CIVIL INFRASTRUCTURE REPORT

Rangitoopuni Development
Riverhead, Auckland

CIVIL ENGINEERING ▾ SURVEYING ▾ LAND DEVELOPMENT

PROJECT INFORMATION

CLIENT:	Rangitoopuni Developments Limited Partnership
PROJECT:	147007 and 147016

DOCUMENT CONTROL

DATE OF ISSUE:	30 April 2025
REVISION	A
AUTHOR	[redacted] [redacted] Associate
REVIEWED BY	[redacted] [redacted] Senior Engineer
APPROVED BY	[redacted] [redacted] Project Manager

[redacted]

Table of Contents

1. OVERVIEW

1.1 Project

The purpose of this report is to provide an assessment of the infrastructure associated with the proposed redevelopment of the Riverhead Forest. The report provides a summary of civil infrastructure matters associated with the Fast Track application, which would see Lot 1 developed for 208 1ha countryside living lots; and Lot 2 developed for a Retirement Village of 260 Villas, 36 care-units and associated amenities. The concept plan for the area is identified in Figure 1 Concept Plan (below).

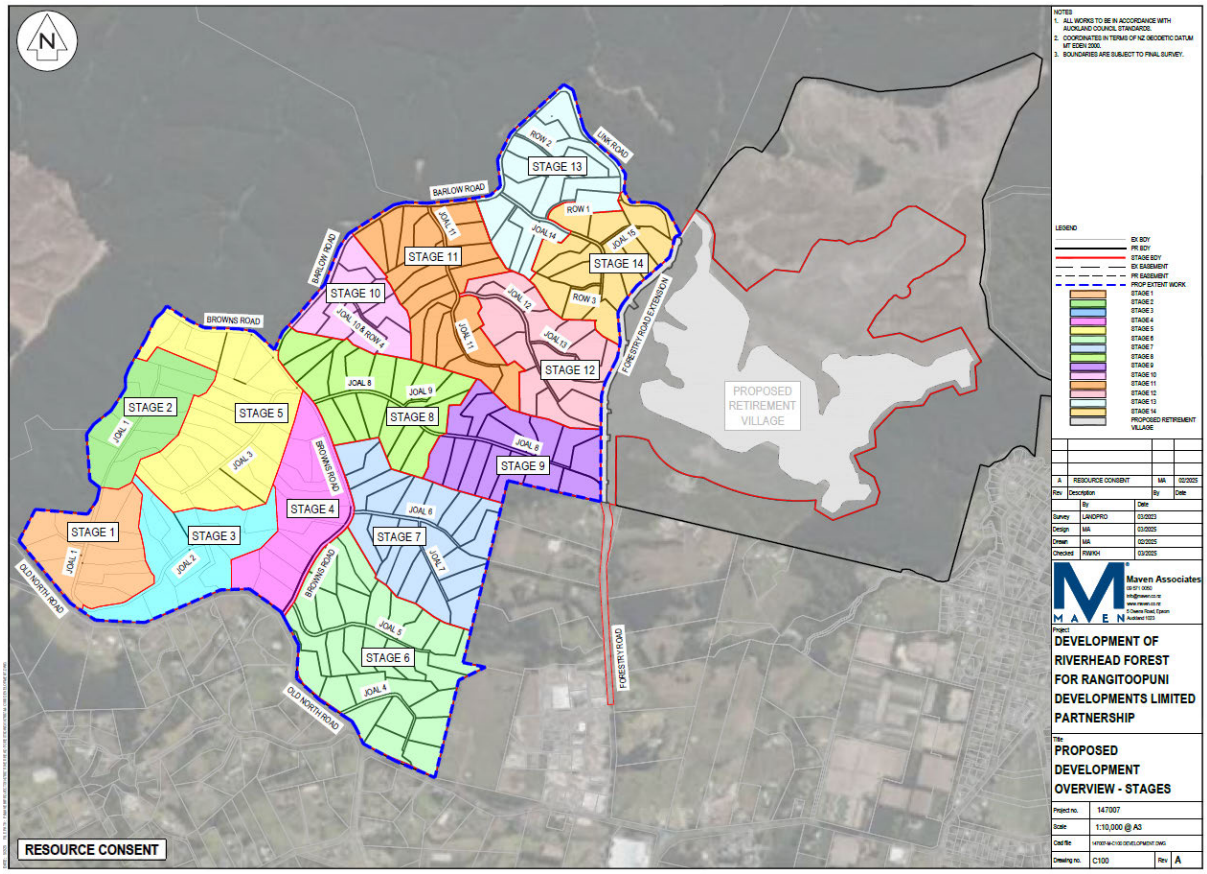


Figure 1: Overall scheme plan and staging plan showing the combined development

The information provided herein relates to stormwater, wastewater, stormwater, water supply, and other service infrastructure and the potential capacity to service the proposed development.

The calculations and assessments included in this report are preliminary in nature based on the information available at the time of issue.

This report provides information in support of the Fast Track application. The calculations and assessments included in this report are 'desktop' analysis and are preliminary in nature based on information available at time of issue.

1.2 Code of Conduct Statement

Although this is not a hearing before the Environment Court, I record that I have read and agree to comply with the Environment Court's Code of Conduct for Expert Witnesses as specified in the Environment Court's Practice Note 2023. I confirm that this report is within my area of expertise, except

where I state that I rely upon the evidence or reports of other expert witnesses lodged forming part of the project's application material. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed.

1.3 Legal Description

Applicant	Rangitoopuni Developments Limited Partnership
Record of Title	1055347 and 1129816
Legal Description	Lots 1 and 2 DP 590677
Site Area	222.75 ha (Lot 1), 173.6 ha (Lot 2)

1.4 Site Description

The subject site forms part of the wider Riverhead (Rangitopuni) Forest holdings. The site is located between Riverhead Township to the east, and Kumeu/Huapai to the south-west. The site is well connected, having ease of connections to SH16 and the Northwestern motorway.

The site features frontage and access from Old North Road (to the south), Deacon Road and Forestry Road. The site has been recently logged, and is intended to be developed for residential purposes, with the balance of the land planted out in native vegetation as part of the development.

The location of the subject site is shown below in Figure 2.

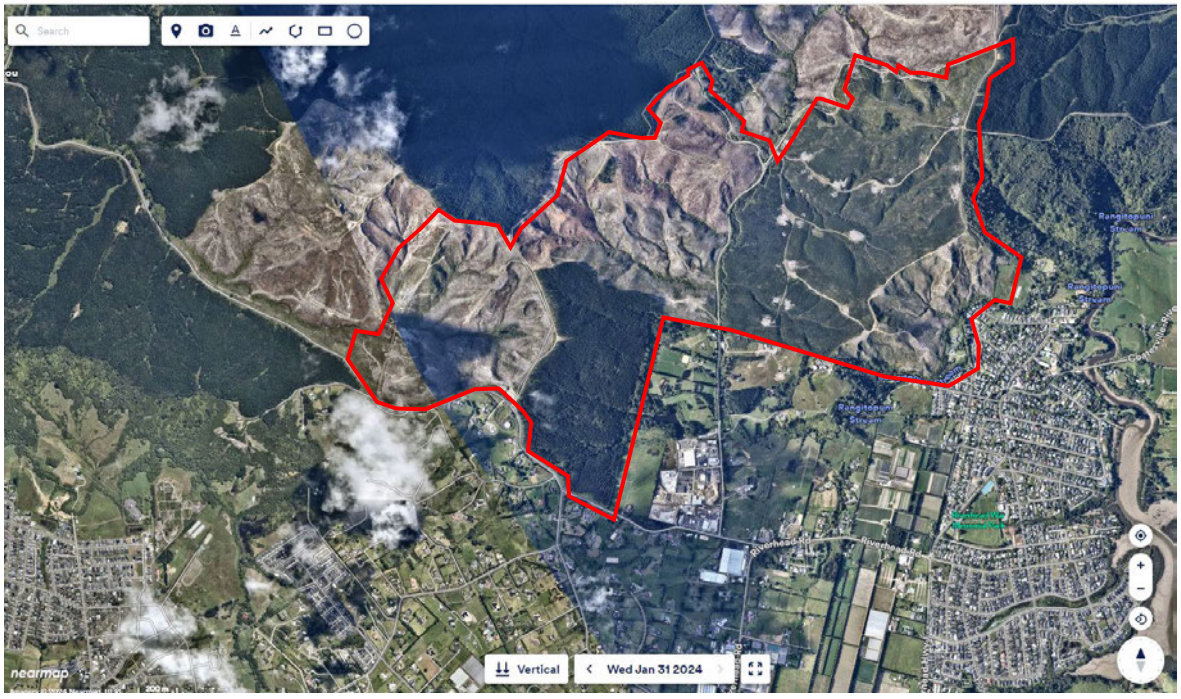


Figure 2: Site Locality Plan (Approximate Lot 1 and 2 boundaries shown in red).

The site features moderate to steep rolling topography, with prominent ridgelines, gullies and identified streams contained within. The site is contained within two stormwater catchments – Lot 1 straddles the Kaipara Catchment (western half), with the eastern area in the Riverhead Catchment. Lot 2 is wholly contained within the Riverhead Catchment. The streams in the Riverhead Catchment flow east, to the rear of the Township, before discharge into the Rangitopuni River upstream of the Riverhead-Coatesville Highway bridge.

There are no existing buildings within the site. The site is benefited from several lawful and existing vehicle crossings and forestry roads within, of which is formed to a rural road standard (compacted gravel, table drains etc).

There are existing power and communications network present within or nearby. The site is, however, not serviced by reticulated water, wastewater, or stormwater networks.

1.5 Proposed Development

The intended development will see 210 1ha countryside living lots being created in Lot 1. A Retirement Village with 260 villas, 36 care units and associated amenities, such as a café and wellness centre with salon, gym and pool, will be developed in Lot 2. The remaining balance lot/areas will be planted out in native vegetation as part of the redevelopment process.

The countryside living areas will feature onsite effluent disposal, whilst rain caught water will be the primary means of potable and non-potable water supply. Stormwater discharge into the various streams and overland flowpaths within the site.

The Retirement Village will be supported by a communal wastewater treatment plant, with disposal to ground. Primary water supply will be via way of roof caught water and will be supplemented as needed by a bore and/or other means. Stormwater discharge would be via the tributaries of the Rangitopuni River.

The roading network within the site would be for the most part privately owned and formed around the existing forestry roads where possible. The roads would feature a combination of chipseal and or concrete finishes. Forestry Road extension (road to vest) is the only public road within the development.

2. EARTHWORKS

2.1 Summary

Earthworks will be required to form the building platforms, construct the accessways and for the construction of roads/culverts and associated infrastructure wihtin the development area.

Widespread recontouring will not be required in support of the countryside living development, although bulk earthworks will be required in support of the Retirement Village complex, given intensity and need to adhere to flatter grades within.

For the most part, the building platforms are elevated above and removed from the streams and/or identified overland flowpaths. This minimises sediment risk to the receiving catchments. Future Resource Consent applications will need to be supported by sediment and erosion control drawings, which will demonstrate how the earthworks will be manged as to comply with GD05.

Bulk Subgrade Earthworks EGL to PGL (topsoil stripping exclusive)

- Total area of ground disturbance = 1,006,600m² (100.6ha)
- Total volume of cut = 899,200 m³
- Total volume of fill = 908,900 m³
- Total volume of net fill = 9,700 m³
- Maximum cut and fill depth = 12m Fill, 12m Cut

Others:

- Topsoil stripping (350mm) = 386,000 m³
- Topsoil respread (200mm =220,840 m³
- Excess topsoil respread in landscape =165,630 m³

Whilst the total volume shows net fill, the fill area has been designed to accommodate a larger than required volume. This conservative approach is to ensure all spoil can be suitably contained within the site. A cut fill balance will, however, be achieved as part of the earthwork operation within the site.

2.2 Sediment and Erosion Control

An earthworks Management Plan has been prepared by Maven Associates, and this is attached within Appendix C). Please refer to the EMP for further detail relative to sediment and erosion control, including the intended methodology, design plans and calculations.

Resource consent will require that erosion and sediment control measures are implemented and maintained in accordance with the Engineering Drawings.

Silt control measures will need to be installed onsite prior to or during (as specified) earthworks commencement. All silt control measures will be checked and confirmed acceptable by the Engineer before relevant earthworks commence. A Geotech Completion Report will be provided at the completion of earthworks.

2.3 Geotech Reporting

ENGEO have been engaged and have provided geotech reporting in support of the overall development, refer to the ENGEO Report (20190.000.001) for further detail.

Overall, the site is considered to be geotechnically suitable for the proposed development provided the recommendations of this report and the Auckland Council Code of Practice (ACCoP) v.2.0 guidelines are followed.

Table 1 provides a summary of geotechnical design parameters appropriate for this site. These should not be taken in isolation but instead considered in context of the recommendations outlined in the relevant sections referenced within the ENGEO report.

The listed parameters below have been followed within the civil design; and the detailed design phase (inclusive of retaining walls and pavement make ups) will be developed in accordance with the recommendations listed above.

Table 1: Geotechnical Design Parameters

Relevance	Parameter		Design Value	Report Section
Shallow Foundations	Preliminary Geotechnical Ultimate Bearing Capacity		300 kPa	14.2
	Preliminary Expansive Site Class (NZS3064)		H1 (High)	14.1
	Seismic Site Class (NZS1170)		C	10.1.3
Retaining Wall Design / Lateral Loads	Engineered Cohesive Fill	Undrained shear strength (kPa)	110	14.4
		Friction Angle (degrees)	32	
		Unit weight (kN/m^3)	18	
	Albany Conglomerate Soils	Undrained shear strength (kPa)	75	14.4
		Friction Angle (degrees)	28	
		Unit weight (kN/m^3)	18	
	Takaanini Formation Alluvium	Undrained shear strength (kPa)	90	14.4
		Friction Angle (degrees)	29	
		Unit weight (kN/m^3)	17	
	ECBF Residual Soils	Undrained shear strength (kPa)	**100**	14.4
		Friction Angle (degrees)	30	
		Unit weight (kN/m^3)	18	
Permanent Batter Slopes	Maximum angle		1V:2H to 1V:3H for cuts and fills up to 1.5 m in height	12.7
Pavement Design	California Bearing Ratio (CBR)		2 - 3 %	14.3

ENGEO have identified the need for inground improvements to ensure suitable factor of safety is achieved for select areas. The required improvements inclusive of building line setbacks, inground palisade walls and/or additional drainage improvements are detailed within the ENGEO reporting, and

within Maven C100 Concept plan sets, C150 Scheme plan sets and C200 Earthworks plan sets. The final design will be subject to further geotechnical assessment, detailed design by ENGEO and Maven and building consent and/or Engineering Plan Approval from Auckland Council.

ENGEO will be engaged during construction to undertake earthwork monitoring. Upon completion of the proposed earthworks an Earthworks Completion Report will be prepared.

2.4 Streamworks

Whilst attempts have been made to avoid earthworks within or nearby to stream margins, streamworks are unavoidable in relation to the required culverts upgrades and installation of riprap.

Please refer to the methodology for streamworks and associated erosion and sediment control within the appended Streamworks Management Plan (Appendix D). A final Streamworks Management Plan will be required prior to construction of any streamworks; as per standard conditions of consent. The culverts have been designed to comply with the provisions of the NES FW; the exception being Culverts 7 and 11 which provide flood attenuation, and thus cannot be sized for 100-yr flows as desired by the NES.

Riprap lengths also exceed the permitted 5m, due to the large catchments and flows. Further details relative to the riprap lengths are included in the Streamworks Management Plan; and within the appended engineering plans and calculations.

3. FLOODING AND OVERLAND FLOW

3.1 Overview

The development site is located within two catchments. The bulk of the site is located within the Riverhead Catchment, with known downstream flooding. The extent of current flooding (from the GeoMaps viewer) is shown below within Figure 3.

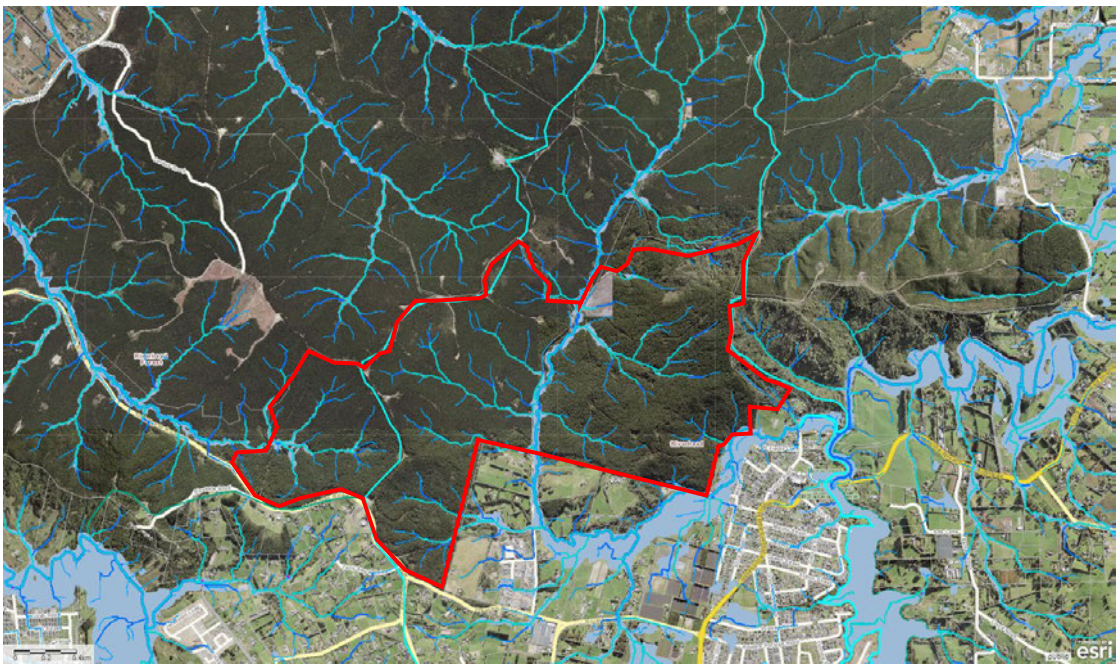


Figure 3: Existing Flooding and OLFPs. Site area in red. Source: AC Geomaps

There is known downstream flooding, although for the most part the flooding extents avoids people and property within the immediate downstream rural properties. It is, however, acknowledged that there is identified downstream flooding within Riverhead Township, which effects both residential properties and access.

As such, to mitigate any adverse effects, specific flood attenuation for 2, 10 and 100-yr events is proposed, to ensure flows are retained to less than pre-development flows and effects.

The overland flowpaths within the site are largely contained to the gullies, streams and associated margins. For the most part these are removed from the development areas and will be maintained as required by the future development.

3.2 Overland Flowpaths (OLFPs)

3.2.1 Retirement Village

The Retirement Village is removed from any large overland flowpaths, being situated on a broad north-east facing ridgeline. Minor redirection of overland flowpaths within the Village area is not of concern. Future OLFPs will be contained within the private road corridors and will be discharged via designed outfalls / swales to the existing streams. This ensures flows are directed away from buildings, as per best engineering practice.

All building platforms and future buildings will be provided with minimum floor levels that comply with the Auckland Council SW CoP V4, and the New Zealand building code as required. Final levels and assessment will be subject to detailed design and building consent approval from Auckland Council.

3.2.2 Countryside Living – OLFPs

The overland flowpaths within Countryside living site (Lot 1) are largely contained to the gullies, streams and associated margins. For the most part these are removed from the building platforms and future building locations.

The proposed JOALs cross various streams and overland flowpaths; and new and/or replacement culverts will be required. The sizing, lengths and locations are shown on the appended engineering plans (C480).

Some existing OFLPs have been redirected away from building platforms; including existing overland flowpaths from Old North Road. Refer to the appended engineering plans for further detail.

All building platforms and future buildings will be provided with minimum floor levels that comply with the Stormwater Code of Practice and the New Zealand building code as required.

3.3 Flooding

To ensure there are no downstream effects from the intended development, mitigation of peak flows is provided. A summary is provided below, however, please refer to the Maven Flood Modelling report (Appendix E), including an E36 Hazard Risk Assessment for further detail.

Maven Associates has undertaken HEC RAS modelling in support of the proposed development. The HEC RAS modelling has been used to develop the overall flood attenuation strategy to ensure the development does not result within any downstream effects.

The Maven Flood modelling report confirms that there is no increase in flows for the 2, 10 and 100-year events. For the eastern catchment which flows through Riverhead, Maven have undertaken 5, 20 and 50-year rainfall events (as requested by Healthy Waters pre-application notes) and the design ensures attenuation to all rainfall events.

This is based on predevelopment levels of impervious within the development site (Lots 1 and 2) and not MPD. The design therefore ensures no downstream effects and/or impacts, with positive effects created from the otherwise assumed MPD condition that Council and PC100's flood modelling is based on.

4. STORMWATER

The Auckland Council Stormwater Code of Practice sets out design and construction standards for stormwater and requires all land development projects to be provided with a means of stormwater disposal and treatment.

The site is not located within the Rural Urban Boundary (RUB) and thus it has been confirmed by Healthy Waters, that the site is not bound by the Region Wide Network Discharge Consent (NDC).

Please refer to the Maven Associates Stormwater Management Plan (Appendix F) for more detailed analysis and assessment, including an assessment of the relevant standards contained within E8 for stormwater discharge.

4.1 Stormwater Overview

There is no existing stormwater network in the vicinity of the development area. The road networks are supported by table drains which discharge into nearby streams / OLFPs.

New stormwater networks will be constructed in support of the development. This will provide a means of disposal for all impervious areas (carparks, common accessways, driveways and buildings). The networks have been designed to comply with the Building Code and the SW CoP V4.

4.2 Stormwater – Retirement Village

The Retirement Village will be provided with a dual stormwater network. Clean roof water will be retained in a separate network from trafficable areas and surface runoff.

Roof caught water will be piped in a sealed U-PVC or PE piped system that will be conveyed into collection reservoirs servicing the onsite water supply system that has been designed by GWE Consulting Engineers. The sealed roof water network has been sized for the 95th percentile event; with overflow (beyond this) to the dirty water network within the lots. One-way flap valves will prevent back flow and contamination of the water harvesting system. First flush diverters are to be installed on all downpipes.

A separate stormwater network will be provided for surface runoff. The networks will discharge via new outfalls to existing streams and/or OLFPs as per ecology advice received. Several of these outfalls will discharge treatment flows only, with the larger flows bypassed and discharged into the attenuation basin, before ultimate discharge to the stream.

These outfalls will be specifically designed and will be provided with rock riprap at point of discharge as per Hydraulic Energy Management: Inlet and Outlet Design for Treatment Devices (TR 2013/18). Please refer to the appended C400 drawings and calculations for further detail.

4.2.1 Stormwater Capacity

The sealed roof system will be sized for the 95th percentile rain event. This sizing has been chosen to provide the balance between storage replenishment versus oversizing networks. A few small clusters of units do not feed this system as their location on a peninsula does not allow discharge into the system by means of gravity feed.

The surface water stormwater network will be sized to cater for 10-yr events for the full catchment (including roofs) as required by the Auckland Council SW CoP. This will convey all surface flows including JOALs, and any catchpits etc needed in landscape areas. This will also support overflows from the clean water network, when rainfall intensity exceeds the 95th percentile event.

The proposed stormwater connections and private stormwater networks will be subject to future Engineering Approval / Building Consent as required for Auckland Council.

4.2.2 Stormwater Quality

Although the site is not bound by the Region Wide NDC, the requirement for treatment is set out within the AUP. Treatment of the roads are not required (less than 5000 v/pd), although treatment would be needed for communal parking areas which exceed 30 spaces.

Notwithstanding the above, given the intensity of the intended development, treatment for the primary trafficable areas is provided. Some small JOALs which serve 10 or less units are not provided with treatment. A combination of propriety devices (stormwater filters) and raingardens are proposed.

Please refer to the attached engineering plans and calculations for the indicative design, locations and sizing of the treatment devices. The final design and layout will be subject to detailed design and Building Consent approval from Auckland Council.

4.2.2.i.1.1 Forestry Road Extension

Under the AUP, Forestry Road is classified as a low volume (less than 5000 v/pd) road and does not require treatment. However, treatment (within the development site) has been provided by way of raingardens, as was discussed with Healthy Waters at the pre-application meetings.

We note that as the treatment devices will only be serving Forestry Road, so will vest to Auckland Transport, who will have to confirm they are supportive of treatment being included.

4.3 Stormwater – Countryside Living

The stormwater management for the development of Lot 1 is provided in typical countryside living fashion. Roof caught water provides the source of all potable and non-potable water supply within the future dwelling(s) within the future lots.

Each lot is provided with a suitable disposal point, via a level-spreader (T-bar) or lot connection to a nearby outfall. The overflow from tanks and runoff from private driveway areas will be discharged via the designated outfalls towards existing overland flowpaths and/or streams. The location of all outfalls has been reviewed by the Geotech Engineer (ENGEO), who have confirmed that the locations are acceptable.

The private accessways/ JOALs will feature swale drains, which will convey stormwater and provide some pre-treatment (where the contour allows). In steeper areas the swales will be provided with

baffles and/or will be armoured by riprap. Refer to the cross-sections appended for additional detail. Outfalls from the swales will be provided to existing streams and OLFPs.

4.3.1 Stormwater Capacity

Each individual lot will be provided with sufficient storage volume to allow for potable and non-potable water supply to all future buildings. It is envisaged that each lot would be provided with a minimum of 4 x 22,500L tanks, although it is likely that up to 90,000L of capacity may be provided depending on number of bedrooms and water demand.

Flood modelling assumes that each lot has a total of 1,000m² impervious (10% allowable), but only 250m² of roof area is provided with SMAF retention (35mm), and 750m² is uncontrolled. This is considered very conservative. The balance of attenuation is provided through the native planting and protection.

The swale drains, culverts, and any lot connections will be sized as required to convey the 10-yr flows as per the Auckland Council SW CoP.

4.3.2 Stormwater Quality

Treatment is not required under the AUP, as the private JOALs are considered low volume (less than 5000 v/pd). However, to ensure positive outcomes, treatment will be provided via roadside swales in the areas of the site which can accommodate this design. Please refer to the standard road cross-section details below:

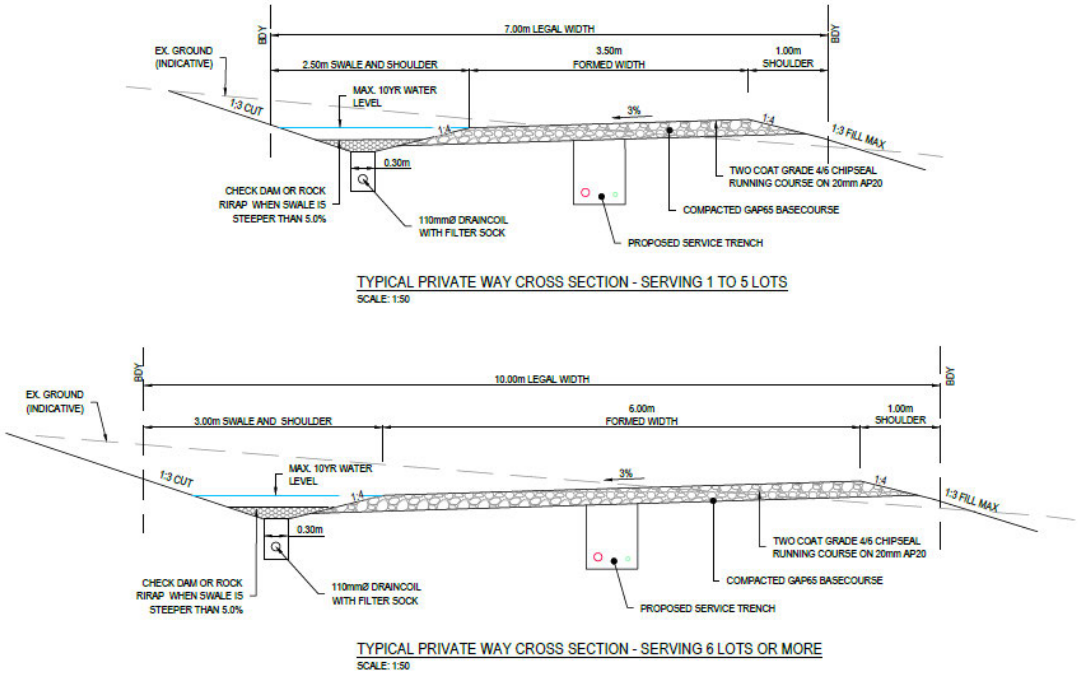


Figure 4: JOAL Standard Cross-sections showing the Grass Swale for Treatment

For steeper sections, treatment will not be possible. Likewise, no treatment is proposed for the private driveways and/or hardstand areas contained within the lots, as allowed by the AUP.

The communal facility contained within Lot 57, (Stage 4) s provided with treatment for the carpark areas via stormwater filters, as this exceeds 30 parking spaces.

All flows will discharge through the planted areas, and into the stream/wetland networks, which will provide treatment of water, and improved aquatic health outcomes.

5. WASTEWATER

The Watercare Code of Practice sets out the design principles for wastewater drainage and requires any development project to be provided with a means of wastewater disposal.

5.1 Wastewater Reticulation Overview

There is no existing reticulated wastewater network within the site. The site is not contained within the Urban extent of Auckland, and Watercare have no long-term plan to provide reticulated wastewater infrastructure to the area.

Instead treated effluent will be disposed to ground throughout the development. For the countryside living lots, this will be contained within their respective lot boundaries. The Retirement Village will be supported by a communal wastewater treatment system, which will dispose of treated effluent to ground.

The wastewater design for all lots has been completed by GWE Consulting Engineers, and this section of the report needs to be read in conjunction with the GWE report and associated plans which indicate the location of the primary and secondary disposal fields.

5.2 Wastewater – Retirement Village

The Retirement Village is supported by a private package plant wastewater treatment plan that will provide treatment for all wastewater before disposal to ground. The design and location of the wastewater treatment plant and disposal areas has been undertaken by GWE Consulting Engineers. Please refer to their reporting and plans for further detail.

A gravity wastewater network will be constructed within the development, and this will provide lot connections to each of the villas and the communal buildings within the Village. Three private pumps with rising mains have been proposed where lots are located on peninsulas that would not be able to be serviced by a gravity feed. These will outlet into discharge manholes in the overall gravity network. The gravity network conveys all flows to the package plant system before being treated and disposed to ground.

The gravity network, private pumps and rising mains are indicated on the Maven engineering drawings appended, as are the wastewater treatment plant. Please refer to the GWE reporting for additional detail relative to the package treatment plant and the disposal areas, inclusive of loading rate and occupancy assumptions.

The final design of the wastewater network, treatment plant and disposal areas will be subject to detailed design and future building consent approval from Auckland Council.

5.3 Wastewater – Countryside Living

The Wastewater Disposal report from GWE Consulting Engineers outlines suitable disposal areas for each lot within the countryside living subdivision.

The GWE reporting for additional detail relative to the disposal areas, loading rates and occupancy assumptions, and confirms that suitable wastewater disposal is possible for all lots. A consent notice will require future compliance with the overarching GWE report, with final design subject to approval at Building Consent stage.

6. WATER SUPPLY

The Watercare code of Practice sets out the design principles for water supply and requires assessment against SNZPAS 4509:2008 NZ Fire Service Fire Fighting Water Supply Code of Practice.

6.1 Potable Reticulation Overview

Although there is a water supply network nearby (Watercare Reservoir and trunk mains in Old North and Deacon roads), the site is not urban zoned and thus is outside of Watercare's intended service area.

A request has been made to Watercare to confirm whether supply can be provided to the retirement village, although this is not being relied upon. Private water supply for both the countryside living lots and Retirement Village is proposed.

6.2 Retirement Village

6.2.1 Water Supply

The Retirement village is provided with a private water network, which will be sourced primarily from roof caught water, via a sealed clean water stormwater network which serves the roof catchment only. This network will be formed from UPVC or PE pipes and will be sized for the 95th percentile rainfall event.

This clean water will be stored in a reservoir(s), treated and will provide potable and non-potable water supply to all buildings within the Village. The roof caught water will be supplemented by bore water, the supply of which has been detailed in the ENGEO hydrology reporting.

Please refer to the reporting from both ENGEO and GWE for further information relative to the sizing of the reservoir, the treatment required and other considerations relative to back up supply during periods of drought.

The future supply and maintenance of the private water network will be subject to detailed design and approval from Auckland Council at building consent stage. The location of reservoirs, treatment plant, and booster pump are indicated within appended engineering plans. The water network has been sized and is located within the private accessways, as per Maven engineering drawings. Future connections will be provided to all buildings from the private network.

6.2.2 Fire Fighting Supply

The minimum firefighting water supply classification for residential developments is FW2. Therefore, any future residential development must meet the following water supply requirements:

- The New Zealand Fire Service Firefighting Water Supplies Code of Practice (SNZ PAS 4509:2008) states that 45m³ of water storage must be available within 90m from each dwelling for firefighting purposes within non-reticulated developments, with FW2 water supply classification.

- The 90m distance is measured from the point where the water supply is available rather than the water source itself (i.e. to the coupling or suction source).

For the retirement village, a series of buried tanks providing 45m³ of storage volume throughout the Village. These tanks have been located in proximity to the private accessways and have been located so that they are within 90m of all buildings.

All communal buildings will be sprinklered which limits the reuqired volume to 45m³. Indicative locations have been shown on the appended Maven engineering plans. Final design will be subject to input from fire and building services engineers. The ultimate firefighting design and arrangement will be subject to review and approval by Auckland Council at the building consent stage.

6.3 Countryside Living – Water

6.3.1 Water Supply

The roof area within each of the lots will form the primary water supply for the future dwelling and ancillary buildings. The roof water will be conveyed to storage tanks. A private pump and treatment will be installed and will supply potable and non-potable use.

A minimum of 4 x 22,500L tanks is assumed, however, the total number of tanks required will be at the future purchaser's discretion (I.e. larger homes will be provided with higher storage volume). There is sufficient space within the lots/platforms to enable suitable supply. The ultimate design will be subject to building consent assessment and approval by Auckland Council.

Overflow from the tanks will be directed to overland flowpaths and/or streams for the level spreader and/or lot connections.

6.3.2 Fire Fighting Supply

The minimum firefighting water supply classification for residential developments is FW2. Therefore, any future residential development must meet the following water supply requirements:

- The New Zealand Fire Service Firefighting Water Supplies Code of Practice (SNZ PAS 4509:2008) states that 45m³ of water storage must be available within 90m from each dwelling for firefighting purposes within non-reticulated developments, with FW2 water supply classification. The 90m distance is measured from the point where the water supply is available rather than the water source itself (i.e. to the coupling or suction source).
- In terms of NZ PAS 4509:2008, a minimum of 45,000 litres is available for Firefighting requirements for a dwelling that is sprinklered and only 7,000 litres for a sprinklered dwelling.

Please refer to appended drawings C495-C497 which detail the typical tank detail for each of the countryside living lots. This shows a complying FENZ solution, whereby 45m³ is provided for firefighting supply. An extract of which is provided below within Figure 5

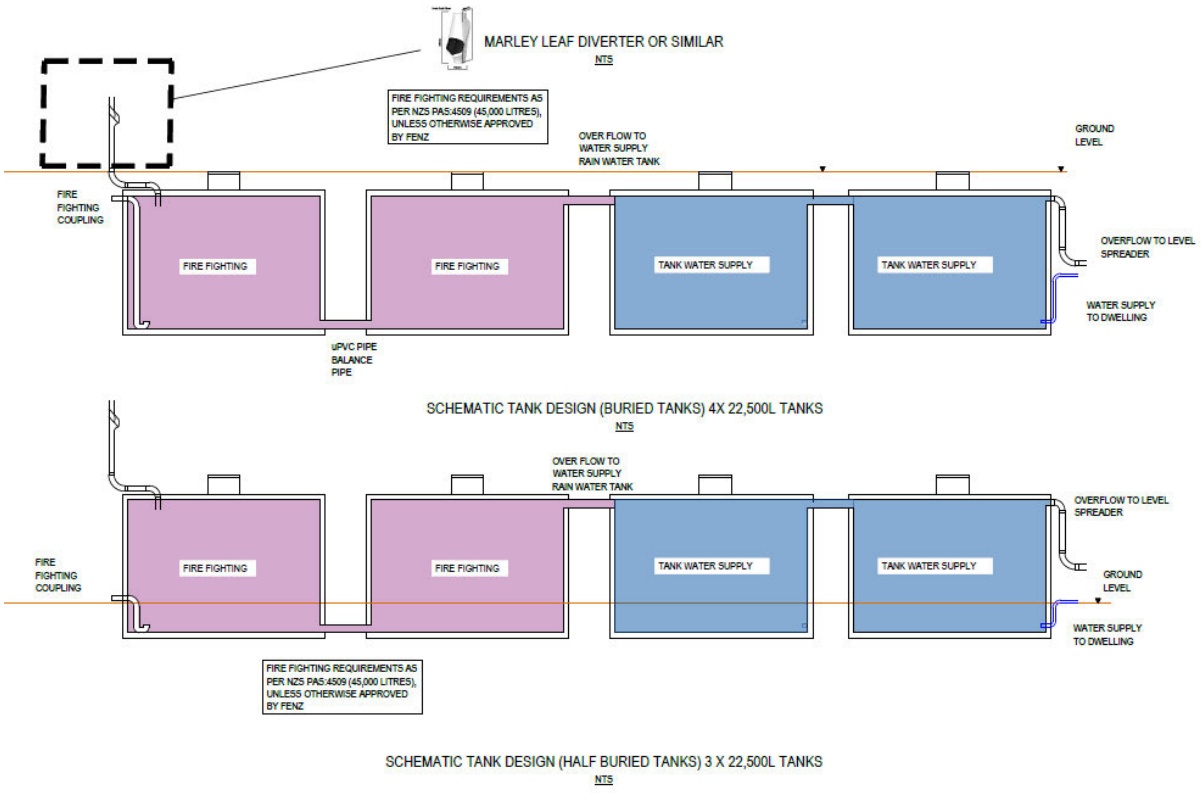


Figure 5: Tank Schematic for generic tanks design as per SNZ PAS 4509:2008

At time of writing, ongoing consultation is underway with FENZ. If FENZ allow reduced volumes, this will be reflected in future consent notices registered against each title.

7. OTHER SERVICES

Telecommunications in the area are managed by Chorus, Power supply in the area is managed by Northpower/Vector. It is understood that services are available, however, upgrades will be required to service the development.

New power and telecommunication networks will be constructed within the private accessways, and a point of supply will be provided for each lot/unit created within the development. Typical servicing details are provided in all roading cross-sections for the JOALs, Forestry Road and the RV accessways. Refer to the appended engineering drawings for further detail.

Consultation with Vector and Chorus has been completed, confirming that subject to upgrades/connections, supply is available.

8. ROADING

An overview of the roading aspects is provided within this section of the Infrastructure Report. For further detail and assessment against the provisions of the AUP, refer to the Commute Transportation Consultants Traffic Impact Assessment for further detail.

Aside from a small section of Forestry Road (local road to vest), all roading within the development are private, and as such a complete roading and access assessment is not warranted.

Instead, assessment is provided below against the relevant design standards of E27 of the AUP, Transport Design Manual, Auckland Transport (TDM) and Austroads Guide to Road Design (Austroads).

8.1 Countryside Living

The countryside side living subdivision is provided with access via way of privately owned JOALs (JOALs 1-15). For ease of reference, the existing private forestry roads which are named (Barlow Road, Browns Road and Link Road) have been retained. These will remain private.

The private accessways will be owned and maintained by the Resident's Association. Easements for access are provided over the lots; as needed for the various lots within each of the respective JOALs as required. The accessways feature two cross-sections, one for 1-5 lots; and the other for 6-10 lots, extracts of which are provided below within Figure 6:

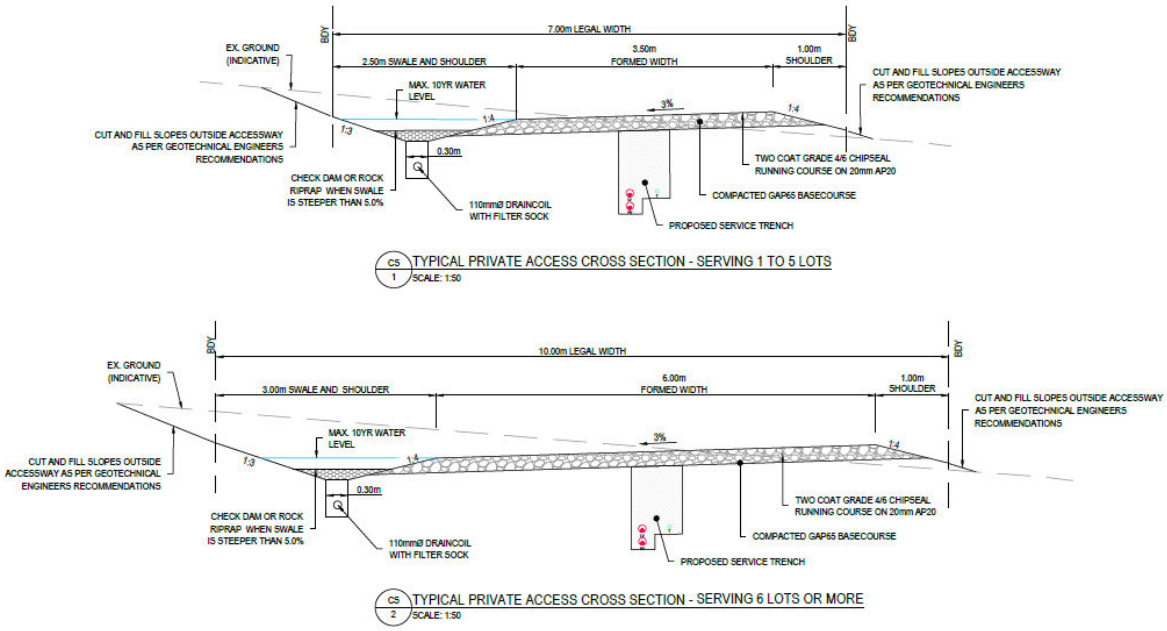


Figure 6: JOAL Cross-sections for the CSL subdivision

For 1-5 lots; a legal width of 7m is provided, with a formed width of 3.5m provided. Passing bays as require by E27 of the AUP (max intervals of 100m) are indicated within the appended engineering drawings.

For 6+ lots the minimum legal width is 10m, with a 6m formed width to provide for two-way movements. This complies with the required formed widths of E27.

All JOALs will be single cross-fall and are provided with a swale for conveyance of stormwater and treatment. The JOALs will be formed with a mixture of concrete (at intersections and entranceways) and chipseal for the remaining sections. The final pavement design will be subject to detailed design and future Engineering Plan Approval from Auckland Council.

All grades are within the allowable maximums of the AUP (20%). Private driveways for lots which feature building platforms away from the JOALs will be provided at future building consent stage; and will be formed to the reuqired standard of the AUP (min 2.5m), and if greater than 100m in length will be provided with passing bay(s).

There is an offroad network of walking trails provided through the covenanted bush areas. These paths provide public access through the trail network. The offroad paths link back to the JOAL network in areas; and public easements in gross are provided over these stretches of JOALs.

Please refer to the Maven Scheme Plans and the Boffa Miskell landscape package for further detail relative to location and intended formation.

8.1.1 Vehicle Access Upgrades – Old North Road

All lots are provided with vehicular access from Old North Road. The three primary vehicle crossings (JOAL 1, Browns Road and JOAL 4) are located around existing crossings. These will be upgraded as required to provide safe and suitable vehicle access.

For the primary entranceways (JOAL 1 and Browns Road) Commute Transportation consultants have provided a design of the intersection which provide shoulder widening to enable a formed traffic lane in each direction and a right-turn bay.

As the accessways remain private, these are both still classified as vehicle crossings. Commute has checked sight distances, and covenant areas are shown on the Maven Scheme Plan to ensure visibility is achieved.

The entranceway to JOAL 4 will be formed to the required AT rural VXG standard for an 80km/h road. Given the lower number of lots served, no right turn bay was required in this instance.

A 3m wide vehicle crossing from Browns Road is also provided for Lot 68; the location has been confirmed as acceptable by Commute.

All JOALs feature a turning head located near the end of the JOAL, where a 6m wide vehicle crossing, formed driveway (with ROW easement) and parking bay have been designed so that the rubbish truck (7.2m rigid axle as per Rubbish Direct reporting) can turned around, as can any other service truck that may be using the JOALs.

8.1.2 Flooding - Countryside Living Access

The JOALs have all been designed so that ponding depths do not exceed 200mm during a 100-yr storm event, as reuqired by the AUP and TDM.

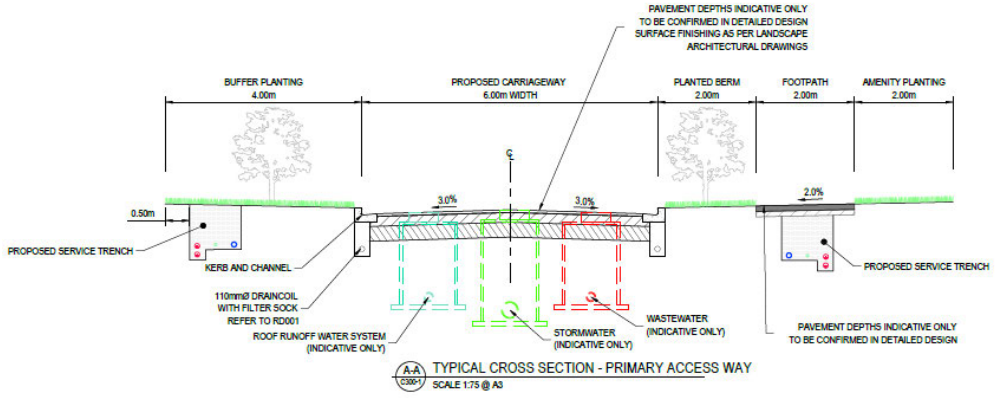
The final JOAL and culverts structures inclusive of the required abutments and retaining walls require further Geotech investigation, detailed design and building consent / Engineering Plan Approval from Auckland Council.

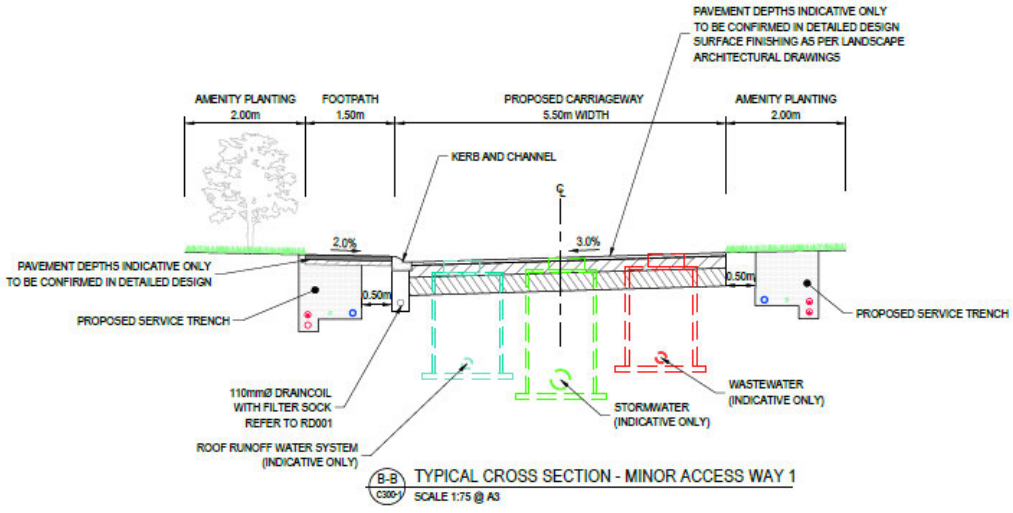
8.2 Retirement Village

The Retirement Village is provided with vehicular access via a series of private accessways. (Accessways 1-8, with minor stubs referred to as a and b from their primary accessway.

The primary accessway (Accessway 1) features a 6m formed formation, with a separated 2m footpath. The other minor accessways feature a formed width of 5.5m and are provided with a footpath for accessways which exceed 10 units; and without a footpath for accessways that serve less.

Extracts from the provided cross-sections within the appended engineering plans are provided below within Figure 7:





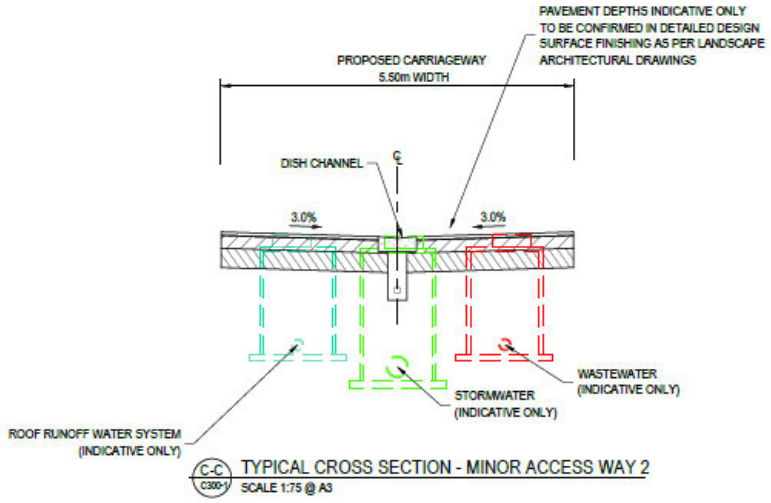


Figure 7: Typical Cross-sections for the Retirement Village

All private accessways will be suitably formed, are provided with complying gradients, and will provide ease of access to all parking areas and driveways.

Turning heads have also been provided to ensure larger vehicles can turn around at the cul-de-sac heads.

Commute Transportation Consultants have undertaken vehicle tracking in support of the private accessways, driveways and parking spaces.

8.2.1 Forestry Road Extension

Forestry Road extension requires modification to bring it up to a public road standard. The existing road is of gravelled formation, with table drains and small culverts, which convey flows from the upstream catchments under the road. A formed stream is located in close proximity to the east; and the road features significant flooding (1.5m) in the 1% AEP event.

To ensure safe vehicle access, Forestry Road needs to be lifted. Given the constraints, this has for the most part necessitated the roadway to push west in the legal extent. To facilitate this, a cut batter or retaining wall (depending on space) is provided.

This in some cases is also supported by a fill retaining wall along the stream edge, where insufficient space prohibits a batter being formed. An extract of the cross-section for Forestry Road is indicated below within Figure 8. The road features a formed 6m width and a 16m legal width (minimum):

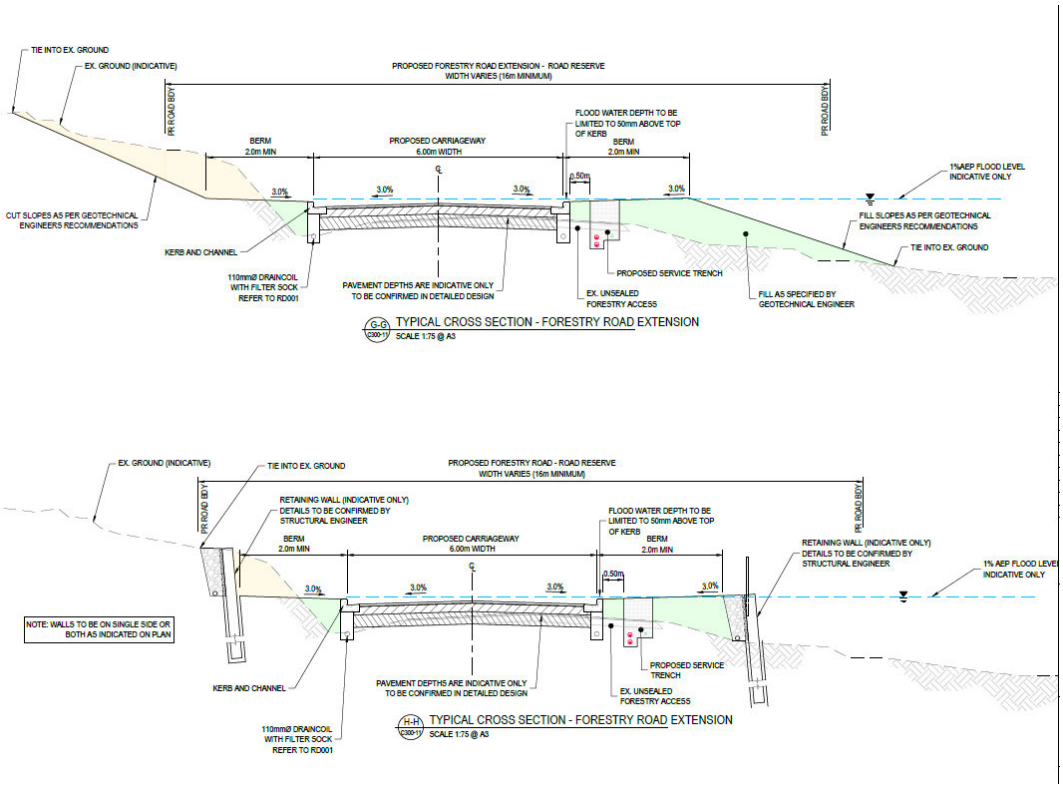


Figure 8: Typical Cross-sections for Forestry Road Extension

The road design is considered to comply with the vertical and horizontal gradient requirements of TDM and will continue to provide safe and efficient vehicle access to all existing private driveways along the public stretch of the road.

No manholes or lids are in the carriageway. Forestry Road features double 3% cross-fall. The final pavement design will be subject to future Circly Design at Engineering Plan Approval stage.

Traffic barriers are shown where their risk to vehicles where they are non-recoverable. These are primarily shown above culverts and above retaining walls along the stream edge.

8.2.2 Retaining Walls – Forestry Road

It is noted that Forestry Road is reliant upon the construction of retaining walls, of which is discouraged by Auckland Transport. In the existing sections of Forestry Road, there are steep almost sheer cut faces which are vegetated. These banks are not engineered, and geotechnically they cannot be retained as part of any upgraded road corridor.

The lifting of the road in some sections also constitutes the need for fill retaining walls where there is either too much level difference or insufficient space to accommodate batters. Through the detailed design process, some of the cut walls could be relocated within the Countryside Living lots, however, Forestry Road upgrade will be reliant upon retaining walls as indicated wihtin the appended civil drawings.

The existing condition of Forestry Road (vested section) can be seen below within Figure 9.

Figure 9: Forestry Road. Near vertical cut faces to the west. Recent stormwater upgrades visible.

8.2.3 Design Speed and Horizontal Design

Forestry Road has been designed to be a 50km/h road. The road curves comply with the minimum radius curves and horizonal curve lengths of Austroads. Road alignment inclusive of detailed vehicle tracking will be undertaken by Commute as part of any future Engineering Plan Approval process.

8.2.4 Existing Vehicle Crossings and Access

Whilst the road alignment and formed height needs to be modified to ensure access can be provided during 1% AEP flood events, careful consideration has also been taken to ensure suitable vehicle access can be provided to the existing properties along Forestry Road. Where possible, the 4m long 5% safety platform is provided, and maximum grades otherwise comply with permitted gradients for single users. We note that several of the existing driveways would not comply in terms of tie into the existing roadway.

8.2.5 Flooding and Vehicle Access

There are multiple existing culverts that cross under Forestry Road. These culverts need to be upgraded, as to ensure flood levels over the roadway comply. Current flood levels exceed allowable thresholds and would not provide safe vehicle access.

As such, the proposed design level of Forestry Road has been lifted to ensure compliance with AT TDM and AUP standards. The maximum ponding depth for Forestry Road and the private accessways which provide access to the Retirement Village are less than 200mm. This has provided the added benefit of providing improved resistance to existing residents on Forestry Road, which could otherwise not access their house during flood events. A hazard risk assessment has been completed as part of the Maven Flood Modelling Report.

9. CONCLUSIONS

The report confirms that there is no adverse civil engineering impacts created from the intended development.

Bulk earthworks are required in support of the formation of building platforms, accessways, roads and the installation of services. The earthworks design has been reviewed by the project Geotech Engineers (ENGEO) and the design includes their recommendations within, inclusive of ground improvements. These are identified on the relevant Maven drawings, and the final design of these areas will require further Geotech investigation, detailed design and future Building Consent approvals.

Maven have prepared a detailed Earthworks Management Plan which outlines how sediment and erosion control will be managed throughout the construction period. The design is compliant with the requirements of GD05. Subject to compliance with the design contained within, any adverse impacts on the environment can be avoided.

Whilst all attempts have been made to avoid streamworks and associated stream loss, there is a need to upgrade existing culverts to provide for fish passage improvements, catchment flows, reducing flood levels (within accessways) and to provide flood attenuation storage. A Streamworks Management Plan has been prepared by Maven Associates. This plan sets out a standard methodology to enable the construction of the culverts. Subject to following the general methodology set out within the Streamworks Management Plan, adverse impacts can be avoided.

There is known flooding and overland flowpaths within the development area. All building platforms are provided with freeboard in accordance with the NZBC and developable areas are removed from these hazards. All private and public roads have been designed in such a way that flooding is limited to the allowable maximum of 200mm during a 1% AEP event. Overland flowpaths from roads and platforms have been considered and allowed for.

The downstream receiving catchments feature existing flooding; and increased runoff that it not mitigated could create adverse impacts. Maven Associates have undertaken HEC RAS modelling in support of the development, and this combined with the attenuation solution confirms that there is no increase in run-off for the 2, 10 and 100-year events (and 5, 20 and 50-year within the eastern catchment). Where possible, pre-development flows have been reduced which will have positive impacts on the Riverhead township, especially when assessed against MPD flows.

The countryside living development is provided with a means of stormwater disposal. Impervious areas and overflows from the tanks and/or impervious areas will be provided via way of level spreaders (for the countryside living lots) and/or dedicated outfalls from the JOAL's swales.

The retirement village is supported by a dual-network system; with clean roof water collected in a separate network which provides supply for the private water reservoir. A separate surface water network provides conveyance of 10-yr flows for the entire Village catchment. This discharges via a series of outfalls to the identified streams, which area connected to the wider attenuation strategy. Treatment within the village is provided to all primary accessways and parking spaces which exceed 30 or more spaces.

A new public stormwater network is provided in support of the Forestry Road extension and upgrade. The existing culverts under Forestry Road are also being upgraded as to ensure improved conveyance and to comply with maximum ponding depths within the AUP and AT TDM.

Water supply for the Countryside Living lots will be via roof caught tanks. A typical detail has been prepared by Maven which would see a minimum of 3 x 22,500L tanks provided. This would provide all future potable and non-potable supply. The actual design and total storage volume will be subject to future building consent approval from Auckland Council, and for larger homes it is anticipated additional storage volume will be provided.

The Retirement Village is provided with a private water network, which will be sourced primarily from roof caught water. This clean water will be stored in reservoirs, treated and will provide potable and non-potable water supply to all buildings within the Village as per the GWE design. The roof caught water will be supplemented by bore water. The final design will be subject to building consent approval and will require management plans which will detail treatment and ongoing monitoring of the private water network to comply with the Water Services Act, 2021.

All lots and/or buildings within the development will be provided with a complying level of firefighting supply as per NZ PAS 4509:2008.

The onsite sewage system for individual Countryside Living lots will be designed in detail and submitted during the building consent process for approval by Auckland Council. The GWE Consulting Engineers report confirms that all lots can be provided with a suitable means of wastewater disposal. A consent notice requiring detailed design and compliance with the GWE report is expected.

The Retirement Village is supported by a private package plant wastewater treatment plan that will provide treatment for all wastewater before disposal to ground, through a series of dripper irrigation lines. A gravity wastewater network will be constructed within the development, and this will provide lot connections to each of the villas and the communal buildings within the Village. Please refer to the GWE report for additional detail relative to the package treatment plant and the disposal areas, inclusive of loading rate and occupancy assumptions.

The countryside living subdivision will be provided with legal and physical access through a network of private JOALs. Specific entrance designs from Old North Road are provided as per the Commute design. The JOALs provide complying formed and legal widths, as per E27 of the AUP. Maximum gradients and the provision of passing bays are also provided, as required.

The Retirement Village is provided with vehicle access via Forestry Road, which will be upgraded to a public road standard. A series of private accessways then provide vehicle access to the Village and retail hub. The accessways are suitably formed, and feature complying grades which are considered fit for purpose for the intended use.

Telecommunications and power networks are present in the surrounding area, and service can be made available to the proposed development, subject to upgrades. Proposed service trenches are indicated on all roading cross-sections appended.

Information gathered to-date confirms the site is suitable for the proposed development. The civil engineering design detailed within this report and associated appendices ensures that all adverse impacts can be avoided and/or suitably mitigated.