in private property
      - power connections
      - Machinery
      - Burning rubbish
      - Other recreational activity, such as fireworks

   d) Monitoring and controlling activities through fire bans
      - FENZ fire bans shall be strictly enforced
      - Any holder of a fire permit should advise both FENZ and Rocky Point services of an intention to light a fire
      - Rocky Point Services shall have authority (via Services Agreement) to further restrict fire activity across Rocky Point. RPSL shall have no authority to authorise any burning or fire in contravention of FENZ guidance.

Evaluation of ignition risk from activities shall be based on the FENZ Trigger Points framework ("*"Establish triggers for voluntary restrictions on high fire risk activities" (2022)*")

These trigger points are aimed at reducing the chance of ignition from activities that may cause a spark or heat. "Hotworks".

<u>High risk examples</u>

1. Welding, Grinding, Gas cutting, Blasting, Fireworks, Open Fires.

<u>Moderate risk examples</u>

1. Roadsides, pasture and general mowing or mulching. (Excludes irrigated areas)
2. Electric fence use.
3. Land preparation including tractors and implements that strike or move through the ground.
4. Tracked machine operation. (Excludes rubber tracks)
5. Exhaust and hot engine type operations. (Vehicles, generators, small motors, motorbikes, blowers etc)
6. Use of Scrub Bars, Chainsaws, Chippers
7. Events that may involve the following- cigarettes/campfires/gas cookers/BBQ/vehicles.

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Low risk examples

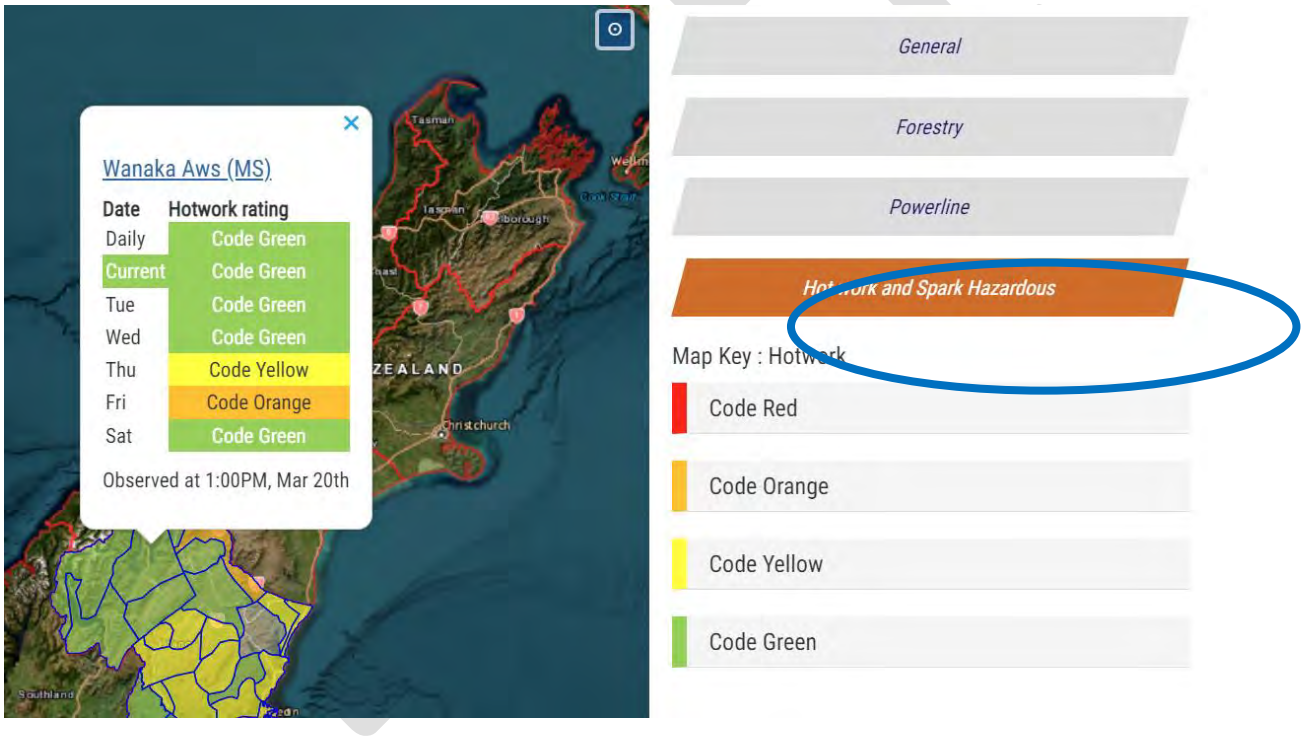
1. General recreation that excludes motorised items. (Walking, biking)

(Any activity that is not listed can be grouped based on its ignition potential)

To determine the Activity Trigger Points, –

Use the "Hotworks" danger level produced each day by NIWA on the Fire and Emergency NZ/NIWA fire weather website. https://fireweather.niwa.co.nz/region/Otago Choose Hotworks on the menu on the right-hand side, then click on your location on the map to see the daily and forecast levels. Then use the colour coded risk level to identify the appropriate actions in the trigger point tables.

NIWA/FENZ Fire Weather website.



FFMC	Curing (%)		
	<50	50-85	>85
<76	Code Green	Code Green	Code Green
76-83	Code Green	Code Green	Code Yellow
84-87	Code Green	Code Yellow	Code Orange
88-91	Code Yellow	Code Yellow	Code Orange
92-95	Code Yellow	Code Orange	Code Red
>96	Code Orange	Code Red	Code Red

Code	Controls
Code Green	No controls (basic firefighting tools required)
Code Yellow	Firefighting equipment/wetting down required
Code Orange	Restricted operations/hours of work
Code Red	Total shutdown of activities

The full Activity Management Framework is contained in Appendix One, below

2. Lessening the propensity for fire to spread and lessening fire intensity

a. Fire breaks
   - Fire breaks shall be established as prescribed in [Maps schedule]
   - Fire breaks shall be maintained by Rocky Point Services
   - Breaks to be surveyed as part of RSL

b. Establishing curtilage areas

c. Greening of vegetation

d. Thinning/removing fuel
   i. Manual thinning
   ii. Grazing

e. Wetting of vegetation using sprinklers

f. Maintaining property
   i. Managing sources of stored fuel (stored petrol/diesel, fire wood, hay, rubbish, prunings)
   ii. Accessways to be maintained in good condition. Note potential impact of parked vehicles, trailers, boats etc.
   iii. Covenants will require that property is maintained in a tidy state, free of debris. In particular, prunings to be removed, not stockpiled)

3. Lessening the effects of fire on buildings and structures

a. Building location:
   - All habitable buildings shall be located within defined curtilage area on each site, with a minimum [15m] offset from the edge of any curtilage area [except where fire rate wall]

b. Building controls:

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- The flammability of buildings shall be reduced through Consent notices on each property title that prescribes That the following fire-retardant [or flame resistant?] materials be used:
    - Fire retardant cladding on each western and downhill facing side of a habitable building
    - Fire retardant roofing [and ceiling?]
    - Debris catchers across all open gutters to minimise the risk of airborne debris catching in gutters
- Minimum of two outside garden taps, each with stored garden hose

c. Proactive wetting of buildings
- by sprinklers
- Manual application of water

4. Keeping people, animals and structures free from harm

a. Ensuring awareness, preparedness and vigilance
- Annual Fire Risk Assessment carried out by RPSL, with follow-up actions documented and closed out within six months.

b. Early identification and reaction

c. Ensuring suitable access routes and safe zones

d. Evacuation planning

5. Responding to fire

a. Automated identification and response
- Remote sensing using Attentis or equivalent (see concept [Diagram])
- Automated initiation of common area sprinklers. [See Infrastructure O&M manual for further detail.]
- [Automated call out of Emergency Services]

b. Response by residents
- Awareness and Preparation
    - Ensuring familiarity with Rocky Point Fire Risk Management Plan. Periodic comms from RPSL to residents
    - Personal fire response plans
    - Notices/signage in dwellings and of evacuation routes around site
    - Fire drills
- Communication/sounding alarm
    - Adopt a precautionary approach to sounding the alarm (act on possibility of fire)
    - Means of sounding alarm [Attentis?]
- Proactively wetting own property
    - Perimeter sprinklers
    - Building sprinklers
    - Manual application
- Defending own property against fire
    - What's appropriate
    - When to stop and evacuate
- Firefighting by residents in common areas

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    - What's appropriate
    - When to stop and evacuate

c. Emergency Services Response
    - Preparedness: Fire Service to be aware of risk management plan, have visited site and become familiar with access and fire response infrastructure.
    - Periodic testing/training using hydrants
    - Call-out
        - 111
    - Access around site
        - Access to water sources (hydrant/stored/lake)
        - Maps to be published with access descriptions, distances and location of infrastructure
        - Access routes to be inspected/maintained. Standards imposed on creation and maintenance of private driveways
        - Parking (risk of private vehicles restricting access of appliances. Risk of appliances restricting access of private vehicles)
    - Reacting (or not) to large fires
        - Use of Helicopters
        - Anticipating when ground equipment and personnel will not engage
d. Reticulated firefighting water supply via hydrants
    - Quantity
        - Level monitoring by Harvest
    - Location/access
    - Application
    - Maintenance
e. Evacuation
    - Evacuation planning
    - Safe zones
    - Multiple defined evacuation routes
    - Looking out for others

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Appendix One: Fire Prevention Guideline for Activities that may cause heat and/or sparks "Hotworks".

CODE GREEN

Requirements for….	Extinguishers (minimum for all equipment/vehicles)	Water and additional equipment	Additional Activity Requirements (A reliable method of communication is required for all activities)
High Risk Activities- Such as 1. Welding, Grinding, Gas Cutting, Blasting, Fireworks, Open Fires	**2kg dry powder**	**9 litre pressurised water/foam (AFFF) extinguisher or full 15 litre knapsack. Shovel**	**Only on bare earth / non-flammable or wetted down areas. Patrol for 30 minutes after completion of activity**
Moderate Risk Activities- Such as 1. Roadsides, pastures and general mowing or mulching. (Excludes irrigated areas) 2. Electric fence use. 3. Land preparation and earthworks including tractors and implements that strike or move through the ground. 4. Tracked machine operation. (Excludes rubber tracks) 5. Exhaust and hot engine type operations. (Vehicles, generators, small motors, motorbikes etc) Spark arrestors to be fitted. 6. Use of Scrub Bars, Chainsaws, Chippers (Excludes non steel blades) 7. Events that may involve the following: cigarettes/campfires/gas cookers/BBQ/vehicles.	**2kg dry powder**	**9 litre pressurised water/foam (AFFF) extinguisher or full 15 litre knapsack. Shovel**	
Low Risk Activities – Such as			

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1. General recreation that excludes motorised items. (Walking, biking)			

Fire Prevention Guideline for <u>Activities</u> that may cause heat and/or sparks "Hotworks".

CODE YELLOW NB: Any items in Bold indicate the requirement has been introduced at that Colour Code level.

Requirements for….	**Extinguishers** (minimum for all equipment/vehicles)	**Water and additional equipment**	**Additional Activity Requirements** (A reliable method of communication is required for all activities)
High Risk Activities- Such as 1. Welding, Grinding, Gas Cutting, Blasting, Fireworks, Open Fires	2kg dry powder	9 litre pressurised water/foam (AFFF) extinguisher or full 15 litre knapsack. Shovel **Within 5m of worksite**	Only on bare earth / non-flammable or wetted down areas. Patrol for 30 minutes after completion of activity. **Wet down area within a min of 4m of the worksite or where sparks may occur**
Moderate Risk Activities- Such as 1. Roadsides, pastures and general mowing or mulching. (Excludes irrigated areas) 2. Electric fence use. 3. Land preparation and earthworks including tractors and implements that strike or move through the ground. 4. Tracked machine operation. (Excludes rubber tracks) 5. Exhaust and hot engine type operations. (Vehicles, generators, small motors, motorbikes etc) Spark arrestors to be fitted. 6. Use of Scrub Bars, Chainsaws, Chippers (Excludes non steel blades)	2kg dry powder	9 litre pressurised water or foam (AFFF) extinguisher or full 15 litre knapsack. Shovel	**Ensure engine compartments are clean. Ensure bearings and other moving parts are greased and in good condition. (Check periodically throughout the activity)** **Where dry or dead grass/scrub is present, consider having an observer behind the operation or where all work can be seen.** **Check electric fences and keep lines free of grass.** **No smoking in high-risk sites.** **Refuel equipment and store fuel away from operating sites.** **Clear vegetation around stationary small motors. Don't park vehicles, motorbikes etc on dry grass.** **Events to require a basic fire plan detailing location of fire extinguishers, designated smoking areas, evacuation routes/safety**

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7. Events that may involve the following: cigarettes/campfires/gas cookers/BBQ/vehicles.			**zones and other mitigation specific to the hazards generated by the event and its activities.**
Low Risk Activities – Such as 1. General recreation that excludes motorised items. (Walking, biking)			Fire Danger Signage to be present

Fire Prevention Guideline for Activities that may cause heat and/or sparks "Hotworks".

CODE ORANGE NB: Any items in Bold indicate the requirement has been introduced at that Colour Code level.

Requirements for….	**Extinguishers** (minimum for all equipment/vehicles)	**Water and additional equipment**	**Additional Activity Requirements** (A reliable method of communication is required for all activities)
High Risk Activities- Such as 1. Welding, Grinding, Gas Cutting, Blasting, Fireworks, Open Fires	2kg dry powder	9 litre pressurised water/foam (AFFF) extinguisher or full 15 litre knapsack. Shovel Within 5m of worksite, and **1000L of water under pressure with 60m of hose, available within 2 minutes.**	Only on bare earth / non-flammable or wetted down areas. Patrol for 30 minutes after completion of activity. Wet down area within a min of 4m of the worksite or where sparks may occur. **Elevate to Code Red if the wind speed is above 30km/hr. (Equivalent to FWI 30- Extreme Fire Danger)**
Moderate Risk Activities- Such as 1. Roadsides, pastures and general mowing or mulching. (Excludes irrigated areas) 2. Electric fence use. 3. Land preparation and earthworks including tractors and implements that strike or move through the ground.	2kg dry powder	9 litre pressurised water/foam (AFFF) extinguisher or full 15 litre knapsack. Shovel **300L of water under pressure with 60m of hose, available within 2 minutes for**	**Elevate to Code Red if wind speed is above 30km/hr.** **Carryout the following activities before 13:00 daily if possible, Mowing, Earthworks, Chainsaw and Scrub bar use, Events, and other activities where there is the potential for an ignition.** Ensure engine compartments are clean. Ensure bearings and other moving parts are greased and in good condition. (Check periodically throughout the activity) **Have an observer** behind the operation or where all work can

4. Tracked machine operation. (Excludes rubber tracks) 5. Exhaust and hot engine type operations. (Vehicles, generators, small motors, motorbikes etc) Spark arrestors to be fitted. 6. Use of Scrub Bars, Chainsaws, Chippers (Excludes non steel blades) 7. Events that may involve the following: cigarettes/campfires/gas cookers/BBQ/vehicles.		**Mowing, Earthworks, Chainsaw and scrub bar (Steel blades) use and Events/activities where there is the potential for an ignition.**	be seen where dry or dead grass/scrub is present. Check electric fences and keep lines free of grass. Refuel equipment and store fuel away from operating sites. Clear vegetation **and wet down** around stationary small motors Don't park vehicles, motorbikes etc on dry grass. Events to require a robust fire plan detailing location of fire extinguishers, designated smoking areas, evacuation routes/safety zones and other mitigation specific to the hazards generated by the event and its activities. **Consider event restriction/closure (dependant on risk level of activity) when wind speeds are greater than 30km/hr.**
Low Risk Activities – Such as 1. General recreation that excludes motorised items. (Walking, biking)			Fire Danger Signage to be present.

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Fire Prevention Guideline for Activities that may cause heat and/or sparks "Hotworks".

CODE RED NB: Any items in Bold indicate the requirement has been introduced at that Colour Code level.

Requirements for….	**Extinguishers** (minimum for all equipment/vehicles)	**Water and additional equipment**	**Additional Activity Requirements** (A reliable method of communication is required for all activities)
High Risk Activities- Such as 1. Welding, Grinding, Gas Cutting, Blasting, Fireworks, Open fires	2kg dry powder	**Not Permitted (Exemptions only for safety requirements)**	**Not Permitted (Exemptions only for safety requirements)**
Moderate Risk Activities- Such as 1. Roadsides, pastures and general mowing or mulching. (Excludes irrigated areas) 2. Electric fence use. 3. Land preparation and earthworks including tractors and implements that strike or move through the ground. 4. Tracked machine operation. (Excludes rubber tracks) 5. Exhaust and hot engine type operations. (Vehicles, generators, small motors, motorbikes etc) Spark arrestors to be fitted. 6. Use of Scrub Bars, Chainsaws, Chippers (Excludes non steel blades) 7. Events that may involve the following: cigarettes/campfires/gas cookers/BBQ/vehicles.	2kg dry powder	9 litre pressurised water/foam (AFFF) extinguisher or full 15 litre knapsack. Shovel, and, **300L of water under pressure with 60m of hose, available within 2 minutes.**	**No mowing, small motors, scrub bars, chainsaws, or other mechanised equipment that may cause a spark.** **For all other activities,** **Restricted hours of work. No work between 1pm and 7pm, or if wind speed is above 15km/hr.** Ensure engine compartments are clean. Ensure bearings and other moving parts are greased and in good condition. (Check periodically throughout the activity) Have an observer behind the operation or where all work can be seen where dry or dead grass/scrub is present. Turn off electric fences if wind predicted to be over 30km/hr Refuel equipment and store fuel away from operating sites. Don't park vehicles, motorbikes etc on dry grass. Events to require a robust fire plan detailing location of fire extinguishers, designated smoking areas, evacuation routes/safety zones and other mitigation specific to the hazards generated by the event and its activities. **Limit Activities and Events to before 1pm. Consider closure of events if wind speed is greater than 15km/hr. (Exemptions may be**

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			possible if further mitigation actions are provided. I.E Helicopter on site)
Low Risk Activities – Such as 1. General recreation that excludes motorised items. (Walking, biking)			Extreme Fire Danger signage to be present**. In conjunction with any public access closures.**

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Rocky Point – Application for Subdivision Consent

Overview of Rocky Point Services Ltd

(incl Template Constitution and Services Agreement)

Prepared by: Shanon Garden

On behalf of TKO Properties Ltd

June 2024

Purpose

This overview is prepared in support of the application by TKO Property for subdivision and land use consent at Rocky Point.

It provides an overview of how different land management requirements will be fulfilled via a shared services entity that will be established as part of the proposed development**.**

Function of Services Company

The Rocky Point Services Ltd services company (RPSL) will coordinate all common interests and infrastructure on behalf of the Rocky Point landowners.

This will include being a party to and assisting in the coordination and adherence to design control and land management covenants, owning and maintaining shared infrastructure and delivering reticulated services to lot owners, and maintaining the common area on behalf of owners.

This same basic structure has been employed successfully across a number of other lifestyle subdivisions where infrastructure is not provided by the local Council.

Establishment and Structure

RPSL will be incorporated by the developer during the development phase and be operational at the time individual lot titles are created.

All incoming lot owners will be allocated shares in RPSL, holding 10 shares per property. Shares will be required to transfer upon transfer of ownership of a lot.

RPSL will have a tailored constitution that sets out the scope of activities that the company is permitted to undertake, how shareholders/lot owners will manage the services company, and how it will be funded. A generic template of this constitution is attached as Appendix [a].

Each lot owner will be party to a Services Agreement with RPSL. This Services Agreement will initially be established as between RPSL and the developer. It will be attached to the lots by way of covenant registered on each title. Linking the Services Agreement to the title ensures it will pass to and remain with incoming and subsequent lot owners.

RPSL will also be a party to the land management covenants that establish the proposed building and land use controls and native vegetation management.

RPSL will levy an annual fee from Lot owners for services provided under the Services Agreement.

Duties of Service Company

The functions of RPSL will include

- Oversight of design controls and coordination of adherence to design and building covenants among owner group
- Management of common areas (maintenance, access, weed and pest control, etc)
- Oversight of vegetation and land management covenants
- Management of the domestic water scheme, including holding the aggregated water right to access water from the Chinamans Terrace water scheme
- Management of shared accessways (rights of way and walkways)
- Facilitating owner's preparedness for wildfire
- Holding of any common consents relating to the property

- Representing owners on topical issues, matters of concern, and in some cases, interaction with neighbours
- Other services as agreed from time to time.

Governance

The governance of RPSL will be prescribed in the constitution.

A subset of lot owners will be required to be directors of RPSL. The constitution will provide for the periodic cycling of directors among the owner group.

The day to day administration of RPSL will be performed by a Management Committee. Typically, the Management Committee will be made up of the current Director group.

Other (non-Director/Management Committee) owners may be delegated by the Management Committee to provide specialist or ad-hoc support under the Services Agreement to the wider owner group.

Care must be taken to ensure that the obligations and liabilities assumed by Directors/Managers are not so onerous as to deter owners from contributing to its necessary functions. Directors' indemnity and insurances must be considered.

Services Agreement and Core Operating Documents

The Services Agreement will set out the basic services to be provided by RPSL on behalf of owners.

In addition to the general ongoing delivery of shared services (a template of which is attached as Appendix [B]) RPSL will maintain and deliver on two specific Management Plans:

a) A Vegetation Enhancement and Common Area Management Plan; and
b) A Wildfire Risk Management Plan

These documents will not be registered as covenants, enabling them to be updated as necessary without requiring modification to land titles.

These two plans have some obvious overlap in terms of managing vegetation to mitigate wildfire risk.

The content of these two management plans will be informed by the expert input prepared as part of the subdivision consent application and will also reflect specific conditions arising from the consent granted.

Template Vegetation Enhancement and Common Area Management Plan and Fire Risk Management Plans are attached as Appendix [C] and [D].

Appendix A: Template RPSL Constitution

Appendix B: Template Services Agreement

Appendix C: Template Vegetation Enhancement and Land Management Plan

[Prepared by Simon Beale – Ecologist]

Appendix D: Template Fire Risk Management Plan

Prepared by Shanon Garden / Reviewed by Jamie Cowan of Wildfire Management]