Infrastructure Assessment for Parkburn Subdivision

Prepared for Fulton Hogan Land Development Ltd

LANDPRO.

Project Name:	Parkburn Subdivision
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1. Statement of Qualifications and Experience

Nathan Archer (Landpro Limited)

I am the National Survey Manager at Landpro Limited and act as the lead Land Development Engineer and Licenced Cadastral Surveyor at Landpro Ltd.

I hold a Batchelor of Surveying from the University of Otago, completed in 2004. I also hold a New Zealand Certificate in Land Surveying obtained from Unitech Institute of Technology, completed in 1998. My additional professional qualifications and appointments include Licensed Cadastral Surveyor (LCS), a Professional Member of Survey and Spatial New Zealand (S+SNZ) and the current president of the Central Otago branch of S+SNZ and a member of Consulting Surveyors New Zealand) CSNZ.

I have 30 years of experience in the Civil Engineering and Surveying industries in infrastructure design, construction and site supervision relating to subdivision works. I have acted as the lead Land Development Engineer for a broad range of Land Development and Subdivision projects in the Central and Queenstown Lakes regions.

My experience includes the design of the earthworks, roading, sewer and stormwater reticulation infrastructure and coordinating supporting servicing arrangements through third party suppliers for land development projects according to approved New Zealand standards and to the satisfaction of the local Territorial Authority.

In my role as originator and reviewer of this report, I confirm that I have read and comply with the Environment Court of New Zealand's Code of Conduct for Expert Witness Practice Note 2023.

2. Executive Summary

This infrastructure assessment investigates the infrastructure requirements to support the Proposed development which comprises approximately 1,020 residential lots, a potential school and a neighbourhood centre. The assessment focuses on the existing infrastructure on site, the requirements to service the development, and the proposed solutions.

The proposed infrastructure will meet all relevant Council and other network Utility Operators standards for earthworks, roading, stormwater, wastewater, water supply, and utilities. This will be confirmed through the detailed design at the Engineering Acceptance stage of the development process. The servicing strategy prioritises sustainability, resilience, and compliance with current regulatory requirements.

Earthworks will be required to form roads and lot platforms as well as create the two proposed coves off Lake Dunstan. Earthworks will be designed to minimise site disturbance.

A transport network will be constructed, including a central loop road, smaller local roads, on and off-road trails for pedestrians and cyclists to enable a connected multimodal network.

Stormwater treatment and flood risk mitigation will be proactively addressed through the inclusion of swales, soakage, attenuation basins and site contouring measures, ensuring the development remains resilient to the effects of climate change and natural hazards.

Wastewater will be conveyed by gravity reticulation to a central wastewater pumpstation and pumped via a new rising main to the Cromwell Wastewater treatment Plant at Richards Beach Road. A larger wastewater rising main will be supplied to the Pisa Mooring & Clark Road intersection by the CODC and extended to the boundary of the site by the applicant.

Water supply can be provided through reticulated watermains within the site. A larger water supply main will be supplied to the Pisa Mooring & Clark Road intersection by the CODC and extended to the boundary of the site by the developer. A new water reservoir system will be constructed on Clark Road above Pisa Moorings to provide pressure and firefighting capacity, ensuring a resilient overall system. The development will comply with all obligations under Taumata Arowai.

Power and internet providers have both confirmed connection feasibility.

This assessment confirms that infrastructure can be provided to support the Parkburn development and integrated into the CODC reticulated networks.

3. Introduction

Landpro have been engaged by Fulton Hogan Land Development Limited (the "applicant") to assess the infrastructure requirements for the proposed development of approximately 1020 residential dwellings, neighbourhood centre and potential primary school at the Parkburn site.

The applicant is submitting a substantive application under the Fast-Track Approvals Act (FTAA) 2024, which aims to expediate developments that align with the public interest, deliver significant economic and community benefits, and address urgent infrastructure needs. This report confirms that

1. The proposed development can be appropriately serviced
2. The development is not at risk of flooding caused by the effects of climate change or natural hazards
3. A suitable and acceptable infrastructure strategy has been outlined.

PROPOSED DEVELOPMENT

The proposed development aims to create a residential community of approximately 1000 residential dwellings of various topologies, supported by infrastructure, commercial spaces and a potential primary school. The development will be serviced with key infrastructure such as road networks, stormwater management, wastewater systems and water supply, while adhering to sustainable design principles.

Thie engineering assessment provides a high-level assessment of the existing civil infrastructure and outlines the required works, including:

- Earthworks
- Roading
- Three Waters
- Utility servicing

This assessment also addresses how the development will manage the effects of climate change and natural hazards, ensuring resilience and sustainability.

The proposed development masterplan is shown in figure 1 below.

Figure 1 – Project Masterplan July 2026

4. Earthworks

REQUIREMENTS:

Earthworks will be required to contour the site to suit the proposed roads and lots shown in the masterplan to form access and platforms for the supporting infrastructure, as well as create the two coves.

CURRENT LANDSCAPE:

The land is currently uitlised as an industrial quarry and clean fill site. The site accommodates infrastructure associated with the quarrying activity, an Asphalt plant, along with other associated activities. The southern half of the site (adjacent to the Pisa Moorings Subdivision) is the current quarry pit approximately 11m deep and is screened by large earth bunds on the southern and western boundaries of the site. The northern half of the site is gently sloping to the southeast towards Lake Dunstan. The Park Burn waterway passes through the northeastern corner of the site which creates a natural divide. The land immediately on the western side of the Park Burn is used for the production of Asphaltic Concrete. The land on the eastern side of the Park Burn waterway is an active clean fill site that is generally flat in nature.

PROPOSED WORKS:

The proposed earthworks are designed to balance the cut and fill material on the site while lifting the existing quarry pit to heights that will ensure future dwellings are above minimum flood and Contact Energy future maximum lake levels requirements.

All earthworks on site shall be carried out in stages and according to the methodology stated on the earthworks staging plan sheets (plan 24113_113) attached in Appendix A. A progressive stabilisation methodology of all open earthworks areas shall be employed to minimise the amount of open area at any one time. This methodology is described in detail in the Landpro Environmental Management Plan attached as Appendix C.

Remediation Area 1 (RA1) is an existing HAIL site. All earthworks within RA1 will be carried out in accordance with the contaminated land report and Remediation Action Plan attached in Appendix E

Remediation Area 2 (RA2) is not a HAIL site. All earthworks within RA2 shall be carried out in accordance with the Geotechnical Engineers recommendations in the Geotechnical Engineers report attached in Appendix D.

Best practice guidelines for erosion and sediment control will be implemented in line with Otago Regional Council (ORC) guidelines and the Erosion Management Plan attached in Appendix C; ensuring minimal environmental impact.

A summary of the Bulk earthworks volumes according to the planned earthworks staging plans attached as Appendix A is as follows:

Stage 2 - Pea Gravel Processing in RA3 (Sheet 113_02)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
726,100	0	10.6200	14

Loose Measure

Stage 3 - Cut to Fill in Area 1 (Sheet 113_03)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
1,186,900	1,186,900	31.0947	11

Solid Measure

Stage 4 - Progressive stabilisation of the open area shall occur over the duration of the works.

Stage 5 - Cut to Fill in Area 2 (Sheet 113_05)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
454,900	454,900	17.0784	10

Solid Measure

Stage 6 - Progressive stabilisation of the open area shall occur over the duration of the works.

Stage 7 - Cut to Fill in Area 3 (Sheet 113_07)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
644,800	644,800	38.4422	14

Solid Measure

Stage 8 - Progressive stabilisation of the open area shall occur over the duration of the works.

Stage 9 & 10: Construct Interface between Site and Lake on Crown Land (Sheet 113_09 & 113_10)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
23,500	0	0.7800	12

Solid Measure

Stage 11: Cut to Fill in Area 9(Sheet 113_11)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
48,200	48,200	3.5684	6

Solid Measure

Stage 12 - Progressive stabilisation of the open area shall occur over the duration of the works.

Stage 13: Pea Gravel Processing in RA2 (Sheet 113_13)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
620,700	0	8.1851	N/A

Loose Measure

Stage 14: Cut to Fill in RA2 (Sheet 113_14)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
0	448,700	8.1851	7

Solid Measure

Stage 15 - Progressive stabilisation of the open area shall occur over the duration of the works.

Stage 16: Pea Gravel Processing in RA1 (Sheet 113_16)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
428,700	0	9.0082	N/A

Solid Measure

Stage 17: Cut to Fill in RA1 (Sheet 113_17)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
103,800	532,500	18.7148	N/A

Solid Measure

Stage 18 - Progressive stabilisation of the open area shall occur over the duration of the works.

Stage 19 - Construct Interface between Site and Lake on Crown Land and the Park Burn (Sheet 113_19)

Cut Volume (m3)	Fill Volume (m3)	Open Area (ha)	Depth of cut/fill (m)
17,000	5,800	1.3600	5

Solid Measure

Progressive stabilisation of the open area shall occur over the duration of the Stage 19 works.

CLIMATE CHANGE ADAPTION:

The earthworks strategy will account for potential climate change impacts; such as increased rainfall and soil erosion, by implementing erosion and control measures and considering longer term stability.

SUMMARY:

Earthworks will be required to form roads and lot platforms. Earthworks will be designed to fill the existing quarry pit to ensure dwellings are above minimum flood levels and minimise site disturbance by staging the work.

5. Roading

REQUIREMENTS:

Connections and upgrades to the existing roading network, including new internal roads to accommodate development traffic.

CURRENT INFRASTRUCTURE:

The site is currently accessed by a single uncontrolled intersection to the Luggate-Cromwell Road (SH6).

PROPOSED INFRASTRUCTURE:

A transportation network will be constructed, including upgrading the existing SH6 intersection into a roundabout layout; constructing a second roundabout on SH6 at the southern end of the site (as requested by NZTA) and a series of internal roads looped to provide transportation links to the land situated to the north and south of the site for future development.

The design of all internal roundabouts and internal roads will comply with the vertical and horizontal geometric design standards of NZS4404:2010, the Austroads geometric design manual and Traffic Control Devices (TCD) manual for signs and markings. The two roundabouts on SH6 will be designed to NZTA standards and specific conditions of consent have been proposed as agreed with NZTA.

The internal roading hierarchy consists of five (5) roading typologies (Type A, B, C, D & E) detailed in Appendix B shall provide a robust roading network that ensures physical and legal access to all allotments. The network also provides connections to adjacent land that maybe developed in future.

The roading typologies are designed in accordance with NZS4440:2010. It's noted that table 3.1 of the Central Otago Addendum to NZS4404:2004 is based on the 2004 version of the NZS4404 standard. And that NZS4404:2004 version of the standard was formally withdrawn and replaced with NZS4404:2010 with one reason being that it did not allow for flexibility in road design.

It is understood the Central Otago District Council are reviewing table 3.1 and are about to release revised roading tables that are more aligned with the NZS4404:2010 standards for public consultation. It is expected that the roading profiles proposed for Parkburn will align with the CODC revised roading tables.

A sectional profile drawing of each roading typology is included in Appendix B and is described below:

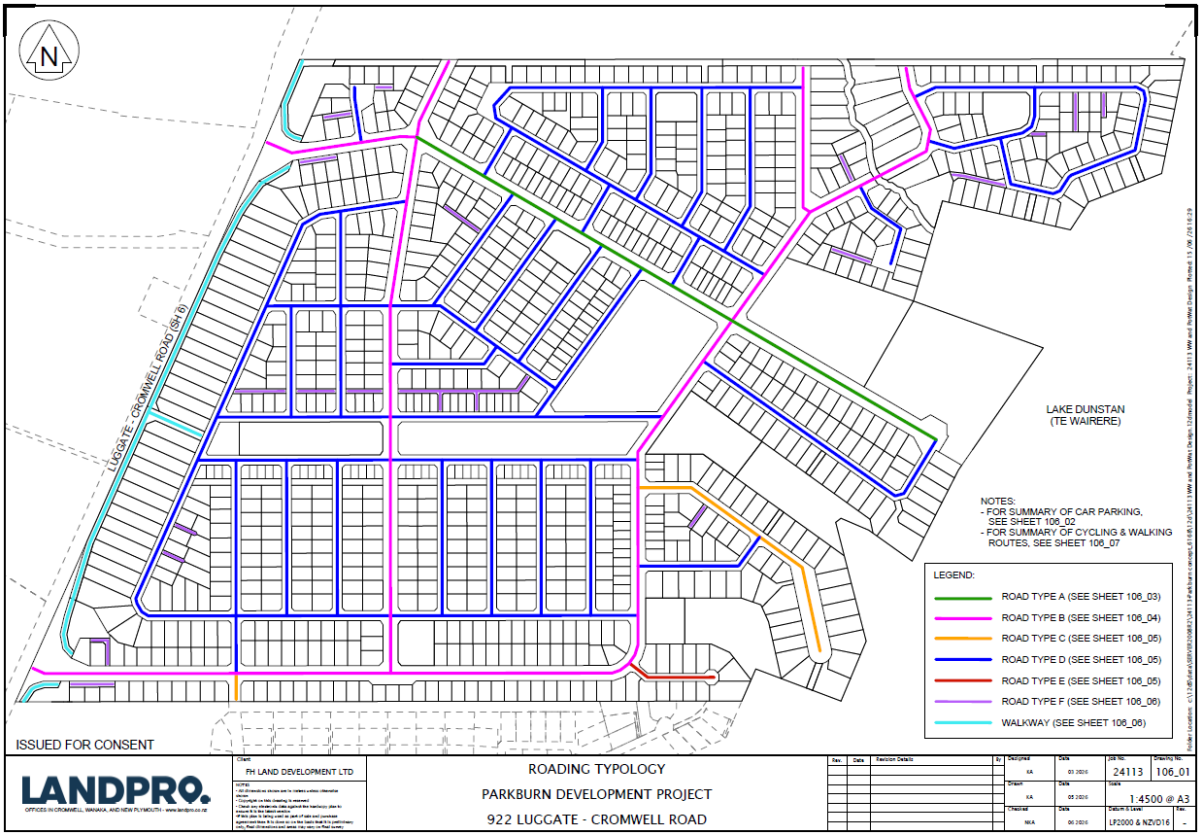

Figure 2 – Project Roading Typology

Road Type A (Collector Roads)

The type A and Type B collector roads shall form a looped road around the various neighbourhoods linking the southern roundabout to the medium density areas, commercial and school areas. A branch road connecting the land to the north and a loop back to the northern roundabout completes the collector network around the various neighbourhoods. A collector road also traverses through the centre of the subdivision in a north south direction to connect the western and central neighbourhoods to the main looped ring road providing road users an option to travel north or south to access SH6. The collector roads include a variant to accommodate recessed parking bays providing clearly defined parking spaces, footpaths and shared paths, standard streetlighting, road signs and markings, street landscaping and other amenity as detailed on the roading profiles in Appendix B.

The type A road collector road (Avenue) is a wider legal width than the type B roads and provides the main vehicle access to the multi use park, neighbourhood centre and potential school site. A large turning area is located at the eastern end of the Type A road for larger vehicles including a bus to turn. This road profile includes a variant to accommodate recessed parking bays providing clearly defined parking spaces, footpaths and shared

paths, standard streetlighting, road signs and markings, street tree landscaping and amenity as detailed on the roading profiles in Appendix B.

The profile includes 2 x 4.2m movement lanes, 2.5m wide shared path on one side of the road, a 2.0m wide footpath on opposite side and a legal width of 28m. A parking variant of the profile includes 2.5m wide recessed parking bays. The profile is based off NZS4404:2010 E13 with typical maximum traffic volumes of 8000VPD. The parking allocation is shown on Sheet 106_02 of Appendix B

Compliance with (green) and departures (red) from table 3.1 of the CODC addendum to NZS444:2004 are identified in the table below.

Collector Roads - Residential & Commercial	Road Reserve width (m)	Minimum sealed carriageway width (m) Between faces of kerb				Footpath (m)	Berm (m)	Max/min gradient	Normal camber	Max super-elevation
		Parking	Traffic	Cycles	Total					
Table 3.1	20	2 x 2.5	2 x 3.5	2 x 1.0	14	2 x 1.5	2 x 1.5	10% max 0.4% min	4%	6%
Road Type A	28	2 x 2.5 (recessed)	2 x 4.2	1 x 2.5 (shared foot/cycle path)	8.4	2.5 (shared path) 2.0	2.0, 2.5	10% max 0.4% min	3.5%	6%
Road Type B	23	2 x 2.5 (recessed)	2 x 4.2	1 x 2.5 (shared foot/cycle path)	8.4	2.5 (shared path) 2.0	2.0, 2.5	10% max 0.4% min	3.5%	6%

While the proposed profile does not comply with table 3.1 of the CODC addendum it is considered to adhere with acceptable modern standards in NZS4404:2010 and traffic safety requirements can be addressed and achieved through the detailed design process.

Road Type B (Collector Roads)

The profile includes 2 x 4.2m carriage lanes, 2.5m wide shared path on one side and 2.0m wide footpath path on opposite side and has a legal width of 23m. A parking variant includes 2.5m wide recessed parking bays. The profile is based off NZS4404:2010 E13 with typical maximum traffic volumes of 8000VPD. The parking allocation is shown on Sheet 106_02 of Appendix B

Compliance with (green) and departures (red) from table 3.1 of the CODC addendum to NZS444:2004 are identified in the table below.

Collector Roads - Residential & Commercial	Road Reserve width (m)	Minimum sealed carriageway width (m) Between faces of kerb				Footpath (m)	Berm (m)	Max/min gradient	Normal camber	Max super-elevation
		Parking	Traffic	Cycles	Total					
Table 3.1	20	2 x 2.5	2 x 3.5	2 x 1.0	14	2 x 1.5	2 x 1.5	10% max 0.4% min	4%	6%
Road Type A	28	2 x 2.5 (recessed)	2 x 4.2	1 x 2.5 (shared foot/cycle path)	8.4	2.5 (shared path) 2.0	2.0, 2.5	10% max 0.4% min	3.5%	6%
Road Type B	23	2 x 2.5 (recessed)	2 x 4.2	1 x 2.5 (shared foot/cycle path)	8.4	2.5 (shared path) 2.0	2.0, 2.5	10% max 0.4% min	3.5%	6%

While the proposed profile does not comply with table 3.1 of the CODC addendum it is considered to adhere with acceptable modern standards in NZS4404:2010 and traffic safety requirements can be addressed and achieved through the detailed design process.

Road Type C (Local Road)

The type C road is located on the southern peninsula between the two coves and includes a grade separated carriageway with central planting and adequate turning for refuse

vehicles. This road has a bespoke width of 7.5m (recommended in NZS4404:2010) permitting two movement lanes and parking on one side of the formation. This road profile provides on street parking (controlled by road markings), footpaths, standard streetlighting, road signs and markings, street tree landscaping and amenity as detailed on the roading profiles in Appendix B.

The profile includes 2 x 3.75m carriage lanes, 1.5m footpath on both sides of the carriageway and has a legal width of 18m. On street parking shall be provided on one side of the road only (two movement lanes past parked cars) controlled by installing no parking markings in accordance with the parking plan in Appendix B The profile is based off NZS4404:2010 E12 with typical maximum traffic volumes of 2000VPD. The parking allocation is shown on Sheet 106_02 of Appendix B

Compliance with (green) and departures (red) from table 3.1 of the CODC addendum to NZS444:2004 are identified in the table below.

Local Roads - Residential	Road Reserve width (m)	Minimum sealed carriageway width (m) Between faces of kerb				Footpath (m)	Berm (m)	Max/min gradient	Normal camber	Max super-elevation
		Parking	Traffic	Cycles	Total					
Table 3.1	20	1 x 2.5	2 x 3.0	-	8.5	2 x 1.5	2 x 4.25	12.5% max 0.4% min	4%	6%
Road Type C	18	on street (one side)	2 x 3.75	on carriageway	7.5	2 x 1.5	2 x 2.0 & 1.6	12.5% max 0.4% min	3.50%	6%
Road Type D	15	on street (one side)	2 x 2.85	on carriageway	5.7	2 x 1.5	2 x 1.4 & 1.6	12.5% max 0.4% min	3.50%	6%

While the proposed profile does not comply with table 3.1 of the CODC addendum it is considered to adhere with acceptable modern standards in NZS4404:2010 and traffic safety requirements can be addressed and achieved through the detailed design process.

Road Type D (Local Road)

The type D roads are laid out to form a grid network and connections to various neighbourhoods. The roads have a formation width of 5.7m permitting two movement lanes or parking on one side of the formation and a single movement lane. These roads provide on street parking controlled by road markings, standard streetlighting, road signs and markings, street tree landscaping and amenity as detailed on the roading profiles in Appendix B.

The profile includes 2 x 2.85m carriage lanes, 1.5m footpath on both sides of the carriageway and has a legal width of 15m. On street parking shall be provided on one side of the road only (one movement lane past parked cars) controlled by installing no parking markings in accordance with the parking plan in Appendix B The profile is based off NZS4404:2010 E12 with typical maximum traffic volumes of 2000VPD. The parking allocation is shown on Sheet 106_02 of Appendix B

Compliance with (green) and departures (red) from table 3.1 of the CODC addendum to NZS444:2004 are identified in the table below.

Local Roads - Residential	Road Reserve width (m)	Minimum sealed carriageway width (m) Between faces of kerb				Footpath (m)	Berm (m)	Max/min gradient	Normal camber	Max super-elevation
		Parking	Traffic	Cycles	Total					
Table 3.1	20	1 x 2.5	2 x 3.0	-	8.5	2 x 1.5	2 x 4.25	12.5% max 0.4% min	4%	6%
Road Type C	18	on street (one side)	2 x 3.75	on carriageway	7.5	2 x 1.5	2 x 2.0 & 1.6	12.5% max 0.4% min	3.50%	6%
Road Type D	15	on street (one side)	2 x 2.85	on carriageway	5.7	2 x 1.5	2 x 1.4 & 1.6	12.5% max 0.4% min	3.50%	6%

The proposed profile does not comply with table 3.1 of the CODC addendum however, it is considered to adhere with acceptable modern standards in NZS4404:2010 and traffic safety requirements can be addressed and achieved through the detailed design process.

Road Type E (Cul-De-Sac)

The type E roads are a cul-de-sac design to provide access to lots via a no exit public road. The roads have a formation width of 5.7m permitting two movement lanes or parking on one side of the formation and a single movement lane. These roads provide on street parking controlled by road markings, standard streetlighting, road signs and markings, street tree landscaping and amenity as detailed on the roading profiles in Appendix B.

The profile includes 2 x 2.85m carriage lanes, 1.5m footpath on both sides of the carriageway and has a legal width of 12m. On street parking shall be provided on one side of the road only (one movement lane past parked cars) controlled by installing no parking markings in accordance with the parking plan in Appendix B The profile is based off NZS4404:2010 E12 with typical maximum traffic volumes of 2000VPD. The parking allocation is shown on Sheet 106_02 of Appendix B

Compliance with (green) and departures (red) from table 3.1 of the CODC addendum to NZS444:2004 are identified in the table below.

Local Roads - Cul-de-sac	Road Reserve width (m)	Minimum sealed carriageway width (m)				Footpath (m)	Berm (m)	Max/min gradient	Normal camber	Max super-elevation
		Parking	Traffic	Cycles	Total					
Table 3.1	12	1 x 2.5	1 x 3.5	-	6	1 x 1.5	2.0 + 2.5	12.5% max 0.4% min	4%	6%
Road Type E	12	on street (one side)	2.85	-	5.7	1 x 1.5	3.0 & 1.5	12.5% max 0.4% min	3.50%	6%

The proposed profile does not comply with table 3.1 of the CODC addendum however, it is considered to adhere with acceptable modern standards in NZS4404:2010 and traffic safety requirements can be addressed and achieved through the detailed design process.

Road Type F - Private Road (Joint Owned Access Lot)

The type F roads are private accessways to be located on privately owned joint owned access lots (JOAL). Each JOAL shall serve 5 or fewer users. The private roads have a formation width of 3.0m and amenity as detailed on the roading profiles in Appendix B.

The profile includes a 3.0m carriageway located centrally within a 6.0m legal wide common access lot. No parking or footpaths are proposed for this profile. The profile is based off NZS4404:2010 E9 serving up to 6du or 60VPD.

While the proposed profile does not comply with table 3.1 of the CODC addendum it is considered to adhere with acceptable modern standards in NZS4404:2010 and traffic safety requirements can be addressed and achieved through the detailed design process.

Internal Roundabouts

There are two roundabouts intersections proposed within the subdivision, both are located on the Road Tupe A "Avenue". The design of all internal roundabouts will comply with the vertical and horizontal geometric design standards of NZS4404:2010, the Austroads geometric design manual and Traffic Control Devices (TCD) manual for signs and markings.

The initial roundabout at the Road 2 & 3 intersection connecting the HWR land to the north requires allowance for heavy vehicles as the HWR land currently has industrial landuse.

Tracking curves for a prime mover and semi trailer (19m long) design vehicle have been applied to this roundabout. It is confirmed in figure 2a below that it is possible for the design vehicle to safely manoeuvre the roundabout within the area provided and no changes to the lot boundaries are required.

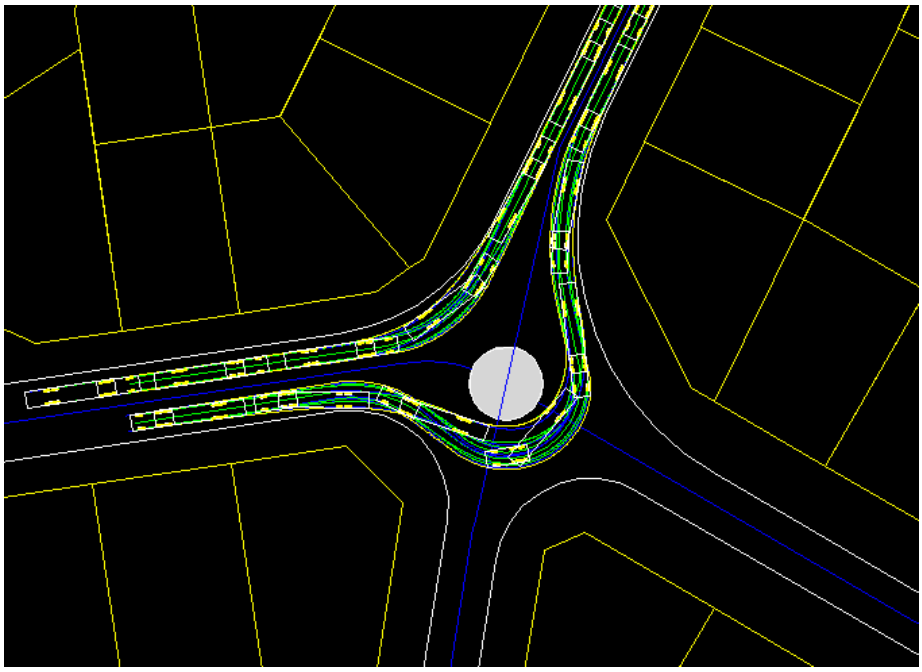

Figure 2a – Road 2 & 3 design vehicle tracking

Walkway Trails

Off road trails for pedestrian and cycle movements will be provided to enable connected multimodal network. Specifically, the existing trails trust cycle network on the shored of Lake Dunstan will be connected to the proposed internal roading networks via the proposed reserve networks as can be seen on plan 106_07 in Appendix B.

A new shared trail shall be provided along the length of the SH6 boundary as can be seen on plan 106_07 in Appendix B and linked to the internal roading network providing a pedestrian walking and cycling network that will circumnavigate the entire development. This will provide pedestrian connections to the existing Pisa Moorings residential neighbourhood and the land to the north which may be developed in future.

TRAFFIC IMPACT:

The traffic Assessment prepared by Carriageway Consulting, outlines the expected traffic volumes and required upgrades to surrounding road network to accommodate the additional traffic generated by the development.

6. Stormwater

SYSTEM REQUIREMENTS:

- Safe and effective conveyance of 2%, 5%, 10%, 20% & 1% Annual Exceedance Probability flows
- Compliance with CODC engineering standards for stormwater management
- Climate change adaption, for all rainfall events.

CURRENT INFRASTRUCTURE:

The site is currently an industrial quarry and is not connected to any public stormwater network, however the site borders Lake Dunstan on its eastern side and the Park Burn bisects the northeastern portion of the site.

Existing discharge points are constrained to overland flows to the Park Burn and Lake Dunstan, all stormwater for the quarrying operation is disposed to ground by soakage within the site. Plans showing pre development overland flows are included in Appendix G

PROPOSED INFRASTRUCTURE:

The Woods Stormwater & Flood Management report (see Appendix G) assesses the flooding model for the site and confirms the risk of flooding to dwellings within the development can be adequately managed by controlling overland flows with roads and earthworks and providing appropriately sized reticulated stormwater infrastructure appropriate the Catchment 1 & 2. This project supports adaption, resilience, and recovery from flooding hazards.

The site is divided into two catchments in the Woods report. The primary discharge method for Catchment 1 is in-ground soakpits (above 203mRL FSL contour). The primary discharge method for Catchment 2 is a piped reticulation network and associated treatment devices.

Design contours and proposed infrastructure will channel stormwater for the majority of the development to the central corridor which in turn will drain to Lake Dunstan after primary treatment through vegetated swales located within the central corridor.

The Northeastern portion of the development (Zone D) will direct all stormwater flows to the Park Burn via overland flow and reticulated piped infrastructure.

The Woods Stormwater Management Toolbox can be used to choose the appropriate treatment device according to the variable characteristics of the stormwater zones within the development as discussed in detail in the Woods Stormwater & Flood Management Report, see Appendix G.

All zones can be engineered to provide stormwater soakage or treatment at source or treatment via a proprietary system to treat stormwater and improve water quality prior to discharge to ground or draining to Lake Dunstan.

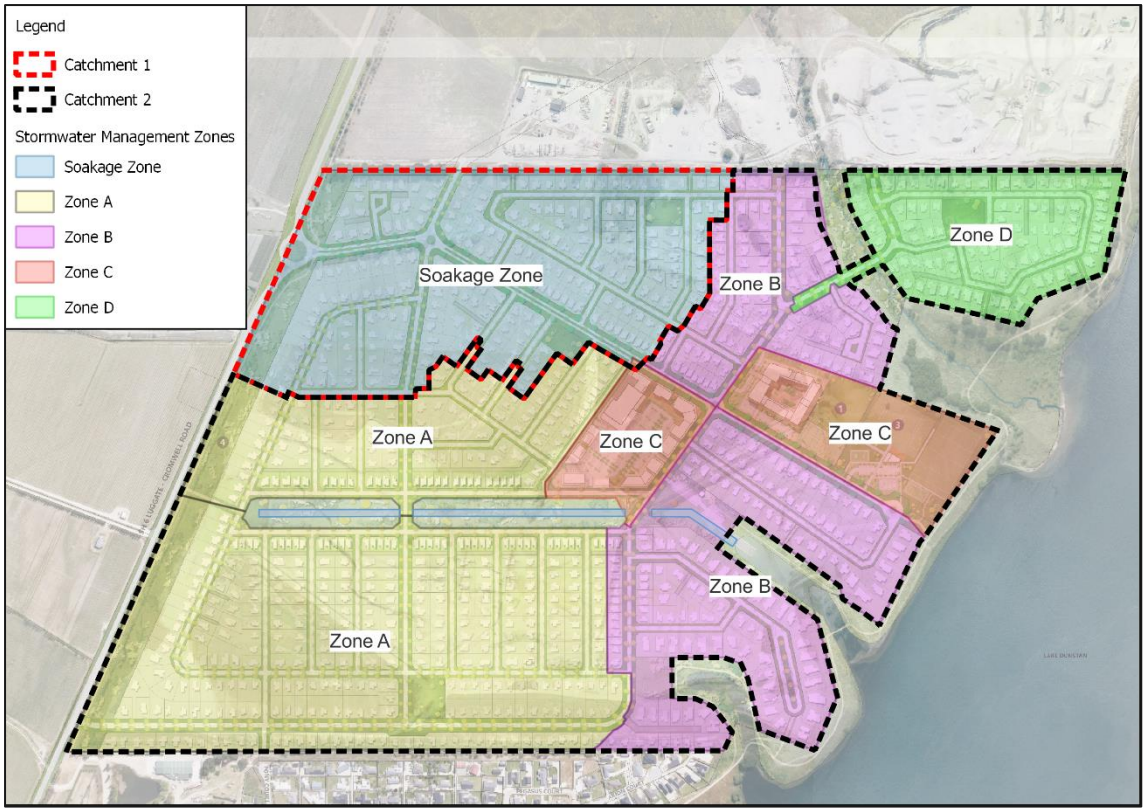

Figure 3 – Stormwater Zones (source Woods report in Appendix G)

Stormwater zones shown in Figure 3 (above identify the areas of the development. A description of the proposed treatment options are listed below.

Catchment 2 - Zone A

Buildings will incorporate low-contaminant generating roofing and spouting materials to minimise contaminant generation at source.

The swales will be sized to convey the water quality design flow in accordance with GD01, based on 10 mm/hr. Indicative parameters are: Slope: 1% Base width: 2 m Top width: 5 m Depth: 0.3 m Side slopes: 1V:5H.

The design will target a minimum 75% contaminant removal efficiency, consistent with the Best Practicable Option.

The final contributing catchments are subject to confirmation following the detailed stormwater pipe network design.

Catchment 2 - Zone B

Buildings will incorporate low-contaminant generating roofing and spouting materials to minimise contaminant generation at source.

Runoff will be conveyed to a communal bioretention device located at the downstream extent of the catchment. The bioretention device will be sized in accordance with GD01 requirements and the Central Otago subdivision stormwater design guidelines.

The communal device will also assist in maintaining pre-development hydrological conditions, reducing peak flows, minimising downstream erosion potential, and improving amenity value.

Catchment 2 - Zone C

Buildings will incorporate low-contaminant generating roofing and spouting materials to minimise contaminant generation at source.

Catchpit filters will capture runoff from small hardstand areas that are not considered high contaminant-generating.

Runoff from high contaminant-generating areas, including proposed parking areas, will be captured and treated via a GD01-specified device. These devices may include, but are not limited to, vegetated swales and raingardens.

Tree pits will provide localised stormwater treatment for roads and will be sized in accordance with GD01 requirements and Central Otago Council guidelines based on NZS 4404:2004.

Tree pits will also support low impact design principles by promoting infiltration, reducing runoff volumes, and improving water quality.

Catchment 2 - Zone D

Buildings will incorporate low-contaminant generating roofing and spouting materials to minimise contaminant generation at source.

Stormwater runoff will be conveyed to a proprietary stormwater treatment device located downstream of the pipe network. The final location of the device will be subject to the stormwater pipe network design.

Proprietary devices will be selected to achieve equivalent contaminant removal performance and first flush capture, consistent with Best Practicable Option guidance.

Catchment 2 - Zone E

Buildings will incorporate low-contaminant generating roofing and spouting materials to minimise contaminant generation at source.

Proprietary devices will be selected to achieve equivalent contaminant removal performance and first flush capture, consistent with Best Practicable Option guidance.

CLIMATE CHANGE CONSIDERATIONS:

The Woods Stormwater & Flood Management report accounts climate change scenarios into and anticipated changes in rainfall patterns. The measures adopted in this regard are the inclusion of larger attenuation channels, sizing of swales to cater for these events, ensuring building platforms have required freeboard for these events.

SUMMARY:

The subject site is currently not connected to a public stormwater network. A new stormwater network will be constructed to provide water treatment, flow management and resilience from flood events. Significant overland flows pass through the site during large storm events, which can be managed to pass safely through the site, without affecting upstream or downstream properties. Climate change has been accounted for in the Woods report, for future resilience.

7. Wastewater

A wastewater modelling report has been prepared by Fluent Solutions (see Appendix F) and provided to the CODC outlining the upgrades to existing infrastructure required to provide capacity to service the Parkburn development. The following assessment is based on the information in the Fluent Solutions report.

SYSTEM REQUIREMENTS:

- Capacity for approximately 800m3/day
- Internal site network capable of handling wastewater flows
- Pumping systems capable of providing 24hrs of onsite storage and discharging wastewater to the existing CODC network at the intersection of Pisa Moorings Road and Stage Highway 6.
- Centralised treatment to be at the Wastewater Treatment Plant (WWTP) in Cromwell

CURRENT INFRASTRUCTURE:

A wastewater modelling report has been prepared by Fluent Solutions (see Appendix F) and provided to the CODC outlining the upgrades to existing infrastructure required to provide capacity to service the Parkburn development.

The site is not connected to a public wastewater network; existing quarry operations use private septic tank systems.

Wastewater infrastructure servicing adjacent communities does not extend to the boundary of the subdivision and is not sized to accommodate the Parkburn development.

PROPOSED PIPE NETWORK INFRASTRUCTURE:

A reticulated gravity system conveying wastewater to a centrally located WWPS is the preferred option.

Each property shall be provided with a standard connection at the boundary to the reticulated wastewater mains. The reticulated network shall be designed to council standards being NZS4404:2004 and the CODC addendum to NZS4404.

The system shall be designed so it can be vested in the Central Otago District Council (CODC).

WASTEWATER PUMPSTATION AND RISING MAINS:

Wastewater must be pumped from the Parkburn subdivision to the CODC centralised WWTP located on Richards Beach Road in Cromwell.

Dual pressure mains shall be extended from the existing CODC wastewater pressure main at the intersection of Pisa Moorings Road and SH6, along SH6 to the boundary of the site, through the proposed roading network within the site and connected to the proposed pumpstation located within the subdivision.

Additional storage capacity shall be installed at the WWPS site to provide the required emergency storage. The rising main, WWPS and emergency storage shall be designed to council standards being NZS4404:2004 and the CODC addendum to NZS4404 or current CODC approved standard at the time of detailed design.

The system shall be designed so it can be vested in the Central Otago District Council (CODC).

INTERGRATION WITH PISA MOORINGS RISING MAIN:

There is potential to integrate wastewater flows from the subdivision with the existing pressure main connecting Pisa Moorings to the Cromwell WWTP.

The report prepared by Fluent Solutions (see appendix F) identified options for an engineered staged integration with the existing main and the maximum volumes before the dual main will need to be operational.

SUMMARY:

There is no existing wastewater network available to the site.

A reticulated gravity network conveying wastewater from each property to a centrally located WWPS within the subdivision is proposed.

Wastewater shall be pumped from the proposed WWPS to the Cromwell WWTP via pressure mains.

The Fluent Solutions wastewater modelling report (see appendix F) identified that wastewater flows can be integrated into the existing Pisa Moorings pressure main for the final stages of development.

8. Water

A water modelling report has been prepared by Fluent Solutions (see Appendix F) and provided to the CODC outlining the upgrades to existing infrastructure required to provide capacity to service the Parkburn development. The following assessment is based on the information in the Fluent Solutions report.

SYSTEM REQUIREMENTS:

- Total water demand of approximately 1547m3/day, with peak demand of 91.3L/s, to service 1020 residential lots plus the commercial allocation and a school.
- Internal site network capable of handling the required water flows.
- Firefighting flows capable of achieving FW3 level of protection in accordance with SNZ PAS 4509_2008 Fire Fighting Supply.
- Connection to the Cromwell Water treatment Plant for centralised treatment.
- Independent Irrigation water supply capable of maintaining the landscaped areas in the initial stages of development and vested in CODC on completion of the maintenance period.

CURRENT INFRASTRUCTURE:

The site is not connected to a public water network; existing quarry operations use private potable systems and a private water take from Lake Dunstan.

Potable water infrastructure servicing adjacent communities does not extend to the boundary of the subdivision and is not sized to accommodate the Parkburn development.

A water modelling report has been prepared by Fluent Solutions (see appendix F) and provided to the CODC outlining the upgrades to existing infrastructure required to provide capacity to service the Parkburn development.

PROPOSED INFRASTRUCTURE:

A reticulated network for potable and firefighting water supply will be required to service the development. A connection to the existing reticulation system at the intersection of Pisa Moorings Road and SH6 shall provide the required water.

Each property within the subdivision shall be provided with a standard potable connection at the boundary of the lot to the reticulated potable water mains. The reticulated network shall be designed to council standards being NZS4404:2004 and the CODC addendum to NZS4404.

An irrigation infrastructure design report has been prepared by Fluent Solutions (see appendix H). A proposed irrigation network shall be installed to provide irrigation water to the street trees and landscaped areas while they are established. An inlet structure and pump station shall be located in the central cove and networked to the streets and landscaped areas. The irrigation take will supply a maximum of 1,093,000 L/day to the available areas.

Both the potable and irrigation system shall be designed so they can be vested in the Central Otago District Council (CODC).

INTERGRATION WITH PISA MOORINGS POTABLE WATER SUPPLY:

A report prepared by Fluent Solutions identified the potential to integrate the potable water supply with the existing trunk main from the Cromwell treatment plant. The report determined two potential upgrades to the existing network that may be required to supply the necessary flows for the Parkburn development.

The Central Otago District Council are completing independent modelling of the network to determine the extent of the upgrades required to the existing infrastructure.

SUMMARY:

The site is not connected to a public water network; existing quarry operations use private potable systems.

A reticulated network for potable and firefighting water supply can be designed to service the development.

The Central Otago District Council are completing independent modelling of the existing network to determine the extent of the upgrades required to supply the required flows in the downstream infrastructure.

A reticulated Irrigation system shall be capable of drawing 1,000,000 L/day from lake Dunstan in order to irrigate street trees and the landscaped areas while they establish on site.

9. Utilities

POWER:

Initial discussions with Aurora confirm that the project's power needs can be met through their network. Please see letter attached in Appendix H.

TELECOMMUNICATIONS:

Initial discussions with Chorus confirm that the project's fibre communications needs can be met through their network. Please See letter attached in Appendix H.

10. Private Infrastructure

No private infrastructure is proposed for this development.

11. Summary

The development at Parkburn is appropriately designed to meet the required infrastructure standards, addressing all relevant aspects of earthworks, roading, stormwater, wastewater, water, irrigation and utilities.

The site will be serviced with sustainable infrastructure, and the effects of climate change and natural hazards will be mitigated through the proposed designs.