

Seven Oaks Kinloch Limited

30 Okaia Drive, Kinloch

Engineering Services Report – Balance Land

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Engineering Services Report – Balance Land

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1. SCOPE

Cheal has been engaged by Seven Oaks Kinloch Limited to obtain a staged subdivision consent for the balance of Seven Oaks land to create a total of 83 residential lots. The land is zoned partly as Kinloch residential and part Kinloch low density residential. Given the proposed lot sizes, the subdivision consent application will be a non-complying activity. Land use consent will also be required from Taupō District Council to consent bulk and location of future dwellings. This Engineering Services Report has been prepared in support of the consent application. In addition, a Landscape and Visual Assessment (LVA), and planting plan, traffic assessment, and ecological assessment have been prepared by others.

This Engineering Services Report serves to outline preliminary design recommendations and drawings for earthworks, roading, stormwater management, water reticulation, wastewater reticulation, as well as power and telecommunications network availability.

Seven Oaks Stages 1 to 8 and the Terraces (Stages 1 and 2) are either fully constructed or underway to varying degrees at the time of writing this report.

2. SITE DESCRIPTION

The Seven Oaks balance land is located at the end of the current Okaia Drive to the north of the previously designed and constructed Stages 1 through 8. The balance land development will entail extension of Okaia Drive and will serve as a connection with existing Kahikatea Drive. The site area generally falls gently from north to south and is currently used for grazing. No significant vegetation or major flow paths are contained within the site which is bordered by additional farming to the north and Department of Conservation (DoC) land to the west and southeast. The northern block of land, known as The Terraces, is currently under construction – starting with the extension of Kahikatea Drive and Stages 1 and 2.

Given the Terraces subdivision generally slopes down into the balance land site, consideration has been given to diverting or transferring existing offsite flows around or through the development, in conjunction with a separate engineering services report prepared for The Terraces block.

The development surrounds two existing 1-hectare blocks, one of which contains a house and various outbuildings. However, both of these blocks form part of the application and are incorporated into the development. Another residence lies immediately to the north of the proposed Kahikatea Drive extension. Again, careful consideration will be required for maintaining access to these properties, addressing stormwater runoff and managing earthworks so as to limit impacts on these properties.

To be read in conjunction with Scheme Plan 220225-SC001 found in Appendix 1.

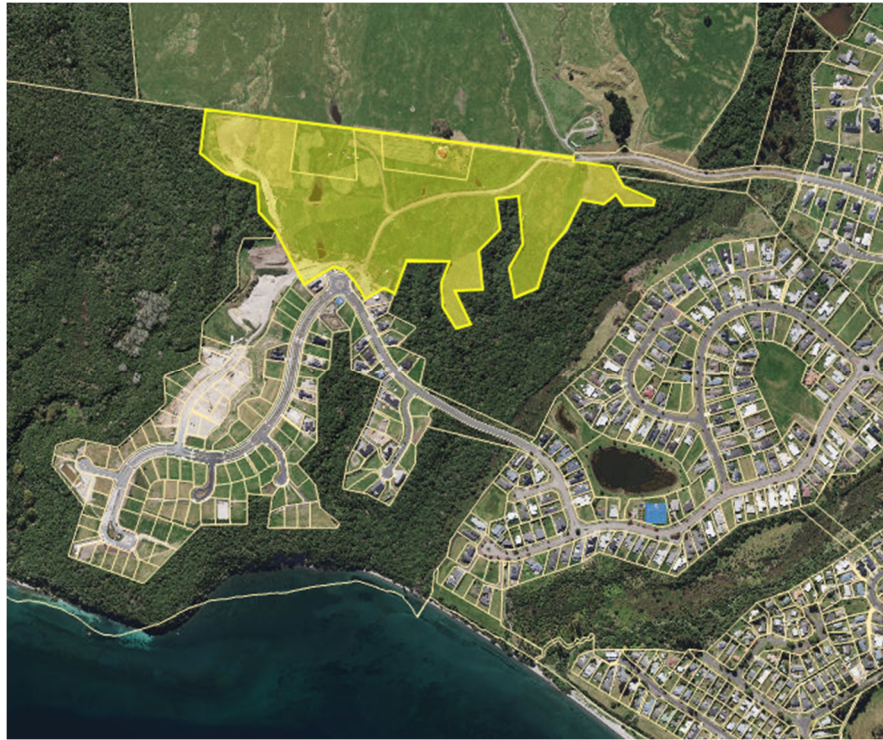


Figure 1- Balance Land Location (Yellow)

3. GEOTECHNICAL CONTEXT OF THE SITE

Although there has not been a specific geotechnical investigation completed for the site, the extensive earthworks completed within Stages 1 to 8 confirms that the general site area is Pumice (Orthic Pumice – Taupō Pumice Alluvium) which is typical soil for the Taupō Volcanic Zone. Pumice soils are free draining and can contain a mix of fine grained to coarse grained material. Local engineers and contractors are familiar with these soils, which are highly suitable for supporting structures and roadways. Care must be taken during construction as these soils can be highly erodible but successful methodologies have been developed in the area to control runoff and potential sediment runoff. It is also known now from previous stages of Seven Oaks that the upper soils have a lower permeability than is typical for pumice soils. Allowance will be made for this during detailed design and to ensure that soakage ponds can be adequately drained.

The Taupō District Plan does not show any fault lines near the property.

4. EARTHWORKS

4.1 Proposed Earthworks Philosophy

Earthworks are proposed over much of the balance land to generally shape the land and smooth out various hummocks and hollows which feature over the balance land area in an effort to minimise earthworks for the future lot owners. However, given the general contour is not steep, formation of individual building platforms is not proposed, and some level of earthworks may be required for individual lots. Additionally, earthworks for the larger lots generally along the northern boundary has

been minimised to allow greater flexibility for future owners. Preliminary earthworks drawings found in Appendix 2 show existing and proposed contours as well as cut and fill depths. Earthworks will likely be completed in a staged approach which will be determined and detailed as each stage progresses, with review and approval from Taupō District Council completed at that time.

The design philosophy seeks to minimise earthworks. No retaining walls are envisaged at this time, but this will be confirmed during detailed design or individual lot owners may choose to construct retaining walls to maximise flat area within their lot.

All proposed earthworks within the Balance Land area will meet the requirements of the Waikato Regional Council (WRC) Permitted Activity (PA) status rule 5.1.4.11 (Soil Disturbance, Roding and Tracking and Vegetation Clearance) of the Regional Plan.

However, due to WRC's interpretation of High-Risk Erosion Area being different from the definition in the Waikato Regional Plan, there is a potential non-compliance with Rule 5.1.4.15. Consequently, a Regional Council consent application has been submitted accordingly.

The below commentary shows how compliance is or will be achieved for the various conditions outlined in Rule 5.1.5.

- a) *Organic material shall not be place in fill where its subsequent decomposition will lead to land instability.*
This condition will be met through appropriate construction management.
- b) *Erosion/sediment controls shall be installed and maintained on all earthworks during and on completion of the works to avoid the adverse effects of sediment on water bodies.*
This condition will be met through detailed design and construction management though preliminary layout of controls is included in Appendix 2.
- c) *Cut-offs or culverts shall be designed and installed to prevent scour, gullyng or other erosion.*
This condition will be met through detailed design.
- d) *Any erosion of instability of the coastal environment, or the beds of rivers and lakes or wetlands shall be avoided or remedied if it does occur.*
Not applicable.
- e) *The activity shall not result in neighbouring land becoming subject to flooding.*
This condition will be met through detailed design of the finished ground levels and provision for overland flows paths of neighbouring land through the proposed site where required.
- f) *All disturbed vegetation, soil or debris shall be deposited or contained to prevent the movement of disturbed matter so that it does not result in:*
 - i. *The diversion, damming or blockage of any river or stream, or*
 - ii. *The passage of fish being impeded, or*
 - iii. *The destruction of any habitat in a water body or coastal water, or*
 - iv. *Flooding or erosion.***This condition will be met through detailed design and construction management.**

- g) *The activity shall not disturb any archaeological site or waahi tapu as identified at the date of notification of this Plan, in any district plan, in the New Zealand Archaeological Association's Site Recording Scheme, or by the Historic Places Trust except where Historic Places Trust approval has been obtained.*
Not applicable in terms of known sites but will be controlled through construction management and appropriate Accidental Discovery protocols implemented in the event of discovery of such a site during construction.
- h) *The concentration of suspended solids in any point source discharge arising from the activity shall comply with the suspended solids standards as set out in Method 3.2.4.6. This condition applies only to permitted activity rules and excludes any non-point source discharges from roading, tracking and vegetation clearance activities (refer condition o) below).*
This condition will be met through appropriate erosion and sediment control measures employed during construction as per previous Stages.
- i) *Any discharge of contaminants into air arising from the activity shall comply with the permitted activity conditions in Section 6.1.8 except where the matters addressed in Section 6.1.8 are already addressed by conditions on resource consents for the site.*
This condition will be met through appropriate construction management.
- j) *In the event of any waahi tapu that is not subject to g) above being identified by the Waikato Regional Council to the person undertaking the activity, the activity shall cease insofar as it may affect the waahi tapu. The activity shall not be recommenced without the approval of the Waikato Regional Council.*
This condition will be met through appropriate construction management.
- k) *No storage or mixing of fuels, oils, or agrichemicals shall be undertaken in areas where deliberate or inadvertent discharge is likely to enter any permanent natural surface water body.*
This condition will be met through appropriate construction management.
- l) *All vegetation that is being felled within five metres of a perennial water body shall be felled away from the water body, except edge vegetation, or vegetation leaning over a water body which, if necessary, may be felled in accordance with safety practices.*
No applicable as no such water bodies exist on site.
- m) *All exposed areas of soil resulting from the activity shall be stabilised against erosion by vegetative cover or other methods as soon as practical following completion of the activity and no later than six to twelve months from the date of disturbance to avoid the adverse effects of sediment on water bodies.*
This condition will be met through appropriate construction management.
- n) *The activity shall not be located within 20 metres of a Significant Geothermal Feature.*
Not applicable.
- o) *The concentration of suspended solids in any non-point discharges from roading, tracking and vegetation clearance activities shall meet the following standards;*
 i. *The activity or discharge shall not result in any of the following receiving water standards being breached:*

- ii. *In Waikato Region Surface class waters – 100 grams per cubic metre suspended solids concentration*
- iii. *In Indigenous Fisheries and Fish Habitat class waters – 80 grams per cubic metre suspended solids concentration*
- iv. *In Trout Fisheries and Trout Spawning Habitat class waters – 25 grams per cubic metre suspended solids concentration*
- v. *In Contact Recreation class waters – black disc horizontal visibility greater than 1.6 metres*
- vi. *In Natural State class waters – the activity or discharge shall not increase the concentration of suspended solids in the receiving water by more than 10 percent*

Standard a) shall apply, except where the suspended solids concentration or black disc horizontal visibility in the receiving water is greater than the standards specified, at the time and location of discharge or of undertaking the activity. Then there shall not be any increase (i.e. further deterioration) in the receiving water suspended solids concentration or black disc horizontal visibility of more than 20% as a result of the activity or discharge.

The point at which compliance with this standard shall be measured is after reasonable mixing has occurred which in any instance does not exceed 200 metres from the point of discharge.
This condition will be met through appropriate construction management.

- p) *Soil disturbance associated with the construction of a road or track within 20 metres of a culvert or bridge provided for in Rules 4.2.8.1, 4.2.8.2, 4.2.9.1, 4.2.9.2, and 4.2.9.3;*
 - i. *Shall not occur adjacent to Significant Indigenous Fisheries and Fish Habitat Class waters during August to December inclusive and Significant Trout Fisheries and Trout Habitat class waters during May to September inclusive; and*
 - ii. *Shall be stabilised against erosion by vegetative cover or other methods as soon as practical following completion of the activity and no later than two months from the date of disturbance to avoid the adverse effects of sediment on water bodies; and*
 - iii. *The location of the proposed soil disturbance shall be notified to the Waikato Regional Council in writing at least 10 working days prior to commencing construction.*

Not applicable.

4.2 Preliminary Earthworks Volumes and Depths

Preliminary earthwork volumes proposed over the Balance Land area (all stages, including Kahikatea Drive) are approximately 45,050m³ of in situ cut and 40,950m³ of fill, allowing for using a fill factor of 1.667. This results in an excess of 4100m³ of fill. This can be refined further in detailed design or disposed of in the adjacent Terraces block, also owned by Seven Oaks. The current cut and fill volumes represent preliminary bulk quantities only and does not account for road cut to subgrade works or cuts for overland flow swales. The maximum depth of cut is approximately 3.2m and fill around 3.7m at its deepest. However, these will be confirmed and refined during detailed design.

It is important to highlight that this development encompasses two different district zone areas. Kinloch Low Density Residential area to the north and Kinloch Residential to the southeast, as shown on the Scheme Plan 220225-SC001. Along the DoC boundary with the Kinloch low density residential zone, the District Plan setback requirement is 10m with no cut or fill greater than 0.5m. However, since this proposal is for a Kinloch Residential zone density a setback of 7.5m has been used to delineate restricted earthworks. This is consistent with the Kinloch residential performance standard and previous stages of Seven Oaks. Ground levels will not be altered at the boundary of any

adjacent DoC Reserve area. Effort has been made to minimise earthworks greater than 0.5m within 7.5m of DoC Reserve area and 1.5m of other boundaries.

However, at certain locations the proposed earthworks do not meet these criteria. It should be clarified that at no time will cut or fill occur in DoC Reserve areas. Existing ground levels will be maintained to +/- 0.0m cut or fill.

The ground will be shaped sloping towards this development and away from DoC land. There are areas of the site where the District Plan requirement of a maximum 0.5m depth of cut or fill within 7.5m of the DoC Reserve will be exceeded and these are discussed below.

For cut and fill depth please refer to Earthworks Cut and Fill Plan 220225-SK203 where the green shading represents fill and beige, orange, brown to dark red shading represents cut.

4.2.1 ROW for Lots 8 to 10

The land to the west side along DoC Reserve is higher than the proposed lot's design. To provide well graded lots in this area, the high land will be cut and a batter constructed from the DoC Reserve land height towards the lot. This requires a cut and fill up to 1.1m in depth adjacent to the 7.5m buffer line and battering down, as shown below, where the yellow/green represents fill.

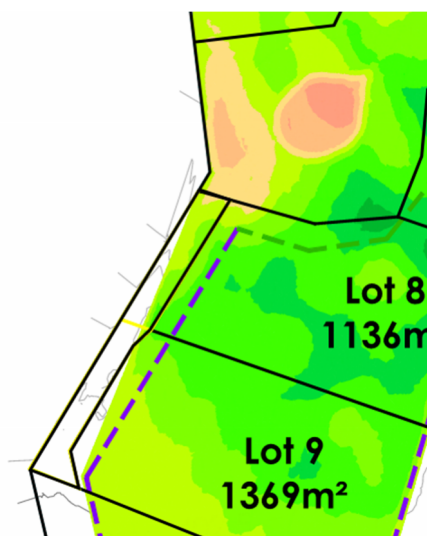


Figure 2 – ROW for Lots 8 to 10

4.2.2 Lots 11 to 13

Lots 11 to 13 share their western boundary with DoC Reserve. Undulating land follows an existing natural gully west on DoC Reserve. High spots protruding along the 7.5m setback will be cut down to meet the road allowing access to these sites and prevent private owners carrying out earthworks within the 7.5m zone adjacent to the DoC Reserve. Similarly, for areas with low levels, fill will be used to meet the proposed design. In order to supply well graded lots, a cut and fill of up to 1m depth in the adjacent 7.5m buffer zone with gentle battering down to meet existing ground is required.

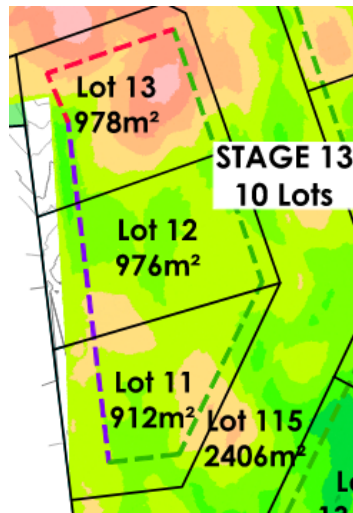


Figure 3 – Lots 11 to 13

4.2.3 Lots 50 to 52

The perimeter of these sites to the west is bordered by DoC Reserve. Within these lots the land is relatively wide and open, with an undulating terrain and an overall gentle downhill gradient from north to south where small gullies fall towards DoC Reserve. High spots of land protruding along the 7.5m setback will be cut down to adequately merge the lots entrance accessing from Okaia Drive. Low gully pockets crossing the land will be filled to provide a general level area. Recontouring will allow to provide well graded lots with maximum 1m cut depths in the adjacent 7.5m buffer zone and similar maximum fill of 1m. The approximate setback of the proposed earthworks to the DoC Reserve in this area is approximately 5.0m from the common boundary line.

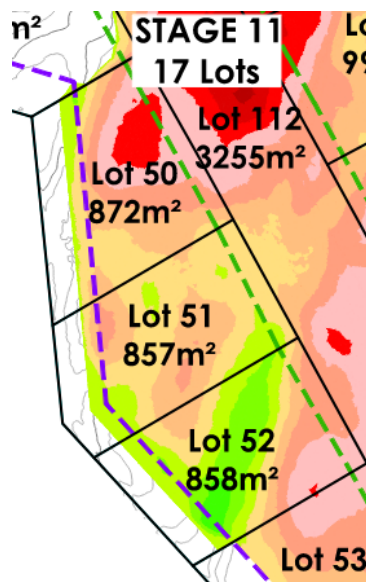


Figure 4 - Lots 50 to 52

4.2.4 Lots 80 and 82

Lot 82 sits on an existing 'storage pond' built as part of Seven Oaks Subdivision for erosion and sediment control. The pond location was selected to utilise the natural capabilities of untouched ground and minimise earthworks of future development. The surrounding areas will be cut to meet road geometry and provide suitable building platforms, however the area sits higher than its

surrounding. To construct building platforms recontouring areas of cut and fill will extend beyond the 7.5m setback with a maximum fill of 1.2m at the 7.5m buffer line then battering down gently to meet natural ground at DoC Reserve, as shown in Figure 5 below, where green shading represents fill and beige/orange shading represents cut.

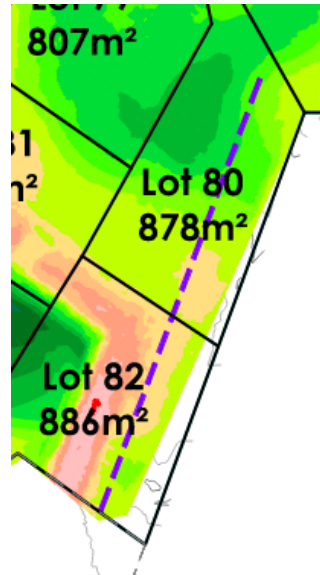


Figure 5 - Lots 80 and 82

4.2.5 Lot 64 and 65

Lot 64 is shaped around a natural spit of land surrounded by DoC Reserve. Lot 65 is north of the spit and presents formations higher than the surrounding area. To achieve building envelopes, a maximum cut of 1m (beige/orange) at the 7.5m buffer line is required then battering down gently to meet natural ground at DoC Reserve, as shown in Figure 6 below, where green shading represents fill up to 0.5m.

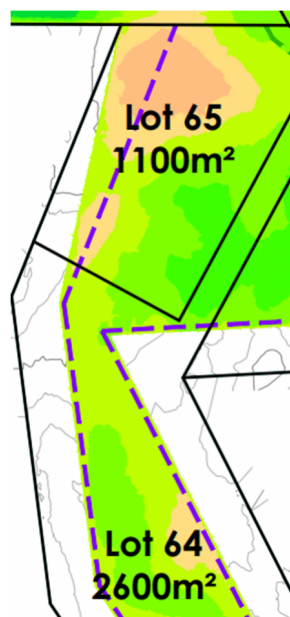


Figure 6 - Lots 64 and 65

4.2.6 Lot 63

A natural gully depression covers most of this site with the land falling southwest. The gully depression area extends within the 7.5m buffer zone. To form a suitable building platform requires fill to up to 0.5m (green) at the 7.5m line battering down to natural existing ground at DoC Reserve, as shown in Figure 7 below, where beige shading represent cut up to 0.5m.

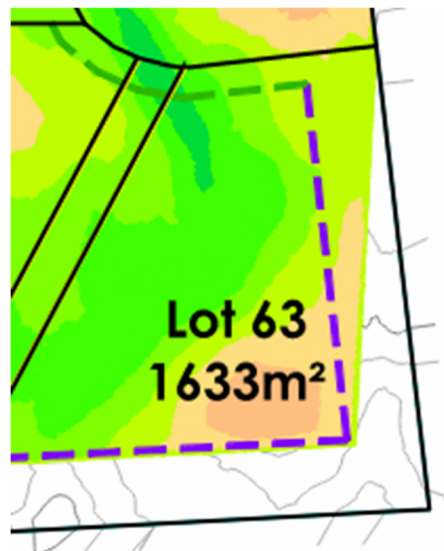


Figure 7 – Lot 63

4.2.7 Lot 62

The gully formation continues rolling down from Lot 80. Lot 79 land is shaped with a centred depression around 2m below the adjacent area and extending into the 7.5m setback to DoC Reserve. The intention is to provide earthworks suitable for future building to be constructed without need for additional cut or fill to be done by private owners within the 7.5m setbacks. A fill up to 1.5m depth approximately 5m from DoC Reserve boundary is required to prevent ponding and erosion issues around these pockets of natural ground and the new compacted materials.

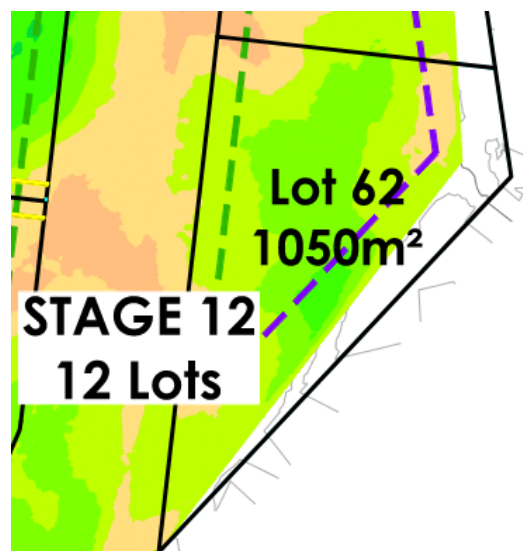


Figure 8 – Lot 62

4.2.8 Lot 61

Lot 61 is traversed by a low depressing gully running north to south towards DOC Reserve to the south-east of this Lot. These undulations of the land require a maximum fill of 1m encroaching into the 7.5m buffer line then sloping down to meet natural ground at the DoC Reserve, as shown in Figure 9 below, where the green shading represents fill up to 1m deep and beige represents cuts up to 0.5m within the 7.5m setback line.

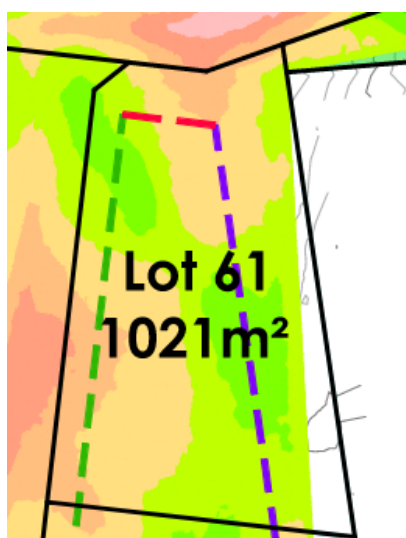


Figure 9 – Lot 61

In summary, preliminary earthworks modelling comprises recontouring existing land to provide necessary shape to the site to accommodate future residential development while preventing unnecessary modification of the land in the 7.5m buffer zone with neighbouring DoC Reserve.

4.3 Erosion and Sediment Control

Various controls will be required during construction to manage erosion and prevent sediment discharge during the earthworks process onsite. These controls will likely consist of sediment retention ponds (SRP), decanting earth bunds (DEB), clean and dirty water diversion bunds, and silt fences. The design, installation, and management of these controls will be completed in accordance with the WRC guidelines. A preliminary design drawing has been completed to accompany the application for WRC earthworks consent and is included in Appendix 2. This design consists predominantly of four SRPs, 5 DEBs, and piped clean water diversion from the upper catchment (Terraces) which will pass through the balance land. The design will also need to be approved by TDC during Engineering Approval stage. Monitoring of controls will likely be completed by WRC during the course of earthworks. Detailed design will be completed as required for the various stages of earthworks and a Construction Management Plan will be prepared and provided to the relevant Council prior to construction commencing.

Flocculation of sediment ponds and DEBs will be implemented if determined necessary following soil bench testing and development of a Flocculation Management Plan. This Flocculation Management Plan will describe the bench testing that has been performed on the sediment from this site, as well as the procedures to follow for flocculation of the SRPs and DEBs if required. All equipment necessary to implement flocculation of the ponds and DEBs is to be kept on site at all times, ready for deployment when required.

It is acknowledged that the land surrounding the site is of significant environmental importance and is to be protected. Previous Stages of the Seven Oaks and Terraces subdivisions demonstrate Seven Oaks' commitment to eliminate discharge from the site by implementing robust systems including providing additional and oversized ponds as well as pumping systems.

5. STORMWATER

Stormwater treatment and disposal for the balance land is proposed to follow similar methodologies used in previous stages of the Seven Oaks development. This will consist of swales for Kahikatea and the shorter cul-de-sacs and a combination of swales and catchpits just for Road 01 and the extension to Okaia Drive. Additionally, the balance land has an added consideration of upstream catchments which currently drain through the proposed development. Consequently, overland flow paths are proposed both through and around the site to allow for these flows.

Please refer to Appendix 2 for the proposed earthworks plan and conceptual services plans.

5.1 Primary Disposal System

As per the TDC Code of Practice, Stormwater runoff disposal from all dwellings and hardstand areas on each lot will be through individual soakholes or soakage pits on each lot, capable of dealing with a 10-year, 1 hour storm event.

The same storm event must be attenuated for all road corridors as well. Consequently, the roads are split into suitable catchment areas, with runoff collected via either swales or catchpits and directed to suitably sized soakage/attenuation ponds. These ponds will be sized for the 10-year, 1 hour storm event as per the TDC Code of Practice and will meet the permitted activity rules for Stormwater Discharge to Ground in the WRC Regional Plan.

Any proposed privately owned rights of way will utilise kerb and channel, with a catchpit draining to a concrete lined drilled soakhole for disposal of the 10-year, 1 hour storm volume.

Four soakage ponds are proposed and will be placed in Stormwater Reserves designated for that purpose. Where possible, pond systems will consist of a smaller, low flow coarse sediment pond (first flush), with larger flows then directed to the primary detention pond via a large diameter pipe. A suitable overflow spillway (vegetated weir) will also be incorporated into the first flush pond for large flows. The base of the ponds will contain deep concrete lined drilled soakholes to allow the ponds to drain completely following a rain event. The Stormwater Reserves and associated ponds will be designed and situated such that a natural and attractive space is provided for walkways and recreational use as much as possible. The ponds shown on the current drawings are indicative only to ensure that enough space is available for the required volume. These will be refined during detailed design. Calculated storage volumes are 33m³ for Kahikatea Drive (Pond 1), 88m³ for Kahikatea Drive (Pond 4), 56m³ for the pond for Road 2 and 61m³ for pond for Road 3.

5.2 Secondary Overland Flow

For storm events greater than the 10-year, 1 hour event, or should the primary system experience blockages, secondary flow paths and emergency spillways are required to safely allow for passage of these flows. These flow paths will be provided within the road corridors and then through the Stormwater Reserves towards the existing flows paths below the site. Discharge points have been selected to align with existing flow paths into the adjacent downstream land. As with previous Stages 1 to 8, the design of the primary disposal system of swales and ponds will be conservative to ensure that actual storage of runoff exceeds the 10-year, 1 hour requirement and that only extreme events will discharge flows off site and only once significant treatment has occurred for initial flows through filtration and settlement within the ponds.

5.3 Overland Flow from Adjacent Property

As stated previously, there are a few existing flow paths entering the balance land site from the three existing properties to the north. Designated overland flow paths or specific Stormwater Reserves will be required to safely pass these flows through the balance land. These overland flow paths are indicated on the concept roading plan included in Appendix 2. Flow paths will consist of specifically designed and sized shallow swales or road corridors where available. Bunding will also be utilised along portions of the boundary to direct flows towards the low points for conveyance through or around the balance land.

Preliminary sizing of a swale for Ex-Catchments D and E has been completed to ensure allowance has been made within the affected lots for the overland flow paths as well as reasonable building area. Upper contributing catchments have been sized and flows calculated on a conservatively large basis and have been based upon 100-year flows from the upper catchments. Catchment sizing is shown in Figure 10 below.

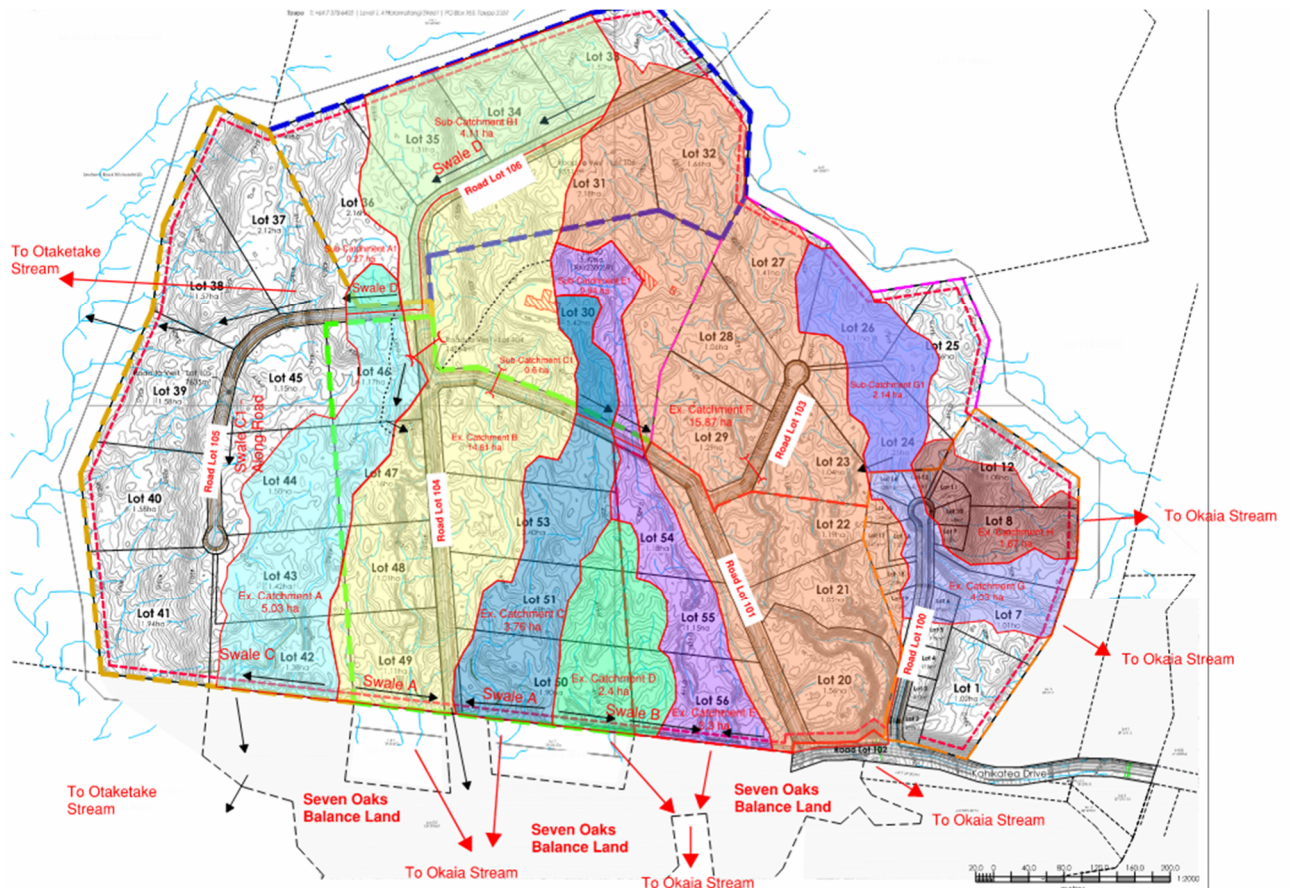


Figure 10 – Contributing Upper Catchment, The Terraces

There are three locations of overland flow from The Terraces (Ex-Catchment A, Ex-Catchments B/C and Ex-Catchments D/E) that need to be collected and passed through the balance land property. All other flows from the Terraces will be diverted within the Terraces and not pass through the balance land. WRC consent has already been granted for Earthworks and Diversions for the Terraces.

Overland runoff flows from Ex-Catchment A of the Terraces will be collected via bunding and a swale along the boundary within the Terraces block and directed toward the existing flow path through the balance land which will remain unaltered. Due to the larger lot sizes, no earthworks are proposed in these lots and the existing flow path can remain in its existing state.

Overland runoff flows from Ex-Catchments B and C of the Terraces will be collected via bunding and swales along the boundary within the Terraces block and directed towards and onto Road 01. These overland flow paths will then pass through the low point in Kahikatea Drive, into the Stormwater Reserve, and out into DoC land as per existing flow paths.

To avoid overland flows from smaller events from continually flowing over the berm and into Road 01, a secondary piping network is proposed within this road to carry these overland flows. This pipe will extend to the boundary of the Terraces as this will also convey minor flows from Ex-Catchment B. For larger events, this pipe capacity will be exceeded and flows will then be conveyed down Road 01 and into the Stormwater Reserve southeast of Kahikatea Drive.

Similarly, Ex-Catchments D and E overland flows will be collected via bunding and swales along the boundary within the Terraces block and directed to the designated Stormwater Reserve. This will

contain a wide swale terminating in an inlet device, such as a manhole with scruffy dome or a wingwall, with a culvert outlet under Kahikatea Drive discharging to the DoC Reserve to the south. The flows from this upper catchment already flow to this same discharge point via natural flow paths. Catchment flows, preliminary swale sizing and culvert calculations are shown in Appendix 5.

For the area within the Balance Land, while earthworks are being proposed across much of the site, the general flow paths and discharge points for stormwater runoff are the same as in the existing condition. However, treatment and attenuation of these flows will be completed prior to discharge to the existing flow paths.

5.4 Stormwater Volumes and Treatment for Specific Catchments

Area included in Stage 2 Pond

The existing Stormwater pond completed in Stage 2 of Seven Oaks has already been designed to allow for a portion of Kahikatea Drive, the extension of Okaia Drive, as well as Road 1 up to the boundary of the adjacent property to the north – a total of 820m of 20m wide road. Consequently, these areas are all proposed to be connected with the existing reticulation in Okaia Drive and Kahikatea Drive. All contributing roads in the balance land will utilise swales for added treatment.

Please refer to Appendix 6 for the catchment allowance for Stage 2 pond.

Kahikatea Drive – between Lots 72 and 73

This section of Kahikatea Drive is proposed to be collected via swales, inlet structures and reticulation and discharge into Pond 1/1a in the Stormwater Reserve. A total combined storage volume of 33m³ is required to attenuate the 10-year, 1 hour storm event for this catchment. Pre-treatment will be accommodated by both the swales and the first stage pond before discharge to the primary pond.

Kahikatea Drive – between Lots 71 and 14

This section of Kahikatea Drive is proposed to be collected via swales, inlet structures and reticulation and discharge into Pond 4 in the Stormwater Reserve to the north of Kahikatea. A total combined storage volume of 88m³ is required to attenuate the 10-year, 1 hour storm event for this catchment. Pre-treatment will be accommodated by swales before discharge to the pond.

Road 2

Runoff from this cul-de-sac is proposed to be collected via a swale on one side and kerb and channel on the other side with catchpits discharging through pipes into the swale. These flows will be discharged into Pond 2 in the Stormwater Reserve. A total storage volume of 56m³ is required to attenuate the 10-year, 1 hour storm event for this catchment. Pre-treatment will be accomplished via the proposed swale along Road 2 before discharge to the primary pond.

Road 3

Runoff from this cul-de-sac is proposed to be collected via single cross fall roadway draining to a swale with a catchpit at the end of the cul-de-sac. These flows will be discharged into Pond 3 in the centre of the turn-around area, similar to that done for previous stages of Seven Oaks. A total storage volume of 61m³ is required to attenuate the 10-year, 1 hour storm event for this catchment. Pre-treatment will be accomplished via the proposed swale along Road 3 before discharge to the primary pond.

5.5 Permitted Activity Compliance

All proposed Stormwater treatment/disposal will meet requirements of the WRC Permitted Activity rule 3.5.11.5 of the Regional Plan. Specifically, the rule requires compliance with the following:

- a) *The discharge shall not originate from a catchment that includes any high-risk facility or contaminated land unless there is an interceptor system in place.*
All runoff discharge originates from public roads or private residential lots and not from any high-risk facility.
- b) *The discharge shall be below a rate that would cause flooding outside the design discharge soakage area, except in rain events equivalent to the 10% Annual Exceedance Probability design storm or greater. Any exceedance shall go into designated overland flow paths.*
The proposed Stormwater treatment design captures and stores all runoff for storm events up to (and exceeding) the 10% AEP event. These flows are discharged to ground. Overland flow from larger events will be directed to existing overland flow paths.
- c) *There shall not be any overland flow resulting in a discharge to surface water, except in rain events equivalent to the 10% Annual Exceedance Probability design storm or greater; then there shall be no adverse surface water effects as a result of the discharge.*
The proposed Stormwater treatment and disposal design captures and stores all runoff for storm events up to (and exceeding) the 10% AEP event. These flows are all discharged to ground. In any case, overland flows are all directed to existing designated flow paths and not to any surface water.
- d) *Any erosion occurring as a result of the discharge shall be remedied as soon as practicable.*
Although measures will be implemented to ensure that no erosion occurs, the eventual Construction Management Plan will require this condition to be met.
- e) *The discharge shall not contain concentrations of hazardous substances that may cause significant adverse effects on aquatic life or the suitability of the water for human consumption after treatment.*
Given the nature of the development being residential, no significant hazardous substances are anticipated. Additionally, the Stormwater runoff will be treated first through swales and then through settlement ponds which are primarily discharged to ground which utilises filtration through the soil.

Therefore, Stormwater discharge to ground from the proposed subdivision will be fully compliant with the Permitted Activity Rules in the WRC Regional Plan.

6. WASTEWATER

Wastewater disposal for the balance land area can be primarily accomplished via gravity drainage. However, it is envisaged that 16 lots will require private pump stations, feeding into common rising mains as required and discharging into the gravity reticulation. The private pump stations will be provided by Seven Oaks when the future owners build on the section. The eventual owners then install, operate, and maintain the pump stations. This approach has been utilised through previous stages as well.

6.1 Wastewater Reticulation

Whether gravity or pumped, all wastewater flows from the balance land would discharge to the 150mm diameter gravity sewer main in Okaia Drive which eventuates at the Lisland Drive pump station. Including the existing properties in Okaia Drive, all Stages of Seven Oaks and the proposed balance land, the total proposed catchment for this sewer main is 260 lots.

Per Taupō District Council Code of Practice:

- Average dry weather flow per person 250 litres/day/person
- Diurnal peaking factor 2.3
- Wet Weather peaking factor 3.5
- People per dwelling 2.7

The resulting peak developed flow rate is therefore 16.41 litres/second. The existing 150mm gravity main is still sufficient to accommodate this peak flow rate.

6.2 Lisland Drive Pump Station Storage Upgrade

To accommodate the additional flows from the balance land, additional storage will need to be provided at the Lisland Drive pump station. The current pump station uses a 35m long, 1350mm diameter concrete pipe as a storage tank. There is currently one tank in place, but there is space on the site for an additional tank to be installed. As per the storage tank calculations in Appendix 3, there are 7 balance land lots already accounted for in the District Plan, 83 proposed balance land lots, 1 Private existing house, and 16 balance land lots that will have their own pump stations with required storage. Consequently, total additional storage is required for 61 lots (83+1-7-16). To accommodate these additional lots, an additional 12-hour storage volume of 20.6m³ is required. Another tank will need to be installed consisting of approximately 6 sections 2.44m length each of 1350mm diameter concrete pipe. Please refer to Appendix 3 which provides calculations for this additional proposed storage and existing pump station plans.

It is expected that existing pumps will be suitable but will run more frequently due to the additional proposed flows. However, if pump upgrades are necessary, this will be determined as part of the detailed design and upgrades implemented in the appropriate stage of the balance land development.

6.3 Kinloch Treatment Scheme Capacity

With regards to the overall capacity of the Kinloch wastewater treatment scheme, the information provided by Council indicates that there is sufficient capacity for wastewater for the proposed lots.

- The treatment plant has a capacity of 1810 lots.
- There are 1498 lots already connected to the system.
- There are 149 lots with consent to connect to the system.
- There are 107 lots with potential to connect (Seven Oaks balance land (83)+ permitted infill (24)).
- This results in 1754 existing and potential lots connecting to the scheme.
- Therefore, there is still capacity for an additional 56 lots.

Attached in Appendix 4 is the spreadsheet provided by TDC which outlines how many lots have been accounted for in terms of wastewater infrastructure.

The 149 lots with consent to connect to the system are the Poplars, Kinloch Golf, Oakdale Drive, and Seven Oaks Stage 8.

The 107 lots with potential to connect are Seven Oaks balance land (83 lots) and permitted infill (24 lots).

The 2021 planned growth for infill lots in Kinloch allowed capacity for an additional 96 lots. Upon review of the existing Kinloch village residential zone, Cheal could only identify two standard residential properties greater than 2000m² which could theoretically be subdivided into a total of 9 lots – 7 additional lots. There are also 3 areas zoned as high density which could also theoretically be subdivided. Using a minimum size of 420m² (similar to other high density lots in the area), an additional 17 infill lots could be generated in this high-density area. Based upon lot size only, this could potentially yield a total of 24 infill lots.

Therefore, the infrastructure plan can accommodate the additional wastewater flows from the proposed balance land lots along with infill of current lots within Kinloch.

Refer to Appendix 1 for Conceptual Services Plan and Figure 11 below for the infill lot assessment.

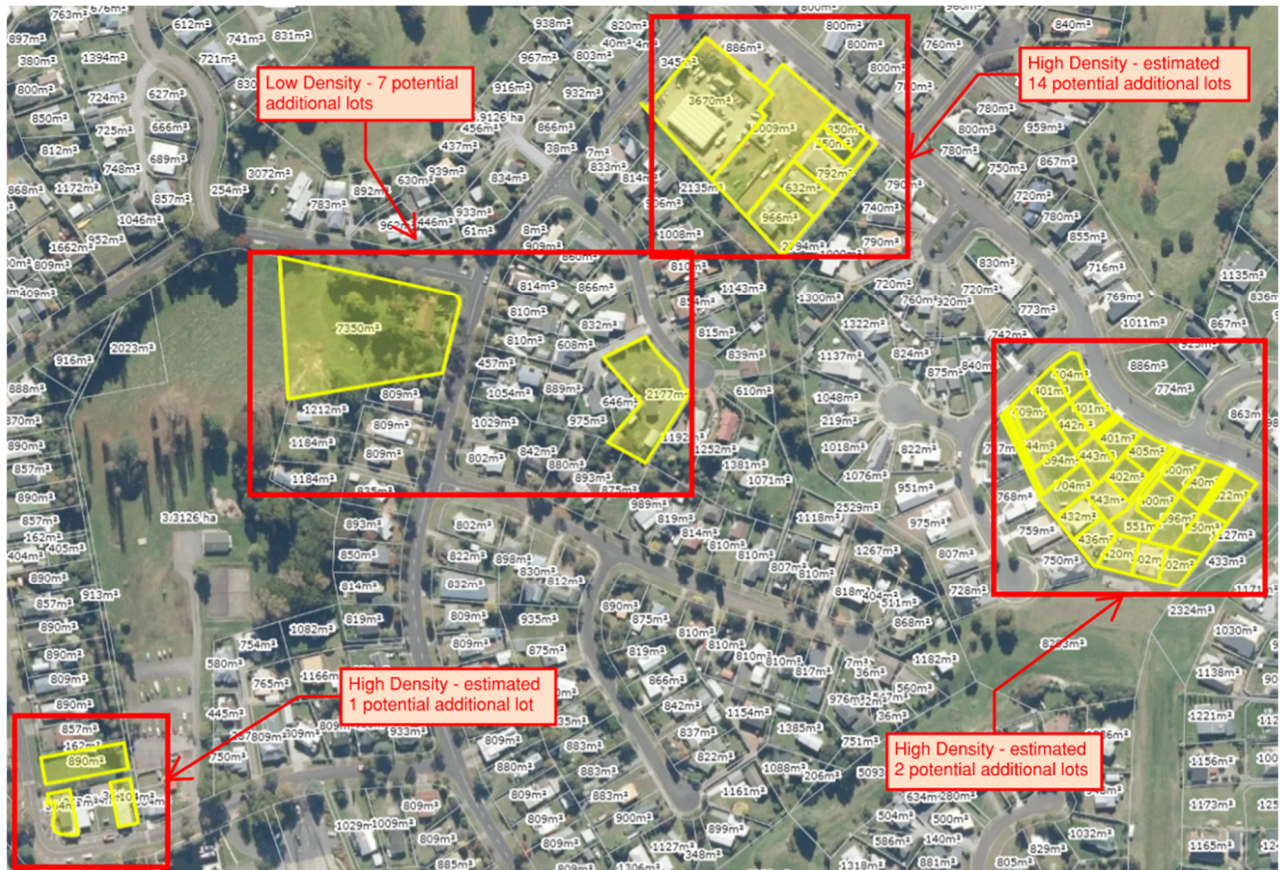


Figure 11 – Potential Infill Lots for existing properties

6.4 Sewer Pressure Individual Pump Station

Due to the site topography, some lots are sited below the gravity reticulation and have been identified (Lots 1 – 13, 63 – 65) and marked on the Conceptual Services Layout Plans 220225-SK401 and SK402. Similar to Sherwood Way and Oakleaf Lane, these 16 lots will need individual pump stations as a solution to provide sewer connection to these lots. We are proposing installing individual pump stations E-one as used through Seven Oaks. They have a storage capacity for 24hours and will require a rising main which then will be connected to the gravity line. For those lots where the public sewer line is not at the road frontage, a private satellite manhole will be constructed to provide individual sewer connections from these sites. The number of lots connected to a private manhole will be limited. A specific design for rising main pipe size and private manhole layout will be provided.

7. ROADING

The main access roads construction will be an extension of Okaia Drive and Kahikatea Drive, via the existing roundabout infrastructure, provided during construction of previously completed Seven Oaks subdivisions. Roads would generally comply with the TDC Code of Practice for Development Land. The narrower cul-de-sacs and private roads will be consistent with design and construction of the Seven Oaks subdivision, following TDC Code of Practice. A detailed Integrated Transportation Assessment (ITA) was prepared by CKL to analyse traffic and transportation effects of the proposed development. This forms part of the Resource Consent Application.

Engineering detailed design would be required for each stage to demonstrate there are no conflicts or if departures are proposed from the Code of Practice on the proposed infrastructures.

Low impact Stormwater features would be incorporated to the streetscape such as vegetated swales and landscaped Stormwater ponds to attenuate the flow of the development. This has successfully been used in the previous stages of the Seven Oaks Subdivision.

A trust relationship exists between DoC and Seven Oaks through ongoing commitments of maintaining a high standard in respect to the maintenance and preservation of all natural reserve areas during construction works. A 1.5m pool fence along DoC common boundary with private lot sections was constructed to clearly delineate DoC Reserve. This has enabled access via environmentally friendly modes to areas of conservation land and bike tracks (under approval of DoC). Community expertise was utilised by engaging Bike Taupō to form track access within DoC areas. Though no new access into the DoC Land will happen for this development, similarly a 1.5m pool fence will be provided on the proposed future development by committing to ensure these areas are protected and enjoyed by all.

Refer to Cheal Drawings 220225-SK301 and SK302 Conceptual Roding Layout.

7.1 Public Roads

7.1.1 Okaia Drive and Road 1

The Okaia Drive and Kahikatea Drive intersection was completed as part of the Seven Oaks Subdivision Stage 2. Okaia Drive will match existing formations with a road reserve of 20m, berms of 5.7m and 5.8m wide, an 8.5m wide carriageway crowned with a 3% crossfall to upright kerb and channel on one side, but with the addition of a vegetated swale on the other side. A shared 1.8m bike and pedestrian way will be constructed on one berm, with a swale on the other.

Similar to Okaia Drive, New Road 1 is proposed as a local street, with a road reserve of 20m, berms of 5.7m and 5.8m wide, an 8.5m wide carriageway crowned with a 3% crossfall to upright kerb and channel on one side, but with the addition of a vegetated swale on the other side. A shared 1.8m bike and footpath will be constructed on one berm, with a swale on the other. The shared footpath will extend to the northern boundary with the Terraces where it is anticipated there will only be a single footpath through the low density lots. All public roads alignment meets the requirements of the District Plan Structure Plan, while enabling access and future proof development opportunities to the land above the site.

opposite 4.5m wide berm. Figure 15 below shows proposed section, similar to Silverleaf Way approved with Stage 2 of Seven Oaks.

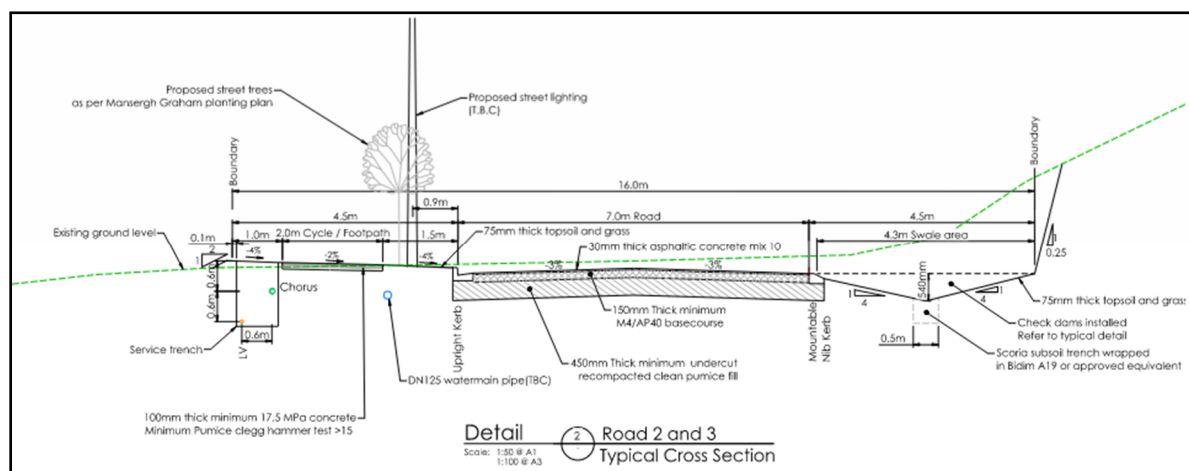


Figure 15 - Preliminary Cul-de-Sac Typical Cross Section

7.1.5 Private Rights-of-ways

Private rights-of-ways will be formed to match the widths vs number of lots serviced or longer. Pavement will compromise of a single crossfall with a proud nib on the uphill side and mountable kerb and channel on the downhill side to collect runoff from the pavement. In accordance with the Stormwater design code, primary protection from a 10% AEP design storm will be attenuated on-site through deep concrete lines soakholes.

7.1.6 Footpath and Cycleways

Corresponding to the network of cycleways and footpaths created within the Seven Oaks subdivision, a network will extend throughout the proposed Balance Land development, providing safe and efficient connectivity without impacting vehicular traffic. The overall layout of the proposed footpath and cycleway network throughout the development and Stormwater Reserves is shown on Conceptual Roading Layout Plans 220225-SK301 and SK302 attached in Appendix 2.

7.1.7 Roading Lighting

Road lighting through public roads will be continued in accordance with the style implemented in previous stages of Seven Oaks subdivision, to Council and best practice lighting design requirements.

8. WATER SUPPLY SERVICING

8.1 Water Supply Reticulation

Water modelling completed by WSP (Consultant for Taupō District Council) for the previous stages of Seven Oaks considered various options for the servicing of Stages 1 to 9, as well as the balance land area. The selected preferred option was to split the areas into a low-pressure zone (Stages 1 to 7) and a high-pressure zone (Stages 8 and 9 and the balance land). This option resulted in 100mm diameter water mains through the balance land.

However, at the time of WSP modelling completed for the balance land, 30 lots were assumed for the balance land. Given there are now proposed to be 83 lots (but only 74 additional lots as 9 lots were already consented as part of Stage 9), this modelling needed to be updated to determine pipe sizing for the proposed development as well as understand any effects on the existing infrastructure. The now completed modelling, included in Appendix 7, indicates that the proposed lots can be serviced by existing Council infrastructure. At the time of the modelling, the proposal for the balance land was for 100 lots. Consequently, the modelling completed is slightly conservative given the reduction in lots now proposed.

Based upon the Council's modelling, a 225mm diameter high pressure main is required along the length of Kahikatea Drive and a 180mm diameter high pressure main is required up proposed Road 1 which provides access to the property to the north of the balance land. Lower pressure 100mm mains and 50mm rider mains will be utilised for the servicing of the individual lots. Cul-de-sacs will require 100mm mains to extend to the ends of the cul-de-sacs to allow for fire hydrants except for Okaia Drive extension which requires a 125mm main.

8.2 Kinloch Water Supply Capacity

With regards to the overall capacity of the Kinloch water supply, TDC has planned for 1,918 lots. This includes 175 lots in Seven Oaks. Stages 1 to 8 account for 147 lots, with 83 lots proposed for the balance land this results in 230 lots, or 55 additional lots for Seven Oaks than originally planned.

As described in the wastewater section 6., the planned growth for infill allows capacity for an additional 96 lots, however in reality there are only 24 potential Kinloch infill lots. Therefore the 55 additional lots for Seven Oaks plus the 24 infill lots, is within the 96 lots allowed for planned growth in the community.

In summary, the proposed number of additional lots as well as potential in-fill lots in the community is less than the number of lots already considered by TDC for water supply infrastructure. Therefore, the infrastructure plan can accommodate the additional water supply requirements for the proposed balance land lots.

9. POWER AND TELECOM SERVICING

Preliminary communication with Chorus and Unison for power and telecommunications servicing has been completed. Both services providers have indicated that servicing for the proposed balance land lots can be accommodated with detailed design to be completed as required once the layout and civil designs have been confirmed.

10. DISCLAIMER

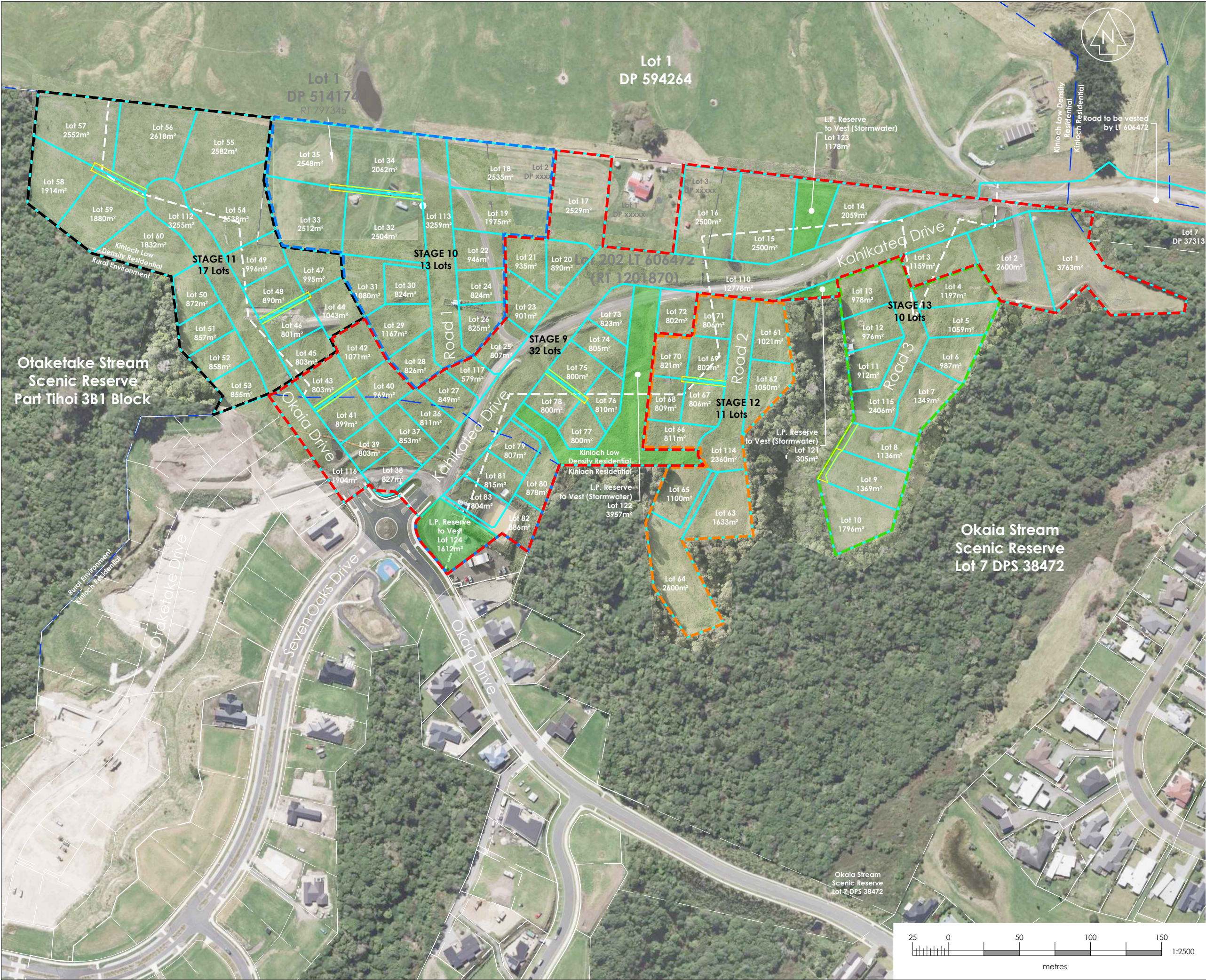
This Report has been prepared solely for the use of our client with respect to the particular brief given to Cheal Consultants Limited.

No liability is accepted in respect of its use for any other purpose or by any other person or entity. All future owners of this property should seek professional geotechnical advice to satisfy themselves as to its ongoing suitability for their intended use.

CHEAL CONSULTANTS LIMITED
3 June 2025

Appendix 1

Cheal Scheme Plans
220225-SC001 and
220225-SC003



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NOTES:

This plan has been prepared for the purpose of a resource consent application only. It is not a precise survey plan.
As areas and dimensions are likely to vary upon survey it should not be attached to any sale & purchase agreements without an appropriate condition to cover such variations.

Aerial Imagery has been obtained from: Taupo District Council GIS and is provided under a Creative Commons Public License and with a DJI Matrice M300 and a Zenmuse P1 Camera. It has been provided as a guide to where the boundaries are positioned, or proposed on the ground, but may not be absolute.

Owners: Seven Oaks Kinloch Limited, Public Trust, James Brendan Sheridan, Lucy Caroline Sheridan & Mark Keith Jacka Comber
Record of Title: 1109169, 797345 & 797346

Asbuilt utilities may have other services in close proximity which are not shown for the purposes of this plan. Please identify existing utility locations and depths with Taupo District Council GIS before any field investigation or construction.

Underground services shown are indicative only. It is the contractors responsibility to identify existing utility locations and depths prior to construction.

Legend:

- Reserve to Vest
- District Plan Zone Boundary
- Easement
- 50m setback from DOC Reserve

O	29/05/25	Scheme Plan Revised	MM	SH	TWB
N	30/04/25	Scheme Plan Revised	RR	SH	TWB
M	28/01/25	Scheme Plan Revised	RR	SH	TWB
L	21/01/25	Lot 125 & 14 Area, Lot 85 & 86	RR	SH	TWB
K	11/11/24	Scheme Plan Amended	RR	SH	TWB
Rev	Date	Amendment	By	Chk	App

Project Title
Seven Oaks Kinloch Ltd.
Okaia Drive
Kinloch

Drawing Title
Proposed Subdivision of
Lot 504 DP 595759 &
Lots 1 & 2 DP 514174

Surveyed			
Designed			
Drawn	K.Larsen	26/07/22	KL
Checked	O.Bucher	08/08/22	OB
Approved	O.Bucher	08/08/22	OB

Status	INFORMATION		
Scale A1	-	A3	
A3	1:2500		
Drawing Number	220225-SC001	Rev	O



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Owner: Mark Keith Jacka Comber
Record of Title: 797346

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Amalgamation Condition

That Lots 2 & 3 hereon be transferred to the owner of Lot 504 DP 595759 (RT 1154198) and that one Record of Title be issued to include both parcels.

See.....
Section 220 (1)(b)(i) RMA 1991

Legend:
--- Stage 16 Boundary
--- Lot Boundary

A	19/06/24	Information	SV	SH	MR
Rev	Date	Amendment	By	Chk	App

Project Title
Seven Oaks Kinloch Ltd.
Okaia Drive
Kinloch

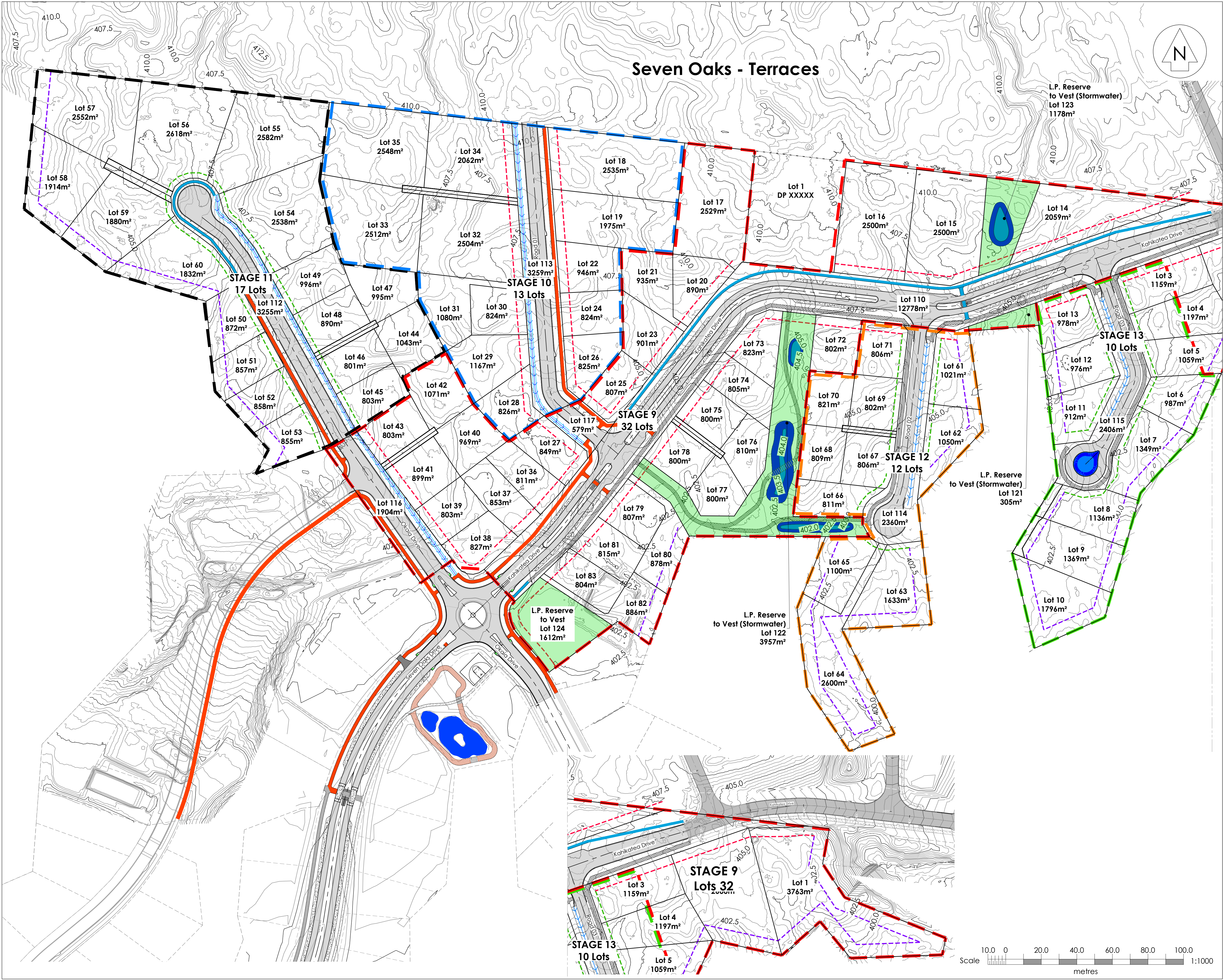
Drawing Title
Stage 16
Subdivision of Lot 2 DP 514174

Surveyed			
Designed			
Drawn	S.Veerla	19/06/24	SV
Checked	S.Hunt	19/06/24	SH
Approved	M.Ryder	19/06/24	MR

Status	INFORMATION		
Scale A1	-	A3	
A3	1:1000		
Drawing Number	220225-SC003		Rev
		A	

Appendix 2

Cheal Concept Drawings for
Earthworks, Roading and
Services



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NOTES:

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Owner: Seven Oaks Kinloch Ltd

Record of Title: 1109169
Total Area: 18.255 ha

Reticulated services will require additional easements after final construction and development of the legal survey.

Rights of way to rear Lots are a minimum 4m wide.

Pool Fence along DOC Land Boundary.

- LEGEND:
- Reserve to Vest (Recreation & Stormwater)
 - Design Contours Major
 - Design Contours Minor
 - Easement
 - Existing Culvert
 - Footpath 1.4m
 - Cycleway 1.8m
 - Combined Footpath & Cycleway 2.0m
 - 3m Setback
 - 5m Setback
 - 7.5m Setback
 - Stage 9 Boundary
 - Stage 10 Boundary
 - Stage 11 Boundary
 - Stage 12 Boundary
 - Stage 13 Boundary



E	14/05/25	For Resource Consent	MM	SH	TWB
D	31/01/25	For Resource Consent	RR	SH	TWB
C	07/11/24	For Resource Consent	RR	SC	TWB
B	16/05/23	For Resource Consent	JZL	SP	TWB
A	21/12/22	For Resource Consent	PH	LU	TWB
Rev	Date	Amendment	By	Chk	App

Project Title

Seven Oaks Kinloch Limited
Okiaia Drive
Kinloch

Drawing Title

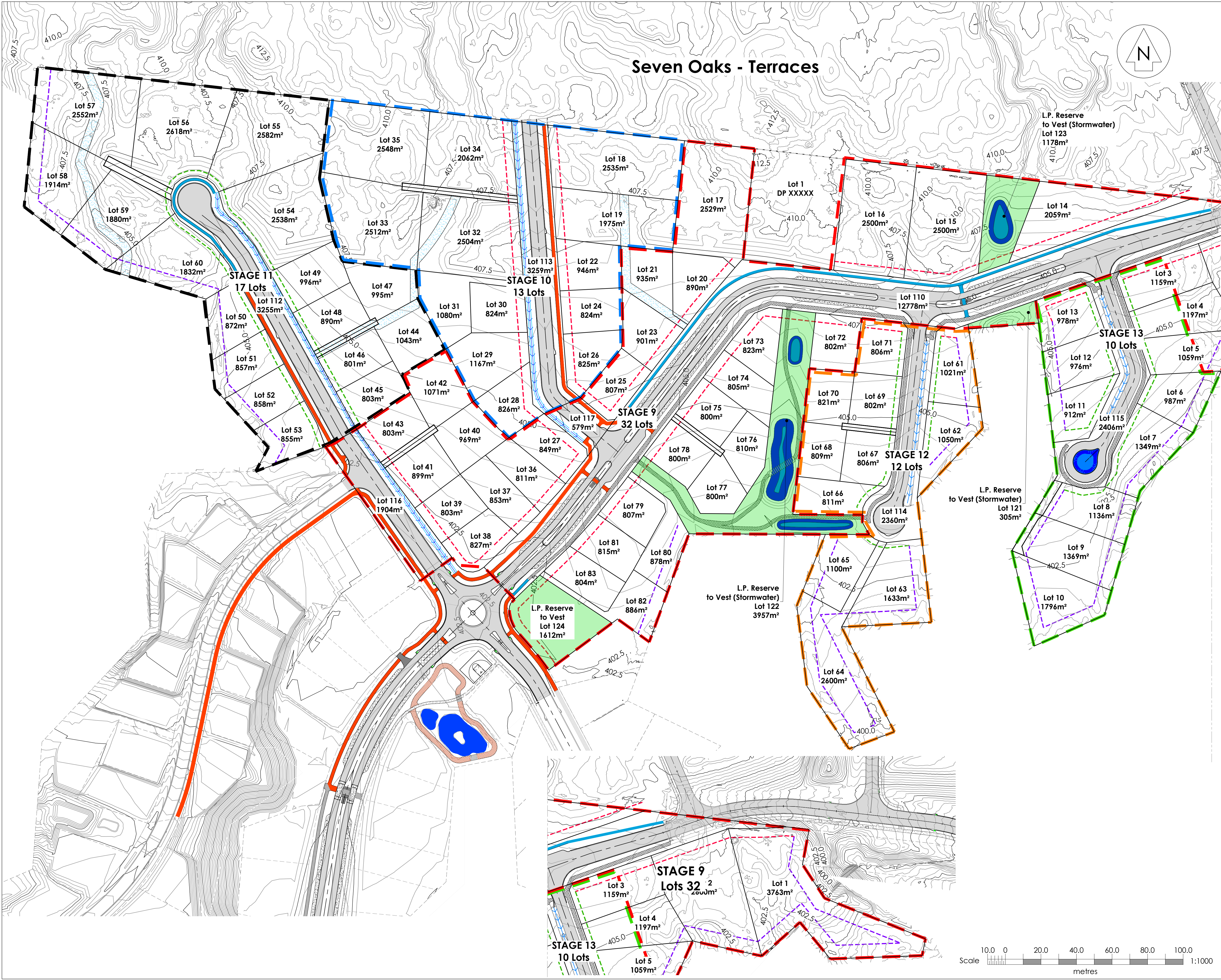
Balance Land
Earthworks
Existing Contour Plan

Surveyed	G.Ripoll	10/22	GR
Designed	S.Pen	12/22	SP
Drawn	P.Harris	21/12/22	PH
Checked	L.Urieete	21/12/22	LU
Approved	T.Brand	21/12/22	TWB

Status **RESOURCE CONSENT**

Scale A1 1:1000 | A1
A3 1:2000

Drawing Number 220225-SK201 | Rev E



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Record of Title: 1109169
Total Area: 18.255 ha

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Pool Fence along DOC Land Boundary.

- Legend:
- Reserve to Vest (Recreation & Stormwater)
 - Stormwater Overland Flow Path
 - Design Contours Major
 - Design Contours Minor
 - Easement
 - Existing Culvert
 - Footpath 1.4m
 - Cycleway 1.8m
 - Combined Footpath & Cycleway 2.0m
 - 3m Setback
 - 5m Setback
 - 7.5m Setback
 - Stage 9 Boundary
 - Stage 10 Boundary
 - Stage 11 Boundary
 - Stage 12 Boundary
 - Stage 13 Boundary

SEVEN OAKS

E	14/05/25	For Resource Consent	MM	SH	TWB
D	31/01/25	For Resource Consent	RR	SH	TWB
C	07/11/24	For Resource Consent	RR	SC	TWB
B	16/05/23	For Resource Consent	JZL	LU	TWB
A	21/12/22	For Resource Consent	PH	LU	TWB
Rev	Date	Amendment	By	Chk	App

Project Title
Seven Oaks Kinloch Limited
Okiaia Drive
Kinloch

Drawing Title
Balance Land
Earthworks
Proposed Contour Plan

Surveyed	G.Ripoll	10/22	GR
Designed	S.Pen	12/22	SP
Drawn	P.Harris	21/12/22	PH
Checked	L.Urieete	21/12/22	LU
Approved	T.Brand	21/12/22	TWB

Status **RESOURCE CONSENT**

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Drawing Number
220225-SK202 | E

NOTES:

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Owner: Seven Oaks Kinloch Limited
Record of Title: 1109169

Legend:

- 3m Setback
- 5m Setback
- 7.5m Setback

SEVEN OAKS

E	14/05/25	For Resource Consent	MM	SH	TWB
D	31/01/25	For Resource Consent	RR	SH	TWB
C	12/11/24	For Resource Consent	SC	SH	TWB
B	16/05/23	Information	JZL	LU	TWB
A	21/12/22	For Resource Consent	PH	LU	TWB
Rev	Date	Amendment	By	CHK	App

Project Title
Seven Oaks Kinloch Limited
Okiaia Drive
Kinloch

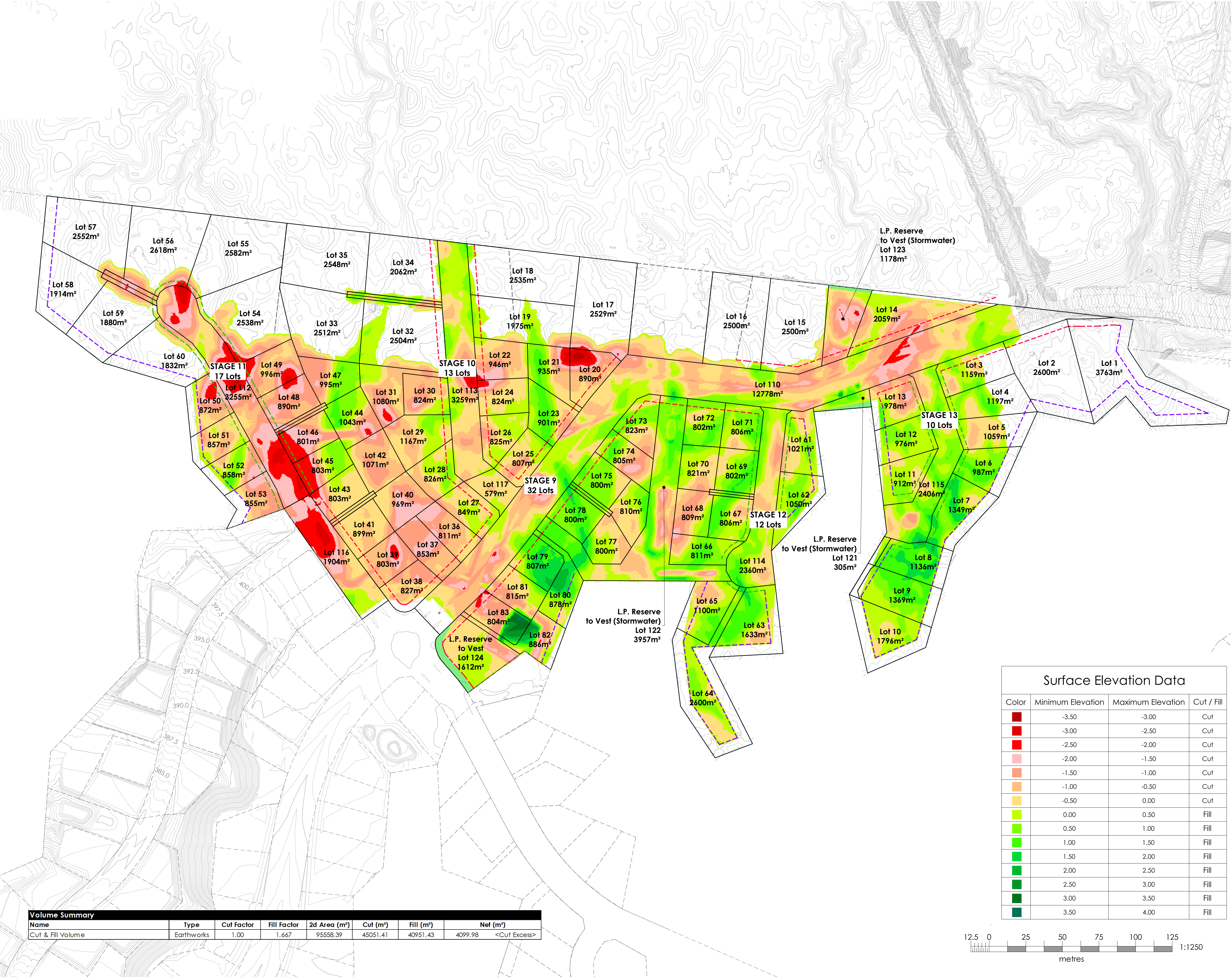
Drawing Title
Balance Land
Earthworks
Cut & Fill Plan

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Designed	S.Pen	11/22	SP
Drawn	P.Harris	21/12/22	PH
Checked	L.Uriaete	21/12/22	LU
Approved	T.Brand	21/12/22	TWB

Status **RESOURCE CONSENT**

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Drawing Number 220225-SK203
Rev E

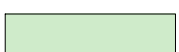
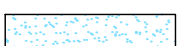




NOTES:

Pool Fence along DOC Land Boundary.

Legend:

-
- | | |
|---|--|
|  | Reserve to Vest
(Recreation & Stormwater) |
|  | Stormwater Overland Flow Path |
|  | Easement
ROW |
|  | Footpath 1.4m |
|  | Cycleway 1.8m |
|  | Combined Footpath & Cycleway 2.0m |
|  | Proposed Road |
|  | 3m Setback |
|  | 5m Setback |
|  | 7.5m Setback |
|  | Stage 9 Boundary |
|  | Stage 10 Boundary |
|  | Stage 11 Boundary |
|  | Stage 12 Boundary |
|  | Stage 13 Boundary |

SEVEN  OAKS

E	14/05/25	For Resource Consent	MM	SH	TWB
D	31/01/25	For Resource Consent	RR	SH	TWB
C	07/11/24	For Resource Consent	JR	SC	TWB
B	16/05/23	For Resource Consent	PH	LU	TWB
A	21/12/22	For Resource Consent	PH	LU	TWB
Rev	Date	Amendment	By	Chk	App

Project Title

Seven Oaks Kinloch Limited
Okaia Drive
Kinloch

Drawing Title

Balance Land Roading
Conceptual Layout Plan
Sheet 1 of 2

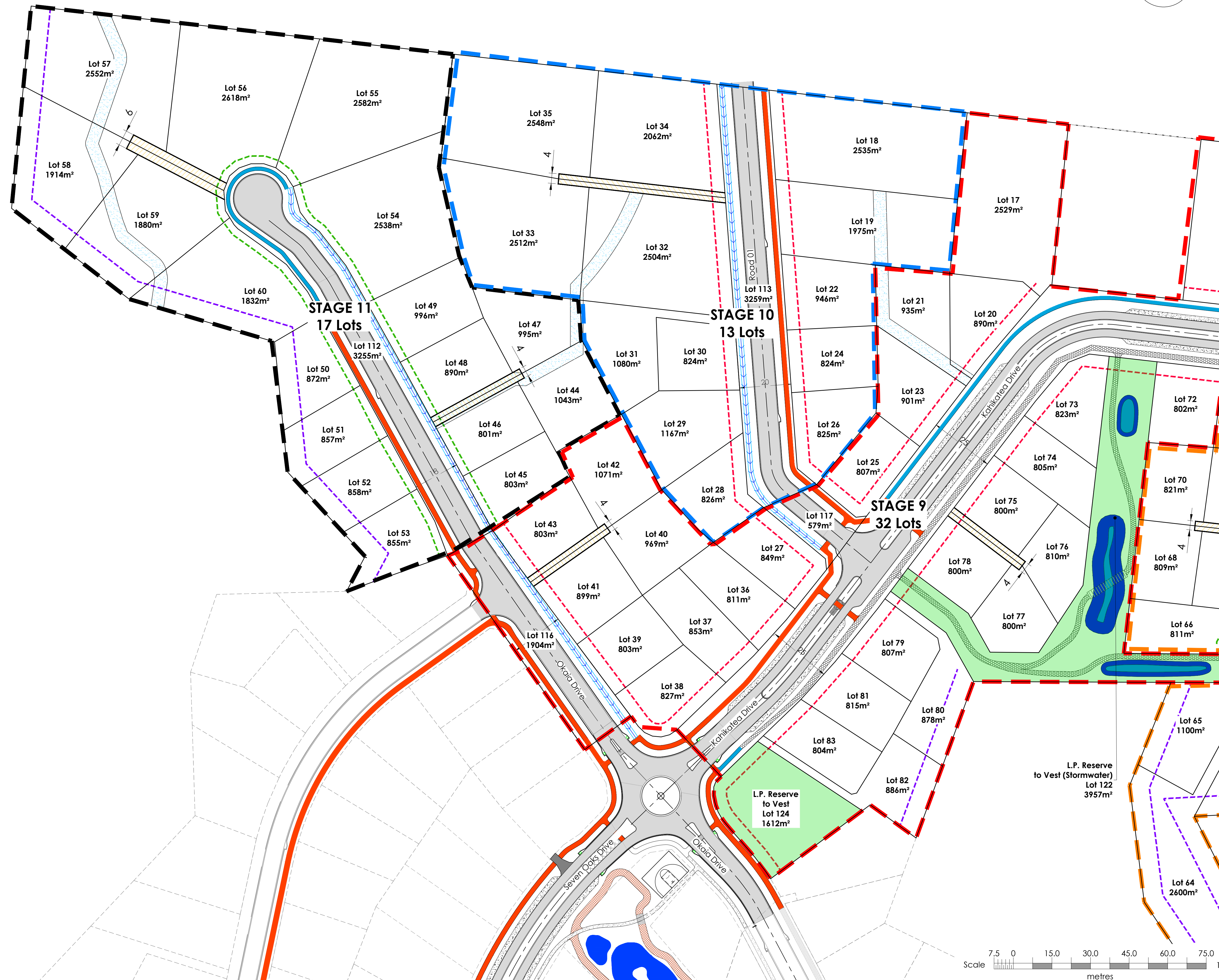
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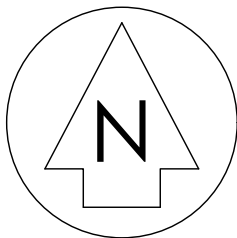
Status **RESOURCE CONSENT**

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Drawing Number	Rev
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220225-SK301	E
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- ROW
- Existing Culvert
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- Stage 13 Boundary



E	14/05/25	For Resource Consent	MM	SH	TWB
D	31/01/25	For Resource Consent	RR	SH	TWB
C	07/11/24	For Resource Consent	RR	SC	TWB
B	16/05/23	For Resource Consent	JZL	LU	TWB
A	21/12/22	For Resource Consent	PH	LU	TWB
Rev	Date	Amendment	By	Chk	App

Project Title
Seven Oaks Kinloch Limited
Okaiia Drive
Kinloch

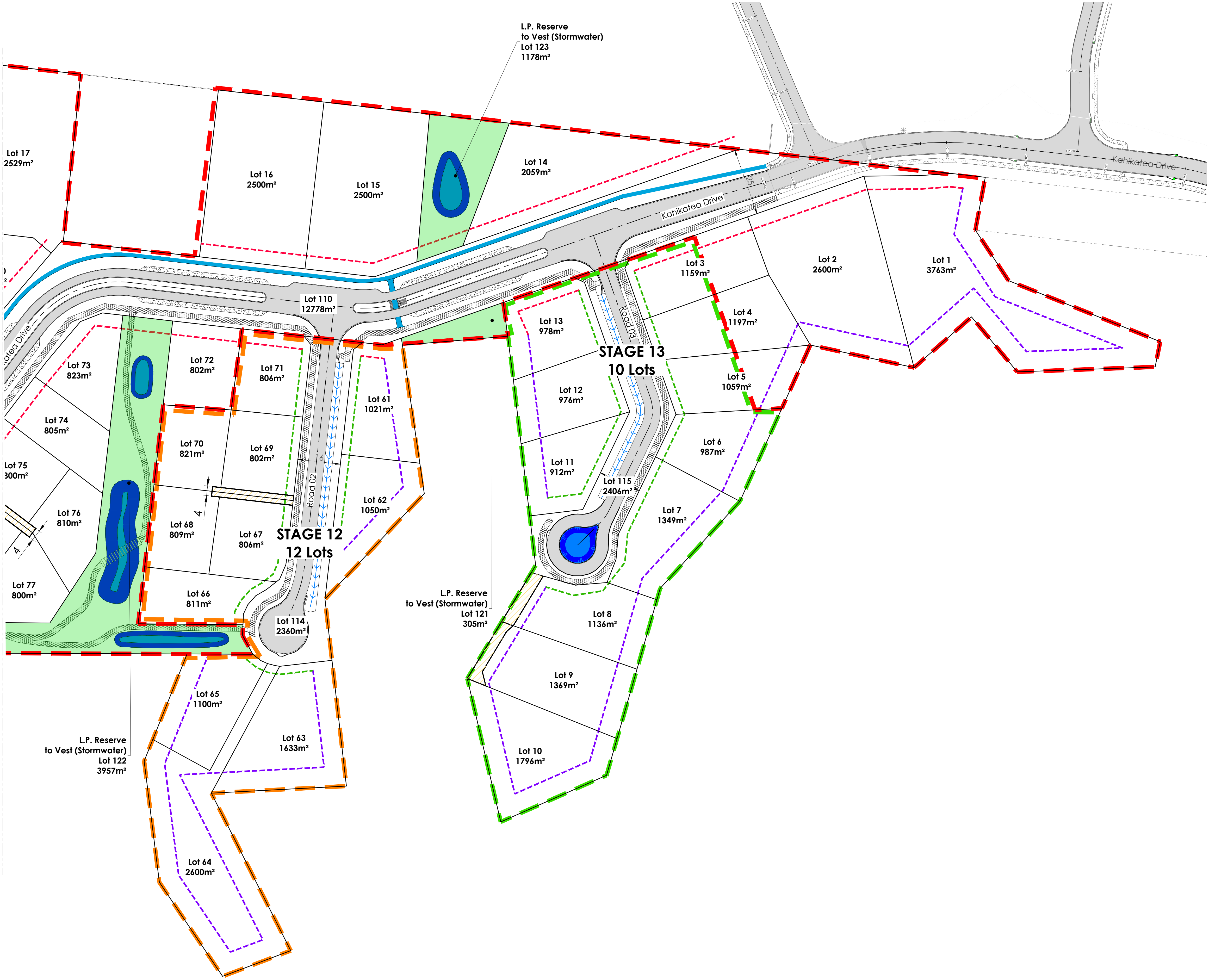
Drawing Title
Balance Land Roding
Conceptual Layout Plan
Sheet 2 of 2

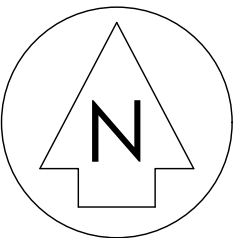
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Designed	S.Pen	12/22	SP
Drawn	P.Harris	21/12/22	PH
Checked	L.Uriarte	21/12/22	LU
Approved	T.Brand	21/12/22	TWB

Status **RESOURCE CONSENT**

Scale	A1	1:750	A1
	A3	1:1500	

Drawing Number
220225-SK302
Rev
E





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NOTES:

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Owner: Seven Oaks Kinloch Ltd

Record of Title: 1109169
Total Area: 18.255 ha

Reticulated services will require additional easements after final construction and development of the legal survey.

Rights of way to rear Lots are a minimum 4m wide.

Pool Fence along DOC Land Boundary.

Legend:

- SW Stormwater Line Proposed
- SWMH Proposed
- Cesspit Proposed
- SWSH Proposed
- SW Soakage Pit
- SS Sewer Line Proposed
- SS Sewer Rising Main Proposed
- SW Swale Proposed
- SSMH Proposed
- SSMH Existing
- Reserve to Vest (Recreation & Stormwater)
- Stormwater Overland Flow Path
- Easement
- ROW
- Stage 9 Boundary
- Stage 10 Boundary
- Stage 11 Boundary
- Stage 12 Boundary
- Stage 13 Boundary

SEVEN OAKS

E	14/05/25	For Resource Consent	MM	SH	TWB
D	31/01/25	For Resource Consent	RR	SH	TWB
C	07/11/24	For Resource Consent	SC	SH	TWB
B	16/05/23	For Resource Consent	JZL	LU	TWB
A	21/12/22	For Resource Consent	PH	LU	TWB
Rev	Date	Amendment	By	Chk	App

Project Title
Seven Oaks Kinloch Limited
Okia Drive
Kinloch

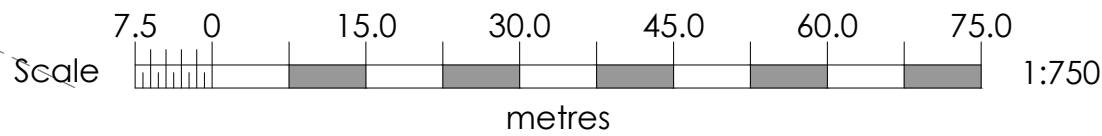
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Checked	L.Uriarte	21/12/22	LU
Approved	T.Brand	21/12/22	TWB

Status **RESOURCE CONSENT**

Scale A1 1:750
A3 1:1500 | A1

Drawing Number 220225-SK401
Rev E



This plan has been prepared for the purpose of a resource consent application only. It is not a precise survey plan. As areas and dimensions are likely to vary upon survey it should not be attached to any sale & purchase agreements without an appropriate condition to cover such variations.

Owner: Seven Oaks Kinloch Ltd

Record of Title: 1109169
Total Area: 18.255 ha

Reticulated services will require additional easements after final construction and development of the legal survey.

Rights of way to rear Lots are a minimum 4m wide.

Pool Fence along DOC Land Boundary.

All Lots marked with an asterisk (eg Lot 9 *) require individual sewer pumps

Legend:

- SW Stormwater Line Proposed
- SWMH Proposed
- Cesspit Proposed
- SWSH Proposed
- SW Soakage Pit
- Culvert Proposed
- (E-one) Individual SS Pump Station
- SS Sewer Line Proposed
- SS Sewer Rising Main Proposed
- SS SW Swale Proposed
- SSM Proposed
- SSM Existing
- Reserve to Vest (Recreation & Stormwater)
- Easement
- ROW
- Stage 9 Boundary
- Stage 10 Boundary
- Stage 11 Boundary
- Stage 12 Boundary
- Stage 13 Boundary

SEVEN OAKS

E	14/05/25	For Resource Consent	MM	SH	TWB
D	31/01/25	For Resource Consent	RR	SH	TWB
C	07/11/24	For Resource Consent	SC	SH	TWB
B	16/05/23	For Resource Consent	JZL	LU	TWB
A	21/12/22	For Resource Consent	PH	LU	TWB
Rev	Date	Amendment	By	Chk	App

Project Title
Seven Oaks Kinloch Limited
Okia Drive
Kinloch

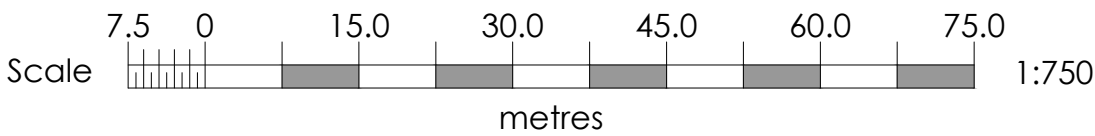
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Balance Land Services
Conceptual Layout Plan
Sheet 2 of 2

Surveyed	G.Ripoll	10/22	GR
Designed	S.Pen	12/22	SP
Drawn	P.Harris	21/12/22	PH
Checked	L.Uriaete	21/12/22	LU
Approved	T.Brand	21/12/22	TWB

Status **RESOURCE CONSENT**

Scale	A1 1:750	A1
	A3 1:1500	

Drawing Number
220225-SK402
Rev
E



Appendix 3

Lisland Pump Station Storage
Upgrade Calculations,
Proposed Sketch Layout and
Background

Design Brief

- Lisland existing Wastewater Treatment Plant assessment to incorporate Balance Land lots at Kinloch for allowance for new 84 lots.
- Gravity connection

Inland Existing House: 1 Lot future sewer allowance

Balance Land: 83 New lots. 16 lots will be serviced via individual pump stations.

Totalling=83+1-16-7 permitted for balance land =**61** Lots for storage capacity required.

- TDC requirements for storage capacity based on 12 hour emergency storage
- HEU and rates as per NZS 4404/2010 and TDC CoP
- Refer to Scheme Plans 220225 - SC001
- Existing Lisland Drive Pump Station as per Layout Plan by Connell Wagner 7579-15

Information used :

$$HEU := 2.7 \quad \text{rate} := 250 \frac{\text{L}}{\text{day}} [\text{Houses}]$$

$$PF := 2.3 \quad PW := 3.5 \quad \text{Peak factors}$$

1.- Volume Generation

$$H := 61 \quad \text{Lots contributing to additional storage}$$

$$ADWF := H \cdot HEU \cdot \text{rate} = 0.48 \frac{\text{L}}{\text{s}} \quad \text{Average Dry Weather Flow}$$

$$WW_vol := ADWF \cdot 24 \text{ hr} = 41.18 \text{ m}^3 \quad \text{Wastewater generation on 24hr}$$

2.- Additional Flows

$$WW_vol = 41175 \text{ L} \quad ADWF = 0.477 \frac{\text{L}}{\text{s}} \quad PDWF := ADWF \cdot PF \cdot PW = 3.84 \frac{\text{L}}{\text{s}}$$

3. - Storage Requirement (12 hours)

$$Em.St := (50)\% \cdot WW_vol = 20.59 \text{ m}^3 \quad 61 \text{ Lots - Emergency storage}$$

$$\text{Tank} := 6 \cdot 2.440 \text{ m} \cdot (1.35 \text{ m})^2 \cdot \frac{\pi}{4} = 20.96 \text{ m}^3 \quad \text{Tank dimensions 6 lengths x 2.440m L x 1.35m Diameter}$$

4. - Assessment Comments

- Existing pumps size and capacity TBC to check performance of PS1 pumps and satisfied that it has enough to handle the incoming additional flows above existing flows at peak. Hours run or well drawdown tests will give good indication of actual pump performance.
- The above requires discussion/approval with TDC. Existing pump data to be confirmed.



Client: Seven Oaks Kinloch Ltd
Address: Okaia Drive, Kinloch
Job Description: WWTP calculations

Date: 13/05/2025
Designer/Reviewed: LU/TWB
Job Number: 220225

Appendix 4

Taupō District Council
Kinloch Future Development
Map

KCSP - Current Number of Lots rated

Includes	No WW
No Lots	64

1562 includes 19 future lots to be in next rating year**1498 with WW****Granted Consents - to connect to WW**

Address	No Lots
The Poplars	12
Kinloch Golf	116
2 Oakdale Dr	1
Seven Oaks - Stage 8	20
Total	149

Granted Consents - NO WW**No Lots**

The Terraces - Low Density	40
Lochridge	47
Waterview	15
14 Oakdale Dr	1
Total	103

Potential Future Development to connect to WW**No Lots**

Seven Oaks - Balance Land	84
Permitted Infill	24
Total	108

Potential Future Development NO WW**No Lots**

Hunt Club	30
-----------	----

Total No Existing Lots with WW	1498
Total No Consented Lots with WW	149
Total No Potential Lots with WW	108

Total No Existing & Future Lots with WW	1755
--	-------------

1810 capacity
50 future

Total No Existing Lots	1562
Total No Consented Lots	252
Total No Potential Lots	138
Total No Existing & Future Lots	1952

Te Tuhi
44 Lots Restricted Flow Residential Demand
Timing: Developed now, but connection likely all by 2035 (after The Terraces)
WSP to import scheme plan provided and prepare concept to supply lots above Kinloch High Zone.

Hunt Club Inc.
30 Lots Full Residential Demand
Timing: 2030-2035
No Scheme plan provided, connection assumed

The Terraces
55 Lots Full Residential Demand, connected to High Zone
Timing: 2025-2035
Scheme plan provided, recommendations for pipe size will be provided.

Oakdale Downs
Total 82 Lots Full Residential Demand,
Timing: Development completed 2019,
All lots connected by 2025
Refer to latest GIS for customer points

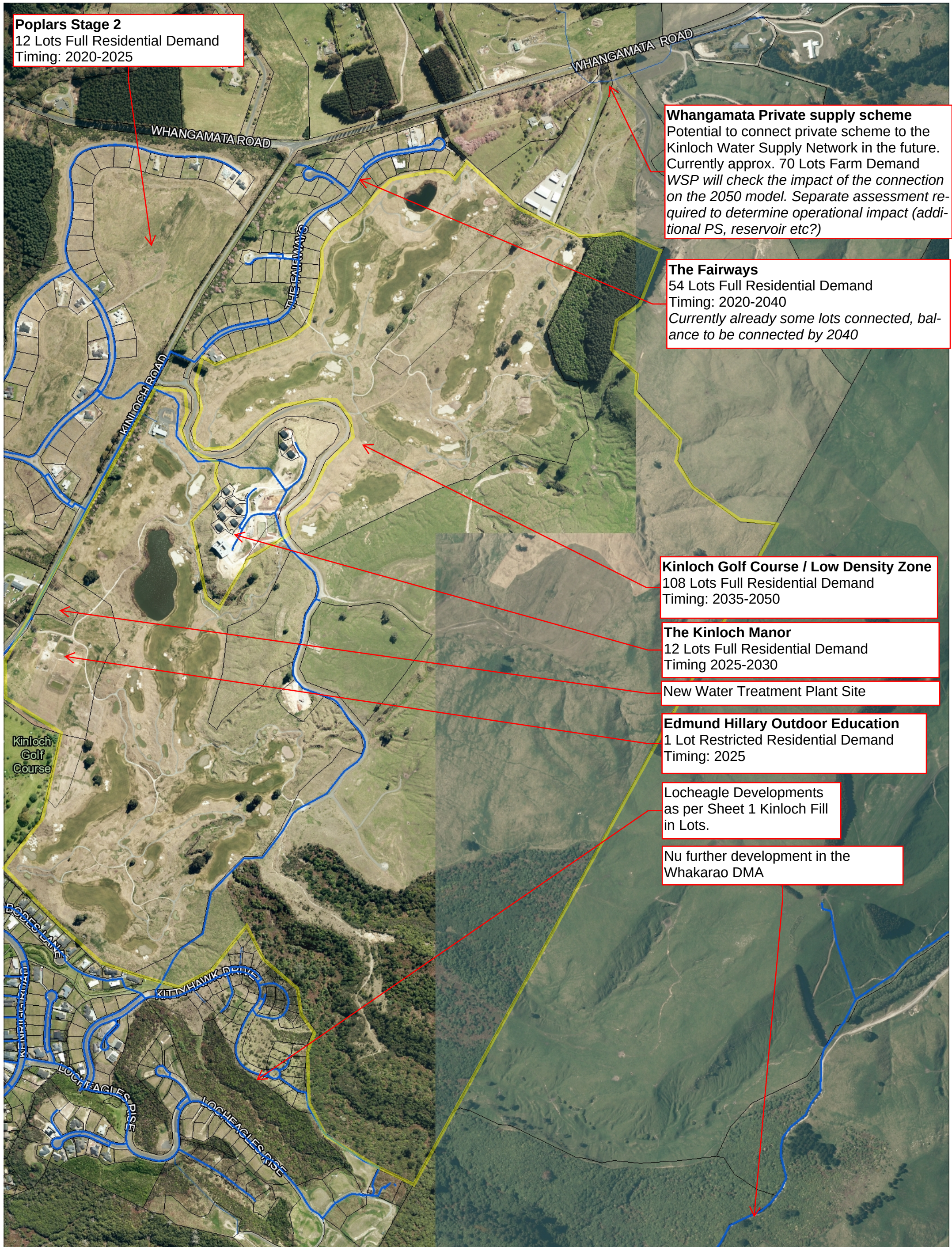
Seven Oaks,
Stage 1-9,
160 Lots Full Residential Demand,
Balance Lot (Stage 10) 30 Lots Full Residential Demand
Stage 1 to 7 connected to Low Zone
Stage 8,9 and Balance Lot to High Zone
Timing: 2020-2026
Scheme plan provided, recommendations for pipe size already provided in development enquiry.

Oakdale Drive,
12 Lots Full Residential Demand,
Timing: 2025-2030

Kinloch Fill In lots (including the Poplars, Locheagles and Fairways) Township
96 Lots Full Residential Demand,
Timing: 2020-2035

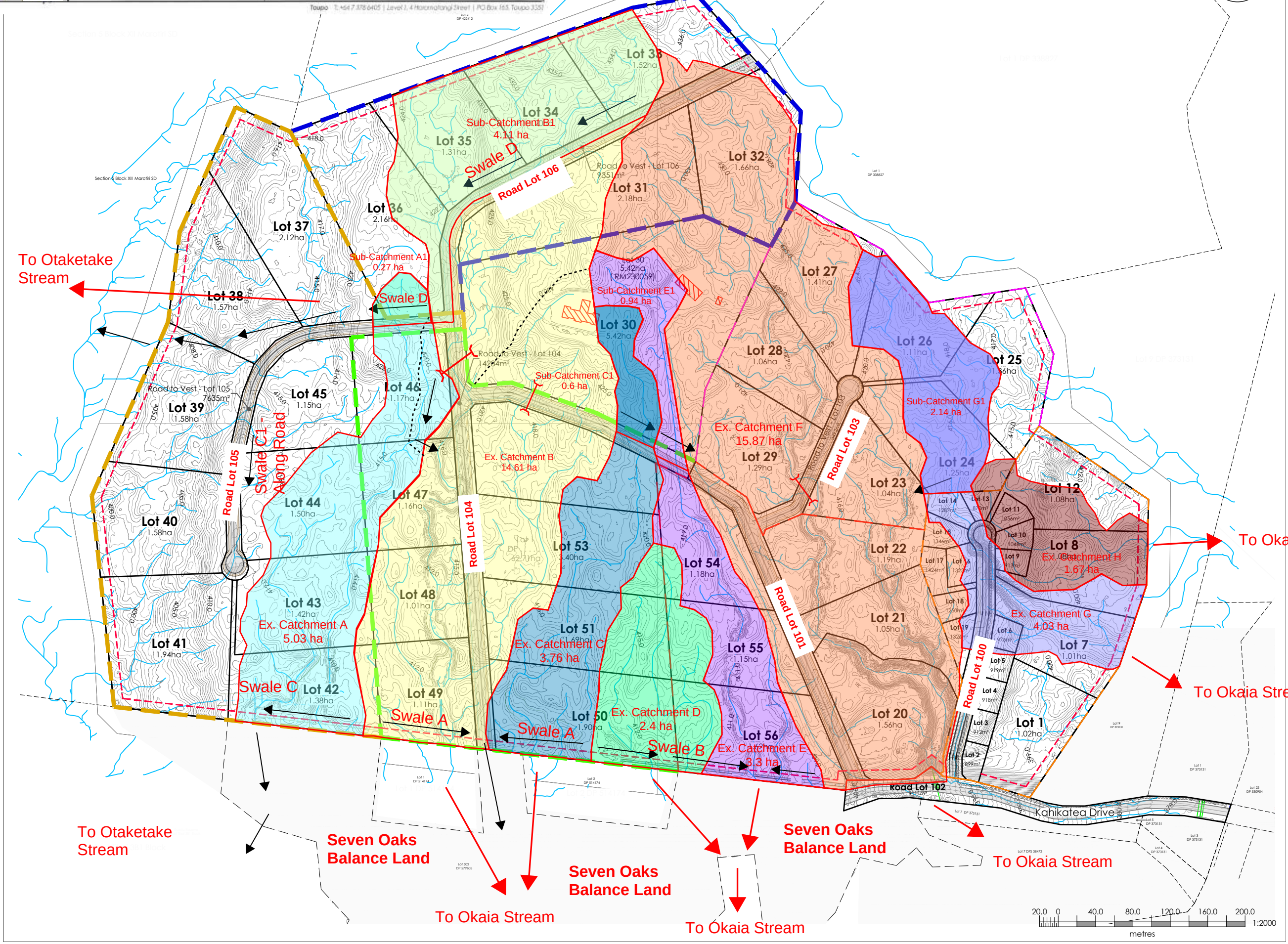
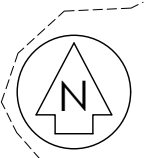
Workshop Site
6 Lots Full Residential Demand
Timing: 2025

Top end of Kinloch High Pressure Zone (480m Elevation contour)



Appendix 5

Upper Catchments and
Preliminary Swale Sizing



C_exist= 0.2 E1/VM1 pasture, high soakage
i_10 = 21.7 Rainfall (mm), 10 year, 30 min.
i_100 = 35.3 Rainfall (mm), 100 year, 30 min.

Catchment Name	Size (m2)	10 Year Flows (existing) m3/s	100 Year Flows (existing) m3/s
A	90000	0.65	1.06
B	66000	0.48	0.78

High soakage gravel, sandy and volcanic soil types:
– pasture and grass cover 0.20
– bush and scrub cover 0.15
– cultivated 0.10

Swale Sizing for Catchment B

100 year event, existing

	Swale B
Peak Flow (m3/s)	0.78
Base Width (m)	1.5
Side Slopes (1v:Xh)	4
Water Depth (m)	0.25
Freeboard (m)	0.5
Top Width (m)	7.5
Top Width of Flow (m)	3.5
Slope (m/m)	1.5%
Mannings Roughness, n	0.03
Area (m2)	0.625
Hydraulic Radius (m)	0.18
Velocity (m/s)	1.280
Channel Flow (m3/s)	0.80
Pass/Fail	PASS

C_future 0.25 Calculated Below
i_10 = 29.1 Rainfall (mm), 10 year, 30 min.
i_100 = 48.1 Rainfall (mm), 100 year, 30 min.

Catchment Name	Size (m2)	10 Year Flows (future) m3/s	100 Year Flows (future) m3/s
B/C	183700	2.24	3.70
D/E	57000	0.69	1.15

For C_future, assuming 300m2 roof, 400m2 hard stand per lot, and 400m2 of road per lot. Average 1.5ha lots.

C_grass = 0.2
C_hard = 0.9
A_grass = 13900 m2
A_hard = 1100 m2
C_future = 0.25

Swale Sizing for Catchment D/E

100 year event, Future

	Swale D/E
Peak Flow (m3/s)	1.15
Base Width (m)	2
Side Slopes (1v:Xh)	6
Water Depth (m)	0.3
Freeboard (m)	0.5
Top Width (m)	11.6
Top Width of Flow (m)	5.6
Slope (m/m)	1.5%
Mannings Roughness, n	0.03
Area (m2)	1.14
Hydraulic Radius (m)	0.20
Velocity (m/s)	1.404
Channel Flow (m3/s)	1.60
Pass/Fail	PASS

Culvert Sizing, Swale D/E

100 year event, pipe full

	Culvert D/E
Peak Flow (m3/s)	1.15
Pipe Diameter (mm)	750
Slope (m/m)	2.0%
Mannings Roughness, n	0.013
Hydraulic Radius (mm)	187.5
Area (m2)	0.44
Velocity (m/s)	3.564
Channel Flow (m3/s)	1.57
Pass/Fail	PASS

Appendix 6

Catchments included in
Stage 2 Stormwater Pond

PROPOSED STORMWATER SOLUTION

Lot 11
DP 373131



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NOTES:

This plan has been prepared for the purpose of a resource consent application only. It is not a precise survey plan. As areas and dimensions are likely to vary upon survey it should not be attached to any sale or purchase agreements without an appropriate condition to cover such variations.

Owner: Seven Oaks Kinloch Ltd

Record of Title: Balance of Stage 1 subdivision (not yet issued)
Total Area: 34.83 ha

Relocated services will require additional easements after final construction and development of the legal survey.

Rights of way to rear Lots are a minimum 4m wide.

LEGEND:

- Proposed Boundaries
- Existing Boundaries
- Easement
- ROW
- LP Reserve to vest (Stormwater)
- LP Reserve to vest (Stormwater & Recreation)
- Recreation Reserve to vest
- Stormwater Pond
- Proposed Road
- Proposed Swale/Drain
- Balance Lot Boundary
- 3m Setback
- 5m Setback
- 7.5m Setback
- Footpath - 1.4m Wide
- Cycleway - 1.8m Wide
- Combined Footpath & Cycleway
- Bush Walkway-Cycleway
- Existing K2K Track
- Pool Fence

SEVEN OAKS

E	16/03/20	Stages 5 & 9 Layouts Amended			
		Footpaths, Cycleways and			
		Pool Fence Shown	PH	PWR	SGP
D	21/01/20	Stages 3 & 5 Lot Boundaries Amended	PH	NR	SGP
Rev	Date	Amendment	By	IC/N/A	App

Project Title

Seven Oaks Kinloch Ltd.
Oka'a Drive
Kinloch

Drawing Title

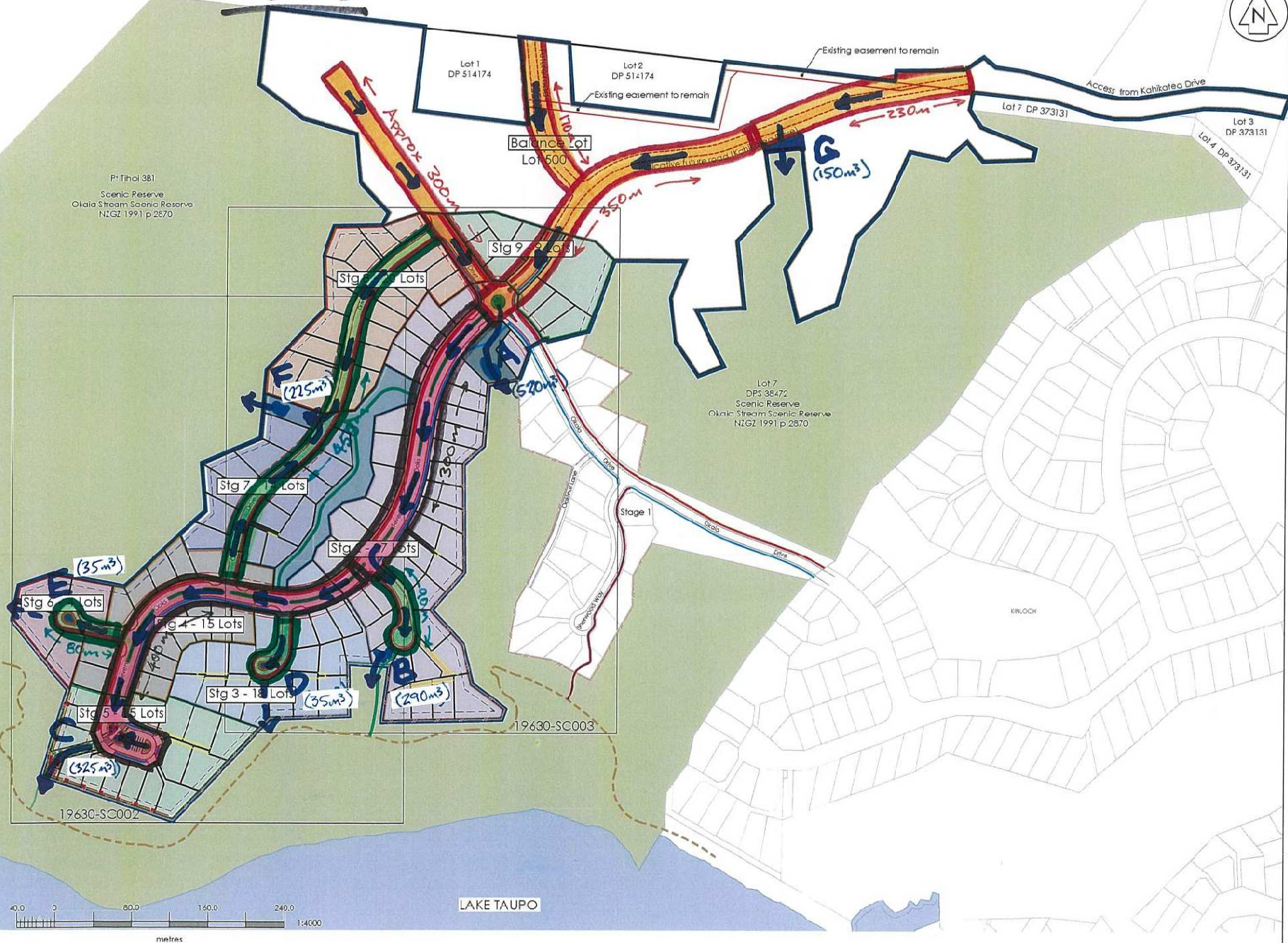
Scheme Plan
Stages 2 to 9
Sheet 1 of 3

Surveyed			
Designed	P. Rely	4/11/19	PWR
Drawn	P. Rely	4/11/19	PH
Checked	D. Forth	4/11/19	DGP
Approved	D. Forth	4/11/19	DGP

Status: **RESOURCE CONSENT**

Scale: A1 A3
A3 1:4000 A3

Drawing Number: 19630-SC001 Rev: E



Appendix 7

Water Supply Modelling

Taupo District Council

KINLOCH SEVEN OAKS STAGE 3 DEVELOPER QUERY - WATER SUPPLY MODELLING ASSESSMENT

Project NO -3-39692.01

9 JUNE 2024

CONFIDENTIAL



CONTACT DETAILS

Kristina Macnaughtan
WSP
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99 Bryce Street,
Hamilton
3204.

REVISION DETAILS

REV	DATE	DETAILS
0	27/03/2024	Kinloch Seven Oaks Stage 3 Modelling Report Draft for Client Review
1	29/4/2024	Kinloch Seven Oaks Stage 3 Modelling Report Draft for Client Review with completed extra scope
2	09/05/2024	Update following Client review and meeting
3	4/06/2024	Update following Client review and meeting
4	9/06/2024	Final

DOCUMENT HISTORY AND STATUS

	NAME	DATE
Prepared by:	Sherine Sathiasothy	27/05/2024
Reviewed by:	Dan Johnson	17/05/2024
Approved by:	Lizzie Fox	9/06/2024

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Taupō District Council ('Client') in relation to investigate if the existing water supply network can meet the LOS and fire flow requirements for the next stage of proposed Seven Oaks Development, and in accordance with the Offer of Service – Kinloch Seven Oaks dated 2nd October 2023. The findings in this Report are based on and are subject to the assumptions specified offer of services dated 2nd October 2023. WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

9 June 2024



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1 PROJECT BACKGROUND

A new development is currently in progress to the west of Kinloch, Taupō. This development is to be constructed in 14 stages and will be accessed from Okaia Drive and Kahikatea Drive and connected to the Central Kinloch water supply.

WSP has been engaged by Taupō District Council (TDC) to perform modelling/hydraulic analysis for the Kinloch water supply network. A development impact assessment was undertaken during Stages 1 and 2 of the development phase and network improvements were recommended.

This report discusses the impact of Stage 3 of the Seven Oaks development, with all proposed developments and other permitted developments in Lochridge and Hunt Club on the network. Stage 1 and 2 reports should be referenced for further assessments carried out.

1.1 SCOPE

The objective of the Stage 3 water supply assessment is to investigate if the proposed developments will benefit from pressure reduction, without compromising the level of service (LoS) within the zone.

Figure 1-1 shows the extent of the high-level and low-level zones with the Seven Oaks developments connected to the high-level zone, and Figure 1-2 illustrates the scope of Stage 3 assessments.

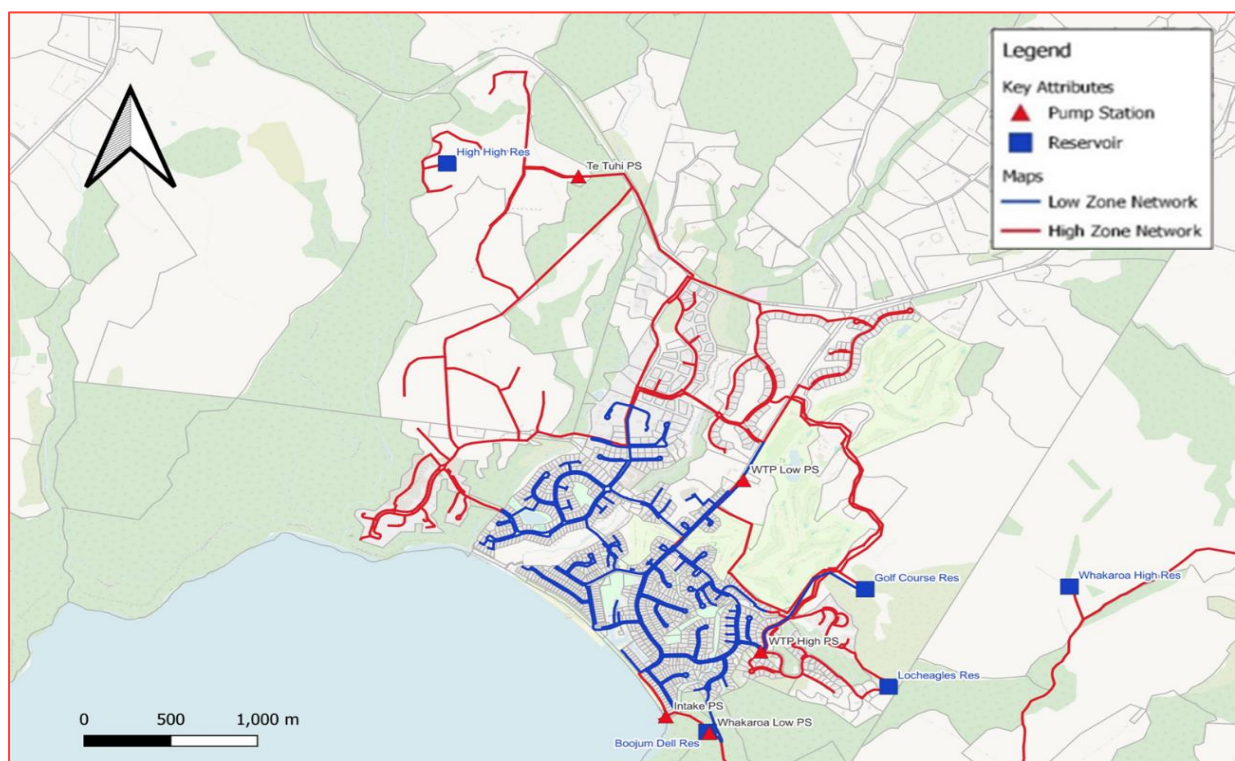


Figure 1-1 : Proposed high and low-level zones

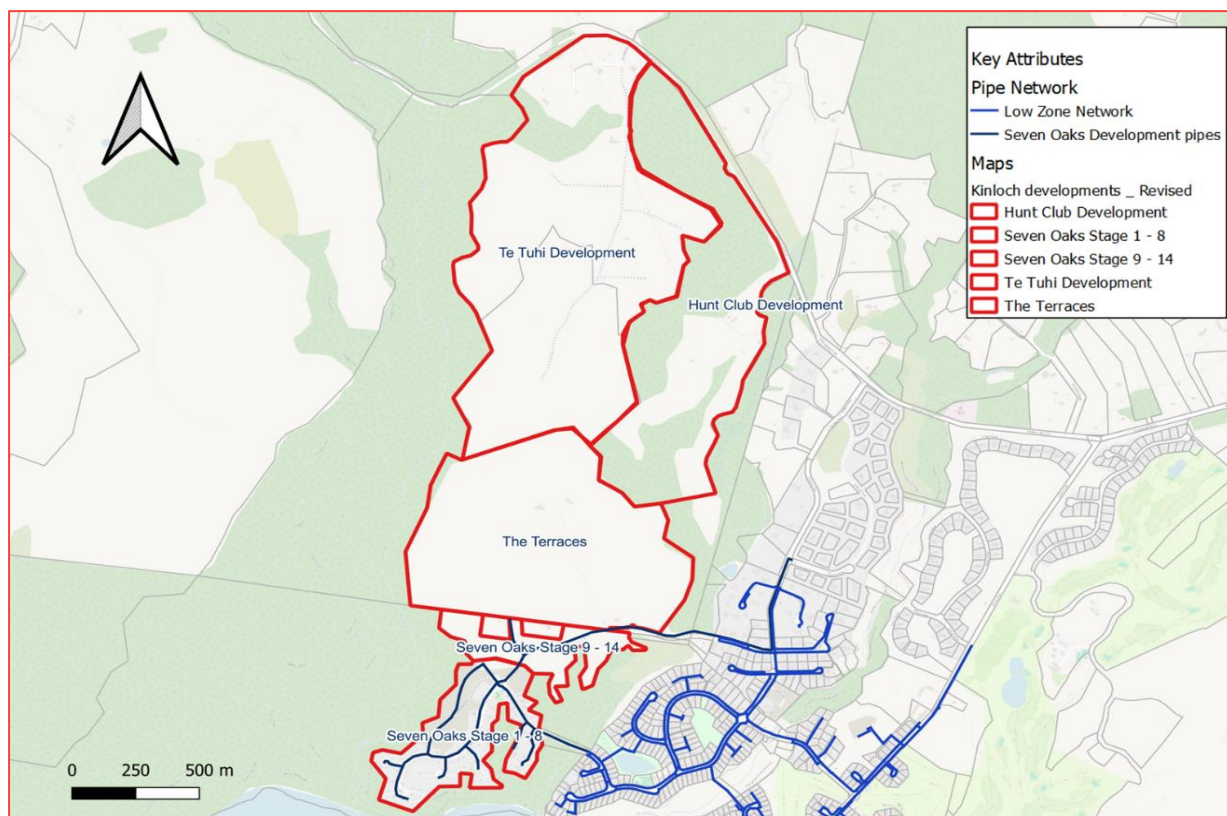


Figure 1-2 : Overview of the Terraces, Hunt Club & Te Tuhi Development Areas

Its worth nothing that the Hunt Club development area has been revised to match the information provided by Council.

1.2 ACCEPTANCE CRITERIA

The hydraulic analysis was conducted as per the TDC Code of Practice (CoP). During the analysis, the following acceptance criteria were considered as shown in Table 1-1:

Table 1-1 : Acceptance Criteria for the LoS

Level of Service	Acceptance Criteria
Minimum Pressure	300 kPa (30 m) pressure at every connection point as per TDC CoP.
Maximum Pressure	750 kPa (75 m) pressure at every connection point as per TDC CoP.
Unit Headloss	Unit Headloss (m/km) of the proposed pipe and the existing supply pipe as per NZS 4404:2010: • 5 m/km for DN ≤ 150 diameter. • 3 m/km for DN ≥ 200 diameter.
Fire flow	New Zealand Fire Service CoP; Standards New Zealand (SNZ) PAS 509:2008 and subsequent amendments, to the satisfaction of the New Zealand Fire Service. Due to limitations in the hydraulic modelling (WS Pro) software, an exceptional flow method has been used to assess the fire flow performance of the Seven Oaks network. In this methodology, an exceptional flow of 25 L/s has been allocated at each selected critical hydrant for 30 minutes at 60% peak day demand. The hydrants are evaluated one at a time for required fire flow (25 L/s) and minimum residual pressure (10 m).

1.3 METHODOLOGY

The methodology used for this assessment is as follows:

- Use the Kinloch Stage 2 hydraulic model (including the options developed in Stage 2) with the proposed developments in Kinloch and Seven Oaks, which also includes the other permitted developments (Te Tuhi/Hunt Club). The number of Lots accessed is detailed in Table 1-2.

Table 1-2 : Lots numbers for Development Areas

Developments	Proposed Lots
Stages 1 - 7	131 Lots
Stages 8 & 9	20 Lots
Balance Land	100 Lots
Terraces	55 Lots (15 residential & 40 low-density residential)
Te Tuhi	47 Lots rural residential (restricted to 1.2 L/min each)
Hunt Club	30 Lots rural residential (restricted to 1.2 L/min each)

For Stage 3, Taupo DC has confirmed that only Scenario 3 is required for the hydraulic assessment, as described in the subsequent section of the report. The following assessment will be carried out:

- Confirm the best locations for PRVs in the Terraces. WSP has used the indicative locations of the PRVs in Figure 1-3 below as a starting point.
- Conduct a fire flow analysis of the hydrants in Kinloch to meet the fire flow and residual pressure criteria set out in SNZ PAS 4509:2008, with the new PRVs in place.
- Confirm the size of linkages from Terraces through Hunt Club land.
- Confirm that the Lochridge (Te Tuhi) network should remain isolated from Terraces and Hunt Club (low pressure to properties on Lochridge Drive will be transferred onto high-high zone).
- Confirm pipe sizing within Southern part of Lochridge.
- Confirm pipes sizes match the as-builts for the low zone pipe network in Lochridge (additional scope).
- Model the looped main through the Hunt Club land and review the PRV locations (additional scope). Figure 1-3 shows the DN180 PE main, with a pressure rating of PN16, that provided a high zone loop from the South through the Terraces and Hunt Club land.
- Provide a short technical report of the model results.

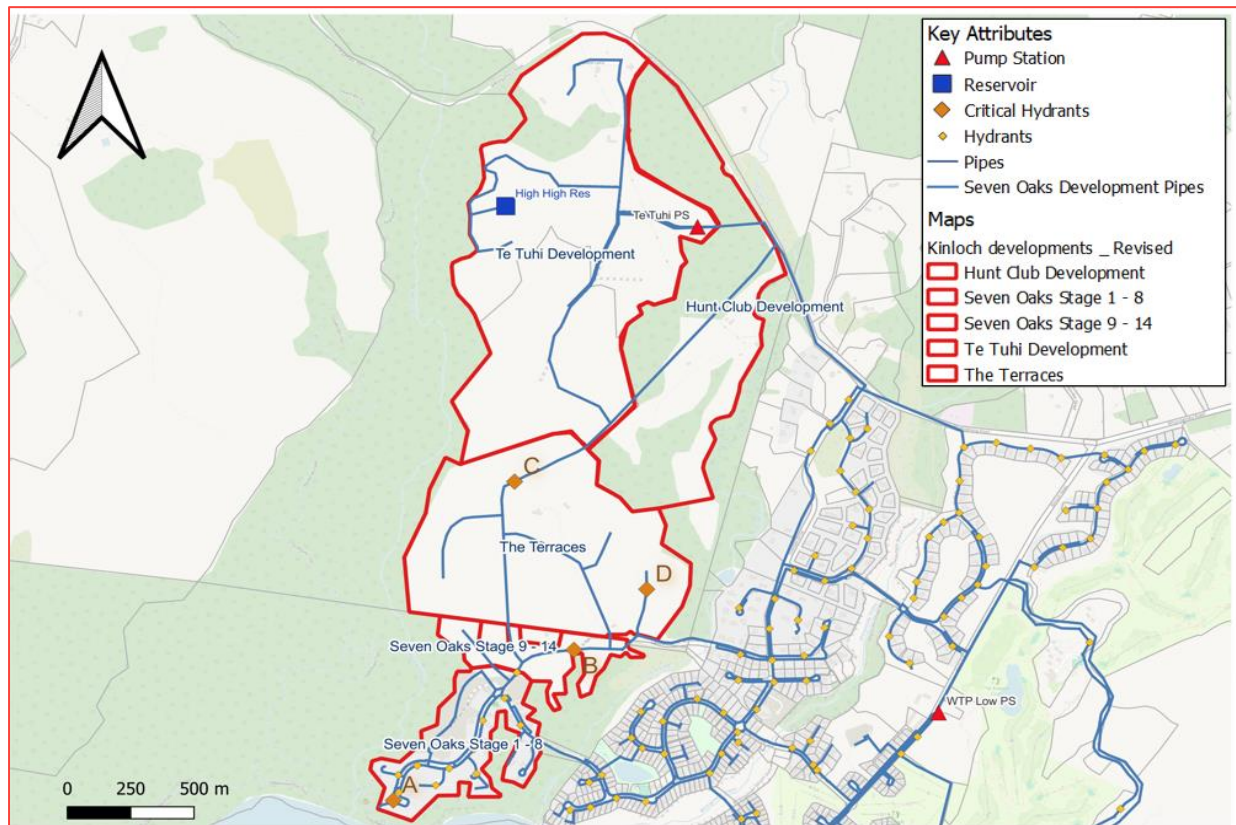


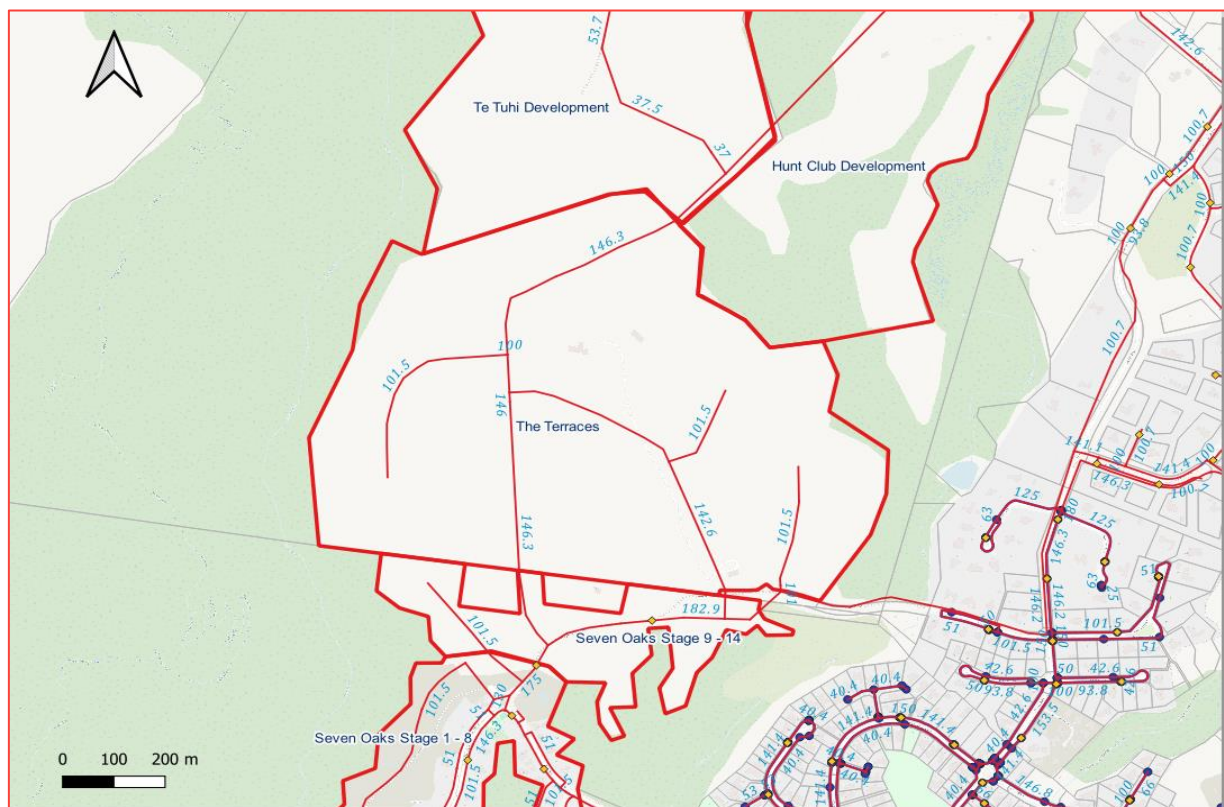
Figure 1-3 : Indicative PRV Locations for the Terraces and Hunt Club Area

1.4 MODEL ASSUMPTIONS

The following assumptions have been adopted for this modelling assessment:

1. WSP used the Kinloch model Stage 2 (including the solutions developed in Stage 1) with the currently established Seven Oaks development demand.
2. The model database is named Seven Oaks Development Stage 3, which comprises the following:
 - i. **Network:** Seven Oaks Stage 3
 - ii. **Control:** Seven Oaks Stage 3 - Control
 - iii. **Run Group:** Seven Oaks Development Developer Query
3. Scenario 3 contains the total proposed Lot count for Seven Oaks Stages, Balance Land, Terraces, Te Tuhi, and Hunt Club development as presented in Table 1-2.
4. Domestic demand for the Te Tuhi and Hunt Club development having 47 Lots and 30 Lots respectively used a rate of 1.2 L/min/lot (restricted supply) as per information received from TDC via email on 24/10/2023.

5. The peak day domestic demand for stages and development is based on the master planning water consumption rate of 1,362 L/property/day, as previously agreed with TDC in the offer of service.
6. A value of 10% of the consumption rate (136 L/property/day) was used as leakage for the new properties/lots added, which is the same assumption as per previous analysis documented in the Stage 1 and 2 reports.
7. In the absence of contour data for Terraces development, the ground level is assumed using the latest data available from Land Information New Zealand (LINZ).
8. Also, due to the absence of hydrant location data for Te Tuhi and Terraces development, two hydrants were assumed at the highest elevation and the furthest location from the network within each development area, as a worst-case scenario.
9. The internal pipe network of the Terraces was digitised as per Figure 1-4 following the proposed pipe layout provided by TDC via email on 08/09/2023.



2 MODEL RESULTS

This section discusses the Stage 3 modelling outputs. The full Seven Oaks development area and the Terraces have been connected to the high zone, by isolating the low zone Okaia Drive and supplying the entire development through Kahikatea Drive as shown below in Figure 2-1.

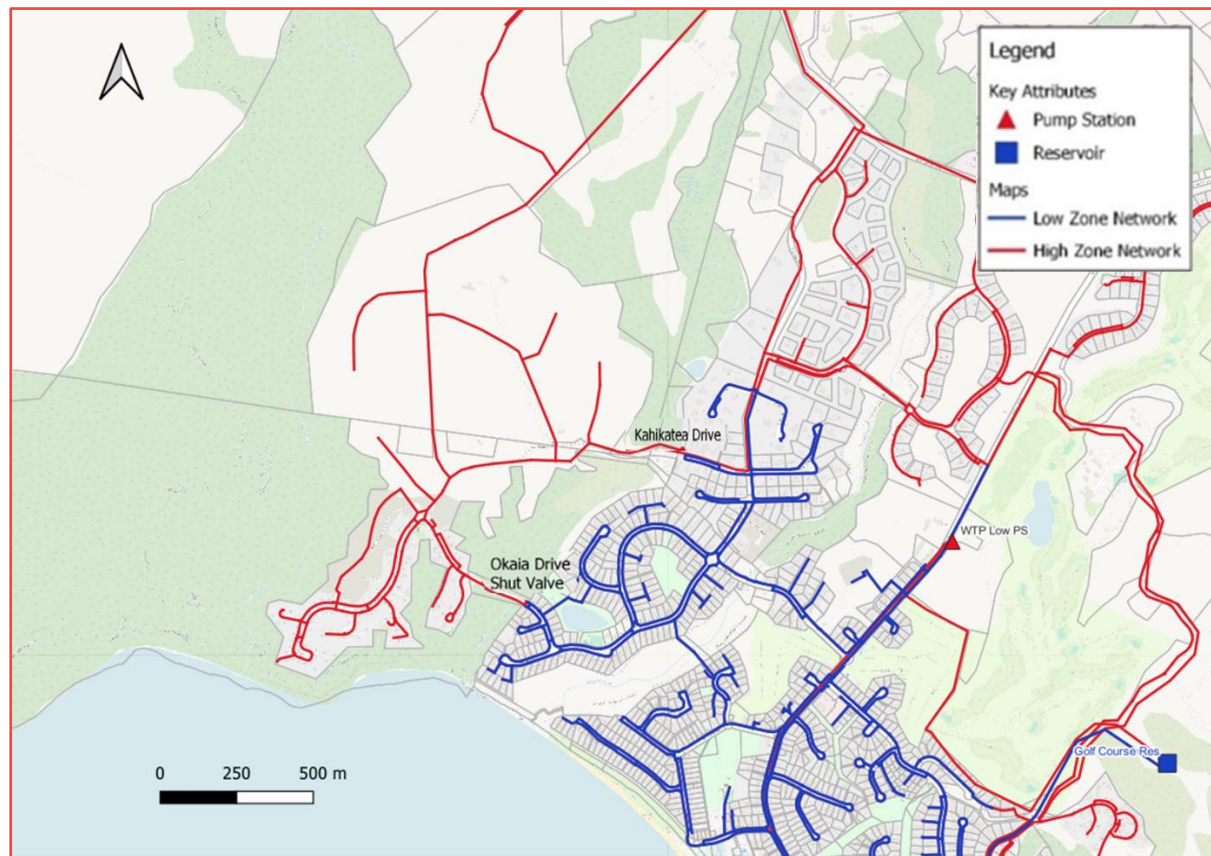


Figure 2-1: Model changes to move Seven Oaks and the Terraces development to the high zone network.

2.1 REMOVAL OF THE DUAL PIPE IN THE LOCHRIDGE DEVELOPMENT AREA

Following the Stage 2 assessment, it was concluded that Hunt Club meets the required minimum pressure targets but the area along Lochridge Drive still fails to achieve a minimum pressure of 30m, due to high elevations. Hence, it was recommended that the properties along Lochridge Drive be transferred to the High-High zone as a solution. However, this option was to be further investigated in stage 3 and the assessment process is detailed below:.

The gravity pipeline that was running parallel to the boosted line in the model has been removed and the entire section traversing Lochridge land is now pressurised. This has resulted in higher pressure for the properties south of the catchment. However, it is worth noting that

the property elevations in the model may not be an exact representation of what's on-site. Hence, during the preliminary design stage, it is recommended that the average pressure be re-assessed based on the surveyed lot heights. This is prudent for the properties in the southern and western sections of the area.

The revised network with the pipe diameters used in the modelling assessment and the average pressure is shown in Figure 2-2 and Figure 2-3 respectively.

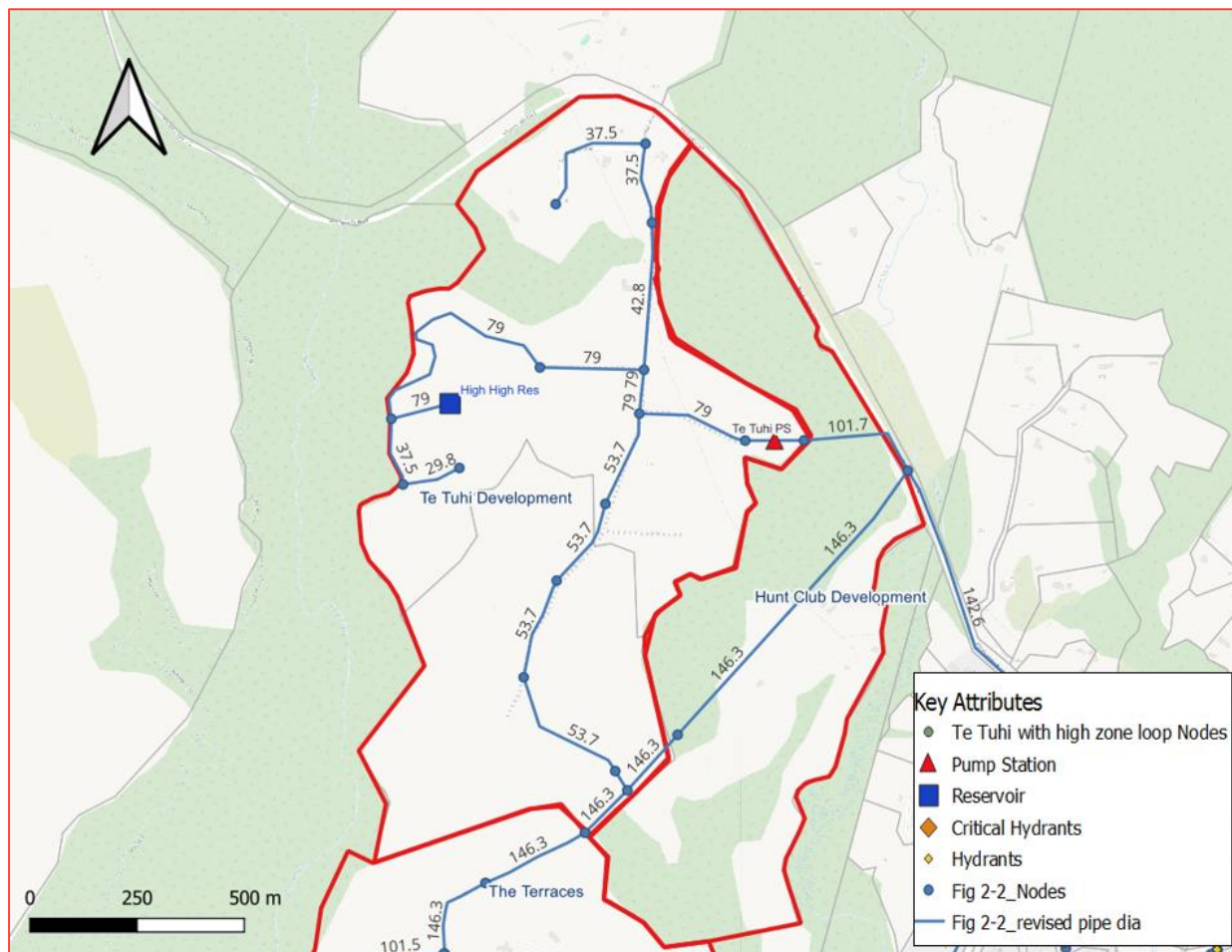


Figure 2-2 : Model network with the main supply connected to the boosted line, South of Lochridge, showing the pipe dimeters.

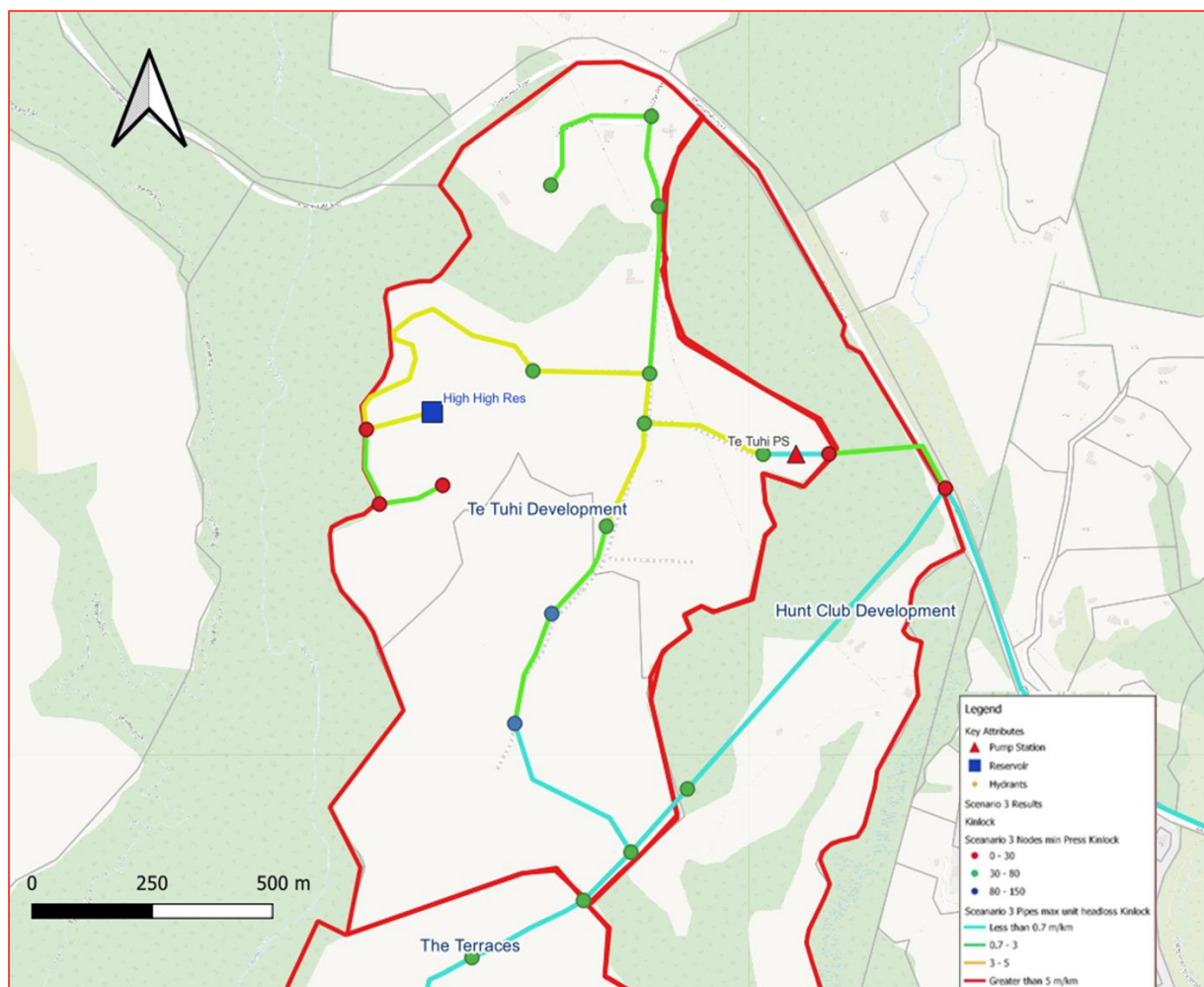


Figure 2-3 : Model network with the main supply connected to the boosted line, South of Lochridge, showing the headloss per unit distance.

2.2 PREFERRED PRV LOCATIONS (WITH THE HUNT CLUB LOOPED MAIN) FOR SEVEN OAKS AND THE TERRACES DEVELOPMENT

This section is not intended as a detail design document but rather a concept to refer to for design of the network. It is acknowledged that additional PRVs will be needed to service all properties within the developments and in particular within the 7 Oaks Stage 9-14 land, and any rider mains that are fed off the looped main that runs through the Terraces and Hunt Club lands.

Analysis of the most suitable locations for the PRVs was undertaken using the Stage 3 network with Scenario 3 demand. The indicative locations are illustrated below in Figure 2-4.

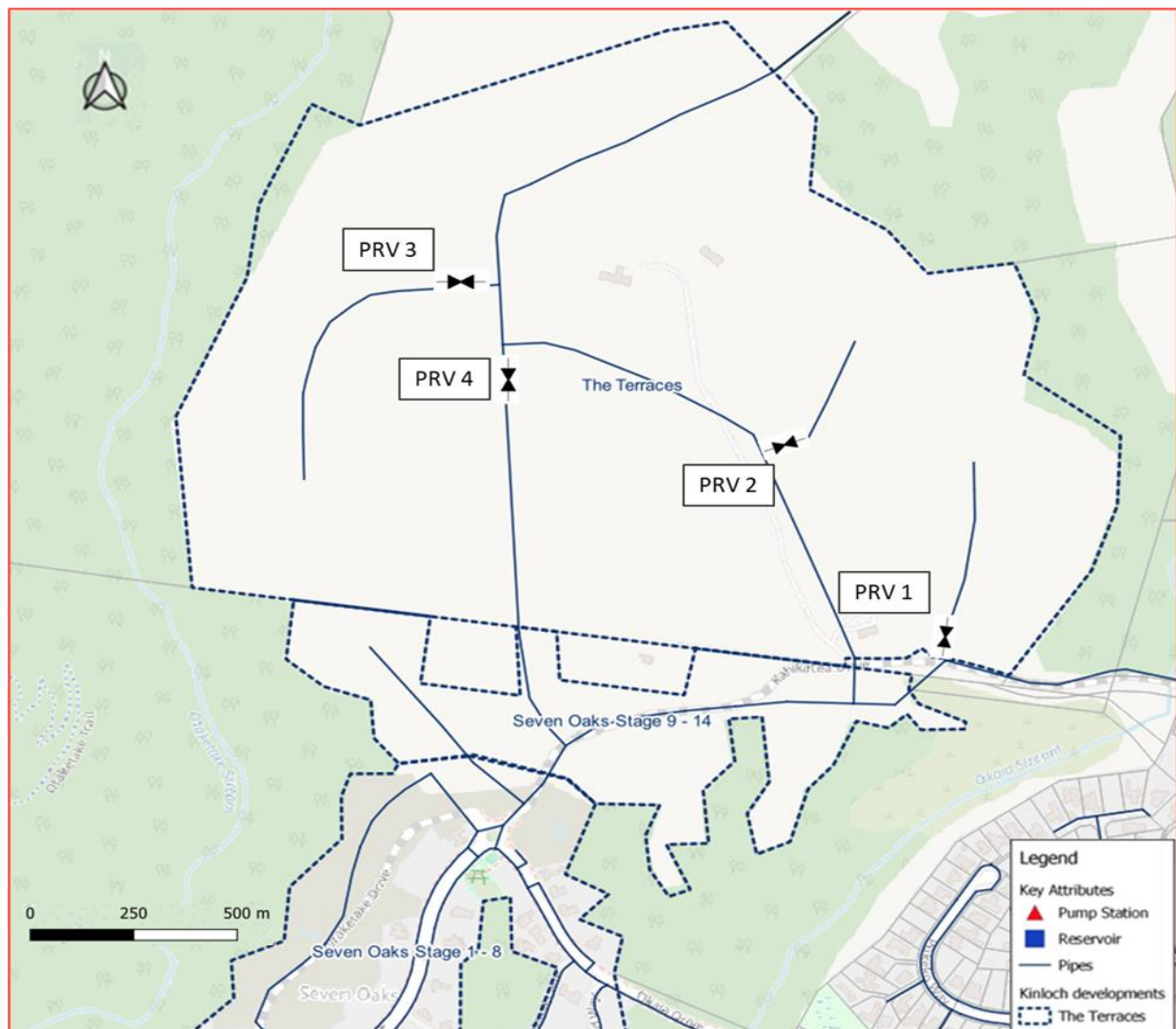


Figure 2-4 : Indicative PRV locations.

TDC advised that installation of the western link between the 7 Oaks Stage 9-14 land and the Terraces land may be subject to considerable time delays. Modelling was therefore completed without this link. A closed valve was included at the location of PRV4. Further modelling can be completed of options for PRVs in this area as design and installation timeframes become clearer.

The recommended location of the PRVs are shown in Figure 2-5 below.

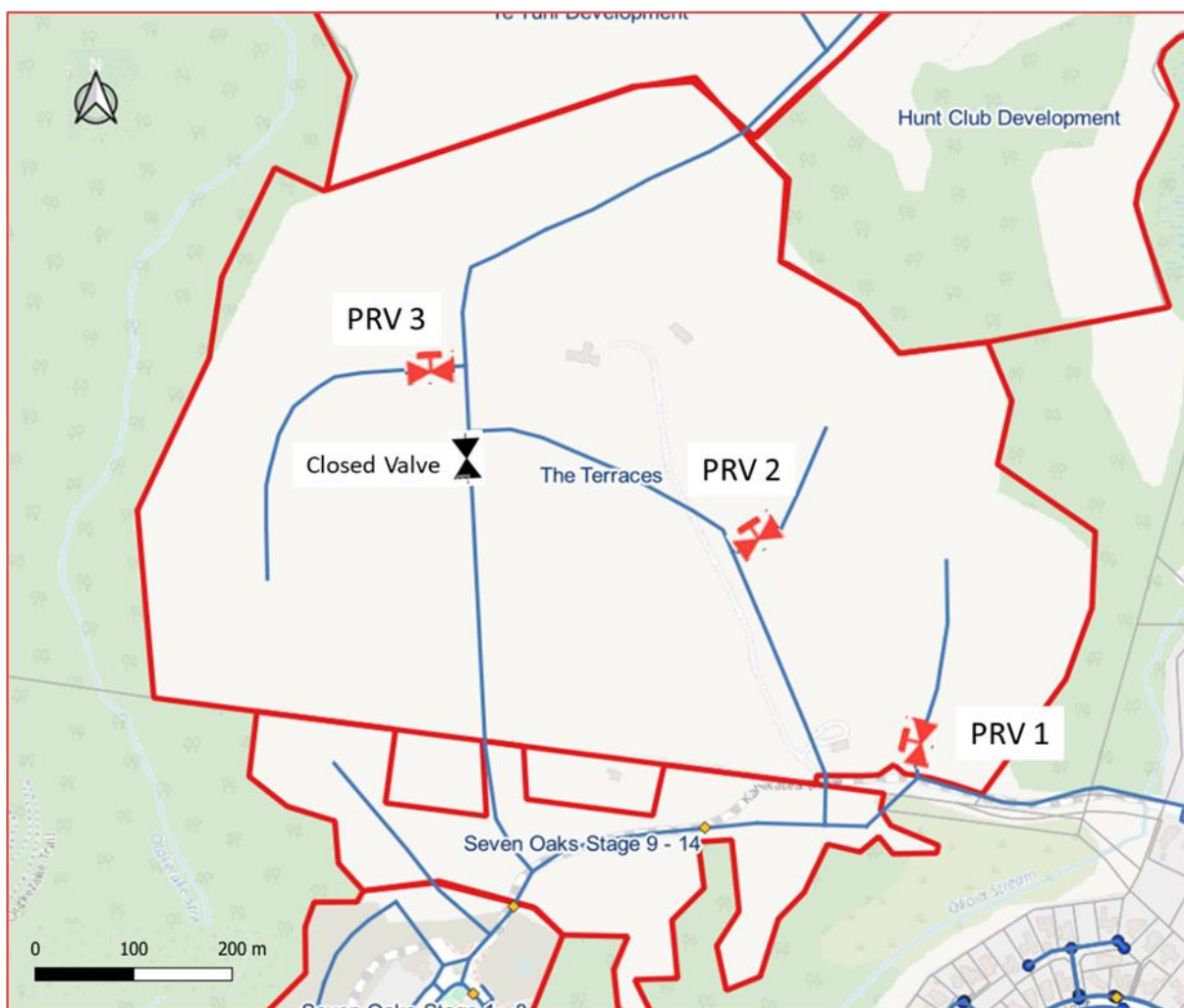


Figure 2-5 : Recommended PRV locations.

2.2.1 PRV 1

PRV 1 will pressure manage Stage 1 lots of the Terraces. The maximum and minimum pressure at the critical customer (furthest node) before and after installation of a PRV are tabulated below.

Table 2-1 : PRV 1 results

Without PRV		With PRV		PRV – Fix outlet Setting (m)
Max. Pressure (m)	Min. Pressures (m)	Max. Pressure (m)	Min. Pressures (m)	
102	67	61	34	60

This is a small pressure-managed zone (PMZ 1).

2.2.2 PRV 2

PRV 2 will pressure manage the north-east side of the Terraces. The maximum and minimum pressure at the critical customer (furthest node) before and after installation of a PRV are tabulated below.

Table 2-2 : PRV 2 results

Without PRV		With PRV		PRV – Fix outlet Setting (m)
Max. Pressure (m)	Min. Pressures (m)	Max. Pressure (m)	Min. Pressures (m)	
94	67	33	33	35

2.2.3 PRV 3

PRV 3 will pressure manage Stage 5 lots, which is west of the Terraces. The maximum and minimum pressure at the critical customer (furthest node) before and after installation of a PRV are tabulated below.

Table 2-3 : PRV 3 results

Without PRV		With PRV		PRV – Fix outlet Setting (m)
Max. Pressure (m)	Min. Pressures (m)	Max. Pressure (m)	Min. Pressures (m)	
104	77	30	30	30

This is a small pressure managed zone (PMZ 3).

2.2.4 PRV 4

As for PRV4, at this stage of the development, its represented in the model as a closed valve. However, once the pipeline across the Terraces has been constructed, the model can be updated with a PRV and reassessed to confirm the pressure setting. Having more accurate lot elevations would enable the model to generate a more accurate results of the required pressure settings.

2.2.5 SEVEN OAKS PRV (PRV 5)

To optimise the network pressure performance, an additional PRV is recommended along the network connecting the Balance Lots to Seven Oaks Stage 1 – 8 as shown below in Figure 2-6. The maximum and minimum pressure at the critical customer (furthest node) before and after installation of a PRV 5 are tabulated in Table 2-4.

Table 2-4 : PRV 5 results

Without PRV		With PRV		PRV Setting (m)
Max. Pressure (m)	Min. Pressures (m)	Max. Pressure (m)	Min. Pressures (m)	
122	95	60	30	50

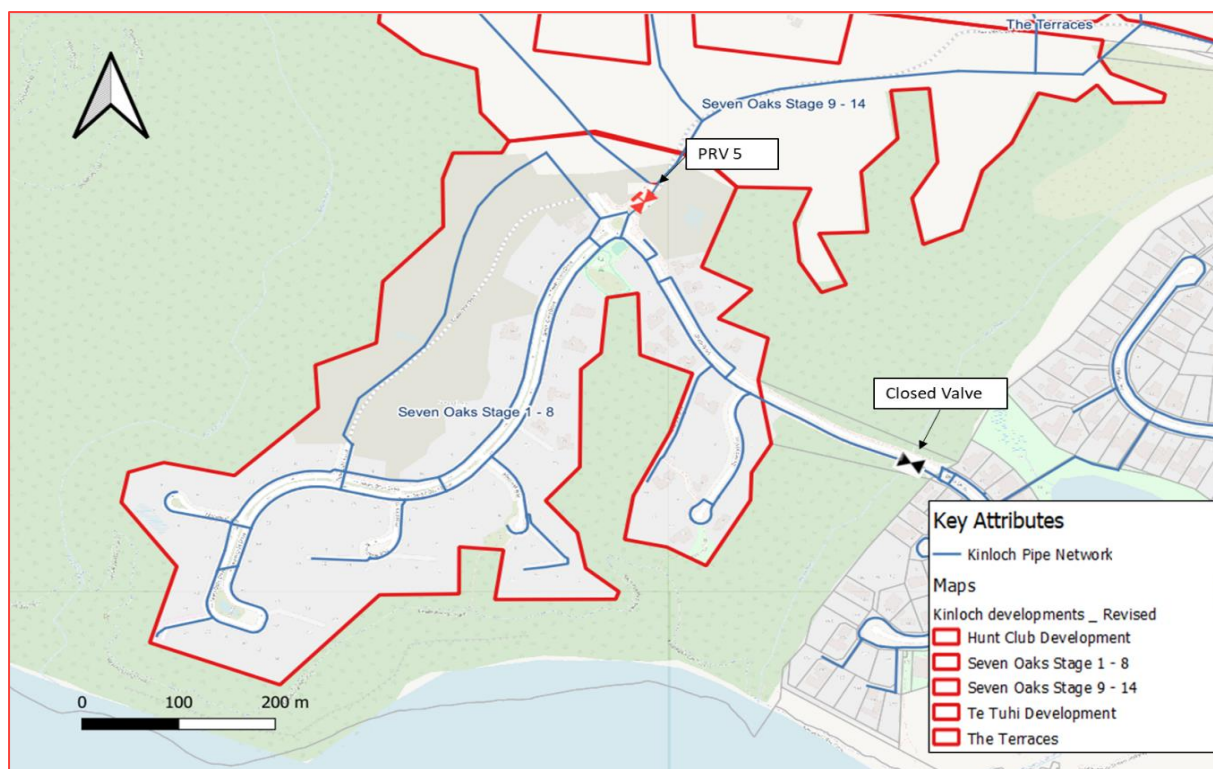


Figure 2-6 : PRV 5 location for Seven Oaks Lower section.

The PRV setting and the minimum pressure achieved pre and post-installation, as predicted by the model are summarised in Table 2-5.

Table 2-5 : PRV and Boundary Valve Details

PRV ID	PRV Setting (m)	Highest Elevation Node ID	Pre-Installation Min Pressure (m)	Post Installation Min Pressure (m)
PRV 1	60	62	76	34
PRV 2	35	64	67	33
PRV 3	30	60	77	30
PRV 4 (CLOSED VALVE in the current model)	N/A	TT5	56	N/A
PRV 5	58	20230523081416	95	46

2.3 CONFIRMATION OF SIZE OF LINKAGES FROM TERRACES THROUGH HUNT CLUB LAND

The pipe diameter of the network between the Terraces and Hunt Club was upsized and the results from the model simulation were analysed to confirm the minimum pressure (m) and maximum headloss (m/km) results for Seven Oaks and other developments including the Terraces, Lochridge, and Hunt Club are within the values specified in the LoS.

Figure 2-7, shows the pipes updated in the Stage 3 Model.

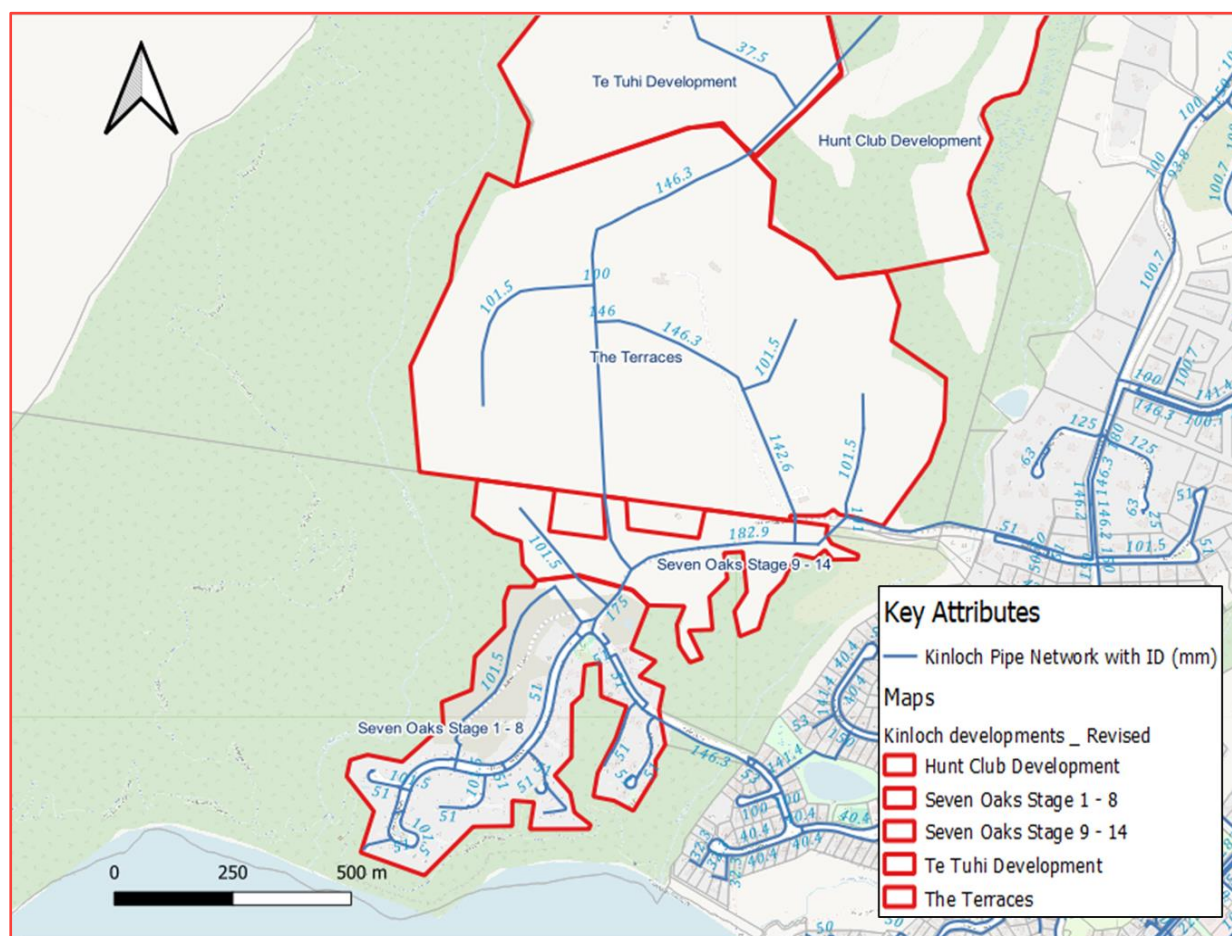


Figure 2-7 : ID Pipes (PN16) upsized in the Stage 3 Model

The LoS results for Scenario 3 are summarised in Table 2-6.

Table 2-6 : LoS Results for Scenario 3

Location	Minimum Pressure range (m)	Maximum unit headloss (m/km)
Stages 1-9 and Balance Land lots in the Seven Oaks Development.	67 - 107	Less than 3
Terraces Development	56 - 77	Less than 3

The minimum pressure results in Seven Oaks development and the Terraces are well within the TDC CoP acceptance criteria. The maximum unit headloss of the pipes is below 3 m/km.

Hunt Club meets the required minimum pressure targets.

2.4 LOCHRIDGE NETWORK CONFIGURATION

A modelling assessment was undertaken with and without the Lochridge (Te Tuhi) network connected to the Terraces and Hunt Club network. The results indicated that the minimum pressure remains lower than the LoS requirement of 30 m during both options.

As discussed in the Stage 2 report, the area along Lochridge Drive failed to achieve a minimum pressure of 30 m, due to higher elevations of 490- 530 m, whereas the average elevation for the entire network is found to be 410 m.

Figure 2-8 shows the minimum pressure (m) and maximum head loss (m/km) for the Lochridge Area.

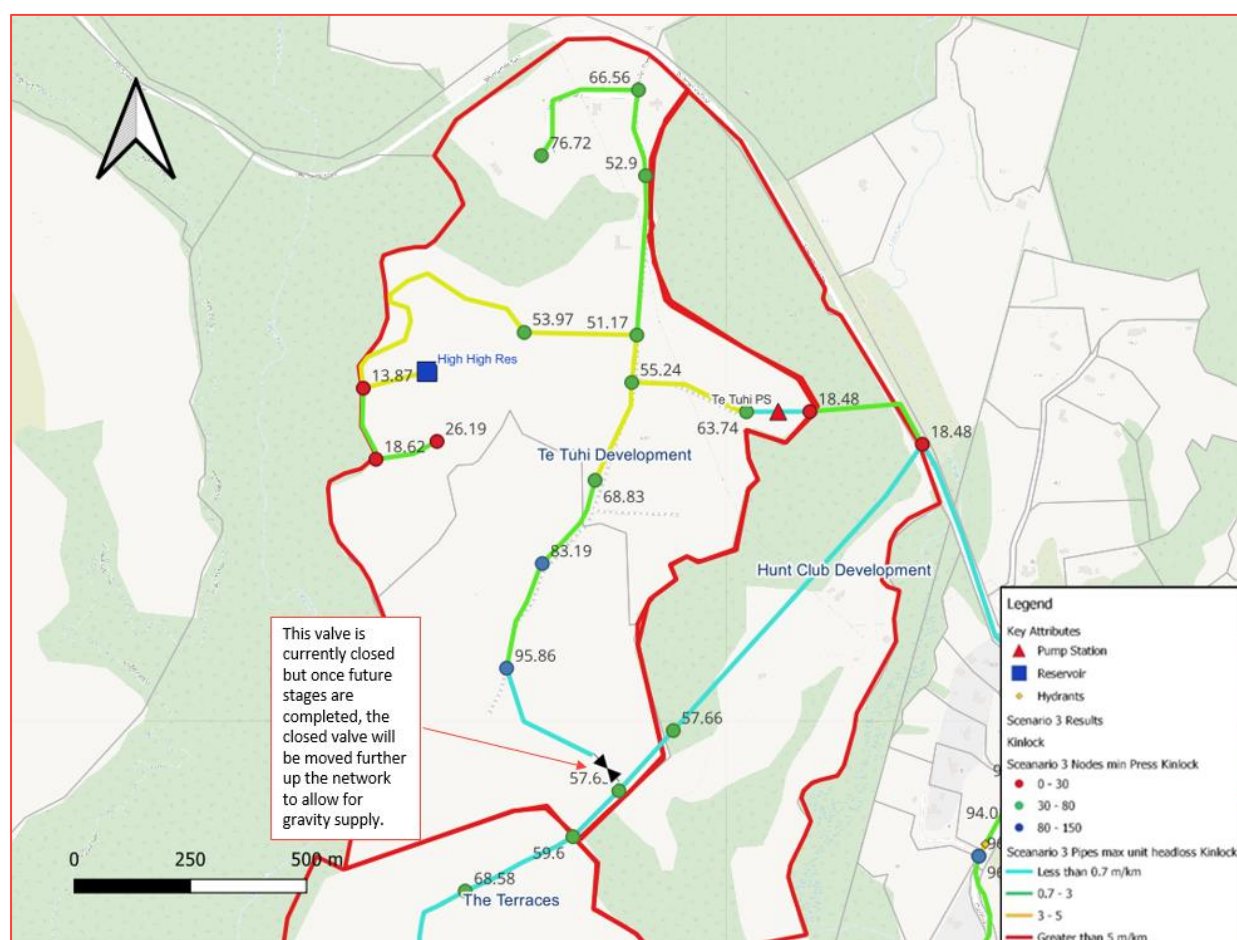


Figure 2-8: Lochridge Development Area Under Scenario 3

As can be seen from the above figure, the main area of concern is the western edge of the development, where the minimum pressures in the network are less than 30m. Options for the developer to ensure the LoS criteria are met might include; installing a booster pump,

adjusting the reservoir elevation, altering the development design to reduce lot elevation, or discussing a LoS agreement with the Council.

2.5 FIRE FLOW

2.5.1 OVERVIEW

An assessment was required to confirm if the Seven Oaks and other developments meet FW2 (residential) firefighting requirements, based on the proposed pipe sizes presented previously. The hydrants tested are as detailed in Table 1-1. All critical hydrants within the proposed developments, including Seven Oaks, the Terraces, and Hunt Club, were evaluated for fire flow availability to FW2. The hydrants within Lochridge are not required to meet FW2 fire flow criteria, as this area is within rural residential areas.

Figure 2-9 shows the hydrants within Seven Oaks and other developments used for the fire flow assessment.

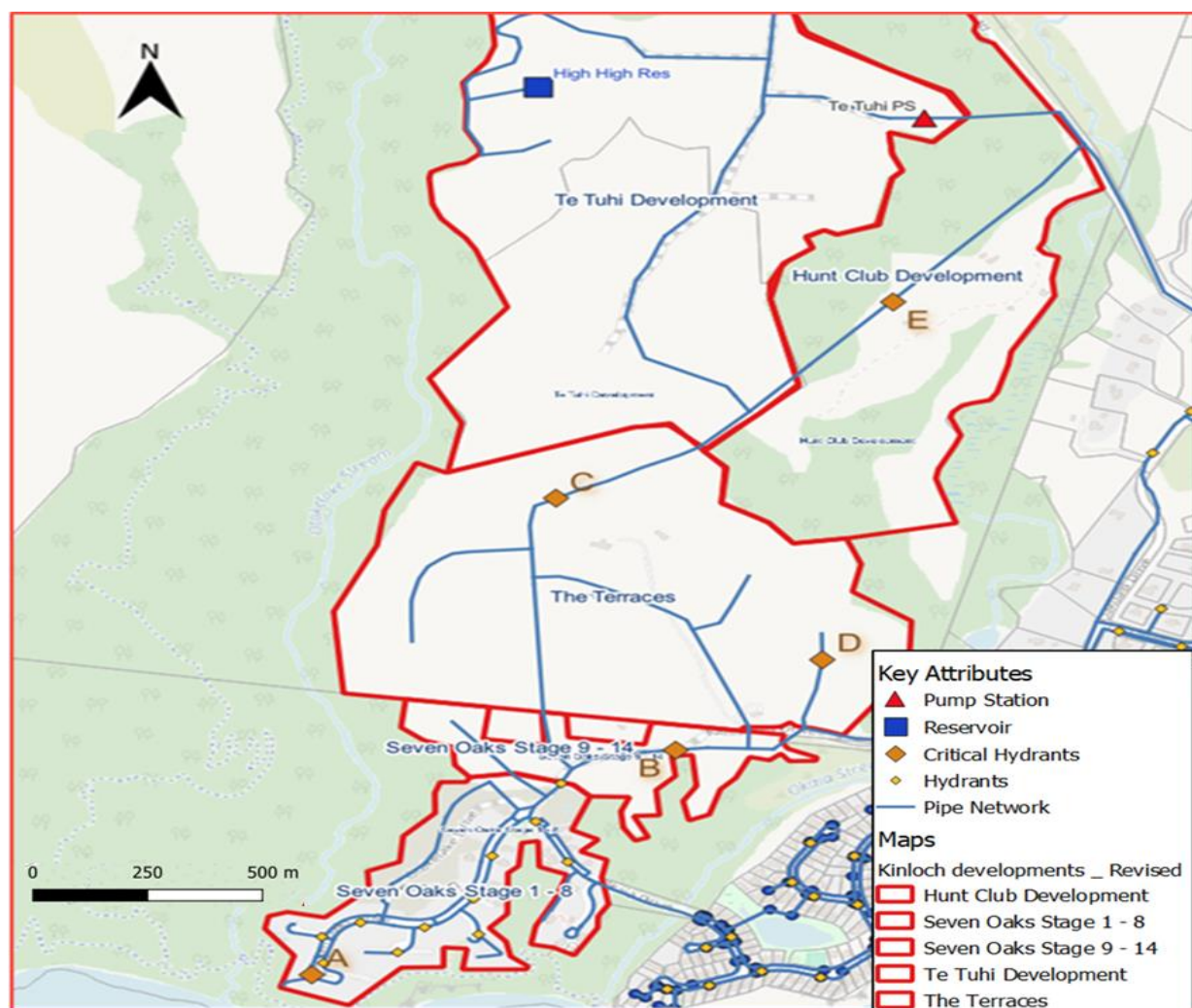


Figure 2-9 : Hydrants Tested (A to E) for Fire Flow Availability Within Each Development

2.5.2 METHODOLOGY

To verify the network's ability to meet fire flow requirements, an exceptional flow of 25 L/s for 30 minutes at the 60% peak day demand was simulated at all the hydrants shown in Figure 2-9. This assumption is based on the condition that if these critical hydrants maintain the minimum residual pressure criteria under this exceptional scenario, all other hydrants in the developments will be capable of meeting the criteria.

2.5.3 HYDRANT LOCATIONS

There are four critical hydrants (A-D) that have been chosen for this scenario. These hydrants represent the most critical points in the network due to their location and elevation, making them particularly susceptible to insufficient pressure during fire events. Further analysis and investigation will be focused on these hydrants to ensure adequate fire protection throughout the developments.

2.5.4 FIRE FLOW RESULTS

Table 2-7 shows the fire flow results of the critical hydrants within Seven Oaks, the Terraces, and Hunt Club in Scenario 3.

Table 2-7 : Simulation Results for Fire Flow Analysis Under Scenario 3

Hydrant	Hydrant ID	Exceptional demand/ required fire flow (L/s)	Residual pressure (m)
A	SO_03	25	22
B	SO_02	25	45
C	TS_01	25	18
D	TS_02	25	40
E	HC_01	25	-7

As shown in Table 2-7, critical hydrants in Seven Oaks and the Terraces meet FW2 specified criteria, however, HC_01 in Hunt Club does not meet the criteria. The failure of the hydrant in the Hunt Club land is not of concern due to its location in the rural residential environment where FW2 criteria is not required.

During the fire flow scenarios (when each hydrant is tested for exceptional demand), the headloss of the supply pipes increases and exceeds the acceptance criteria. However, this is only during the 30-minute duration of the simulated fire flow event.

Appendix A contains the graphical representation of residual pressure for the identified critical hydrants (A-E).

3 CONCLUSIONS

The hydraulic performance of the development areas - Seven Oaks, Terraces, Te Tuhi, and Hunt Club was evaluated, based on the proposed staging, and projected demand as detailed in the Stage 1 report.

The findings from the analysis are summarised below:

- Proposed PRV Locations for Seven Oaks and The Terraces to resolve the high pressure in the Seven Oaks and the Terraces developments are shown in the Table below:

PRV ID	PRV Setting (m)	Furthest Node ID	Pre-Installation Min Pressure (m)	Post Installation Min Pressure (m)
PRV 1	60	62	76	34
PRV 2	35	64	67	33
PRV 3	30	60	77	30
PRV 4 (CLOSED VALVE in the current model)	N/A	TT5	56	N/A
PRV 5	58	20230523081416	95	46

- The network within the Southern part of Lochridge is now connected to the boosted network, which has increased the average pressure for this part of the network from 55m to 100m, and minimum pressure from 43m to 95 m., and maximum pressure from 67m to 108m. In the future this section could be rezoned on to the gravity part of the network or a PRV valve utilised to reduce maximum pressures to within LoS criteria.
- It is recommended that the developer confirms property elevations during detailed design to verify modelled LoS and network pressures.
- A DN180 PN16 pipe is required to meet LoS and supply the Hunt Club land from the Terraces.
 - The analysis concluded that with the updated linkages from Terraces through Hunt Club land, all development areas including Seven Oaks, the Terraces, and Hunt Club meet the minimum pressure requirements in all scenarios.
 - Maximum unit head losses for the pipes within the development, meet the TDC LoS limits.

- All critical hydrants within Seven Oaks and the Terraces meet the FW2 criteria, based on the fire flow modelling assessment.
- The Lochridge and Hunt Club areas do not meet the FW2 criteria, however, these two areas are classified as rural residential and are not required to meet this specification. The NZFS code of practice states that the firefighting water supply in a reticulated area should meet the fire classification of FW2 for residential properties located in urban fire districts and it is to be used as a guidance in rural areas. The TDC CoP for Development of Land states *'that for water supplies in rural areas there is no requirement to provide for fire-fighting in the network design. However it is recommended that fire appliance access and adequate onsite storage is provided, or a sprinkler system installed to meet the rural recommendations of SNZ PAS 4509:2008'*.

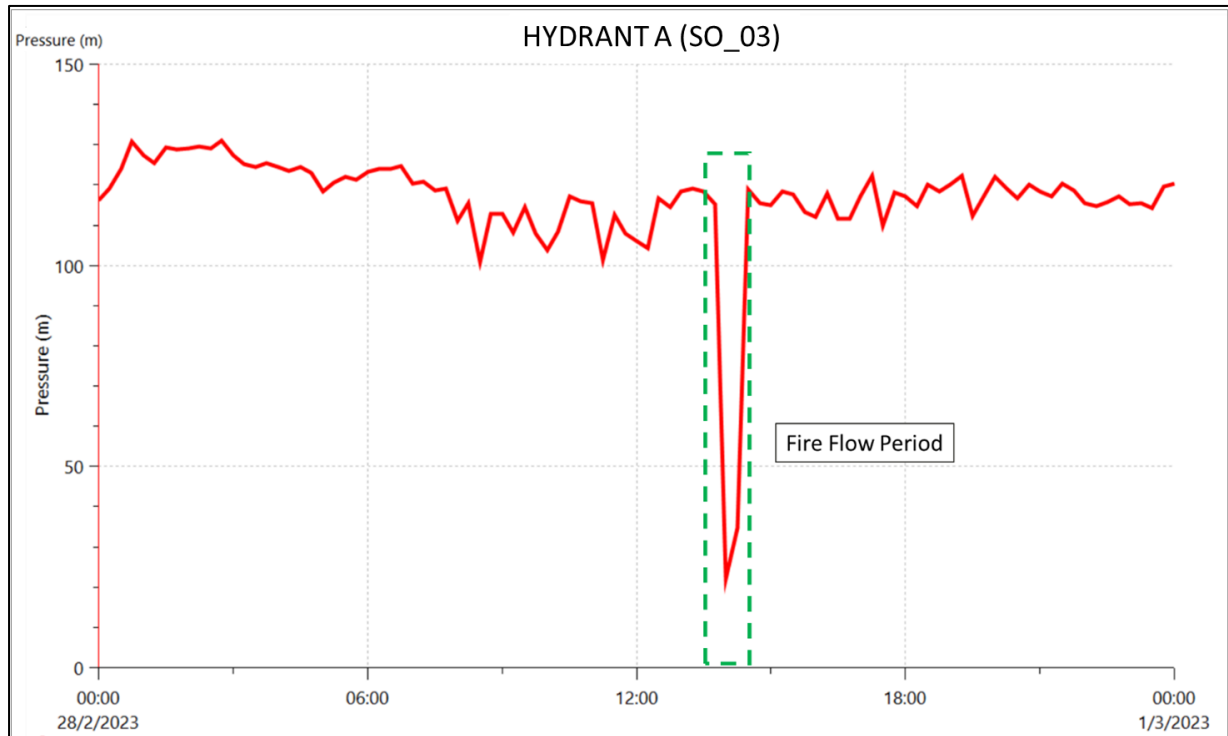
4 LIMITATIONS

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for Taupō District Council ('Client') in relation to investigate if the existing water supply network is capable of meeting the LoS and fire flow requirements for the next stage of proposed Seven Oaks development, and in accordance with the Offer of Service – Kinloch Seven Oaks dated 2nd October 2023. The findings in this Report are based on and are subject to the assumptions specified offer of services dated 2nd October 2023. WSP accepts no liability whatsoever for any use or reliance on this Report, in whole or in part, for any purpose other than the Purpose or for any use or reliance on this Report by any third party.

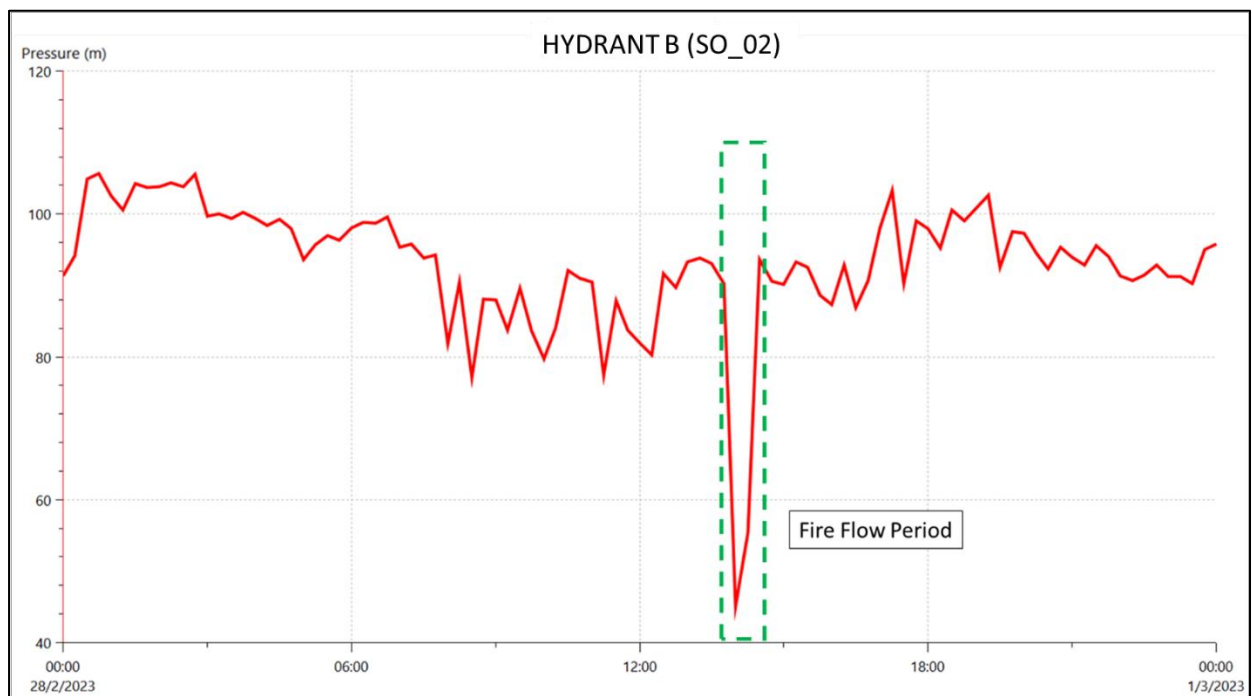
In preparing this Report, WSP has relied upon data, surveys, analyses, designs, plans and other information ('Client Data') provided by or on behalf of the Client. Except as otherwise stated in this Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable for any incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented, or otherwise not fully disclosed to WSP.

Appendix A

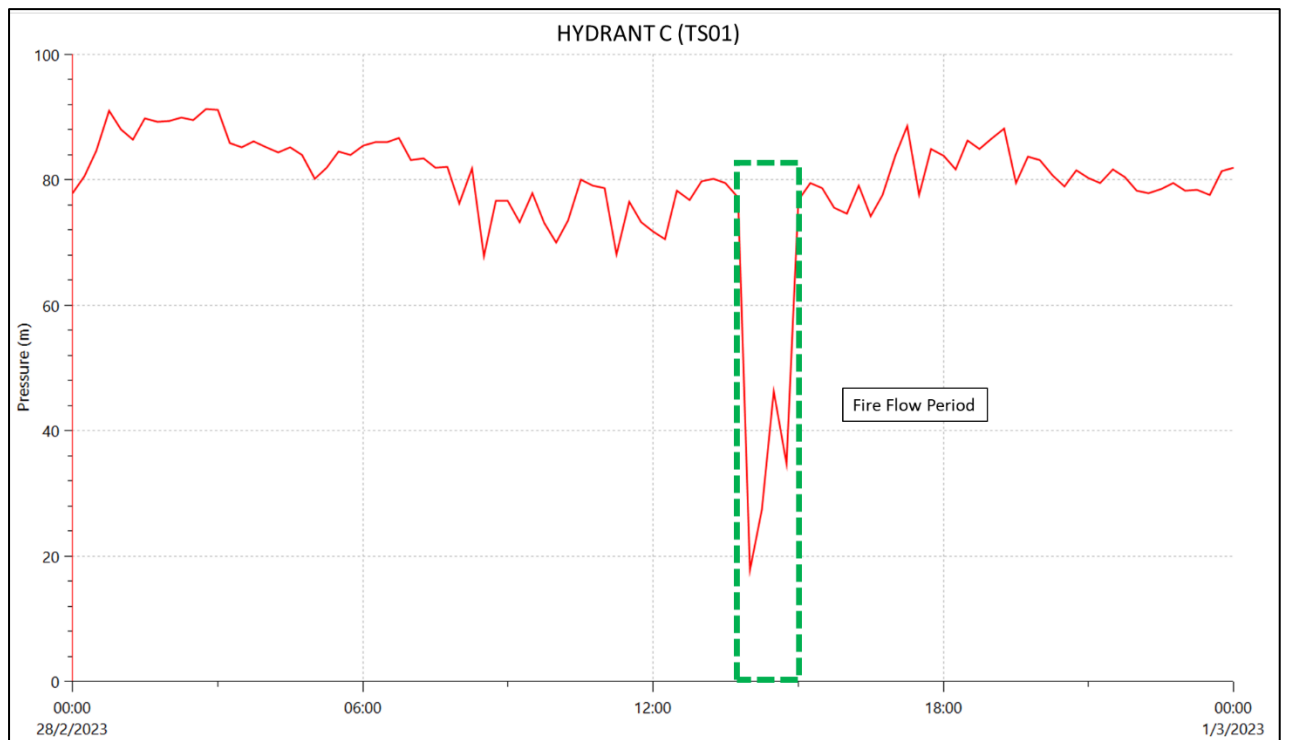
Fire flow results



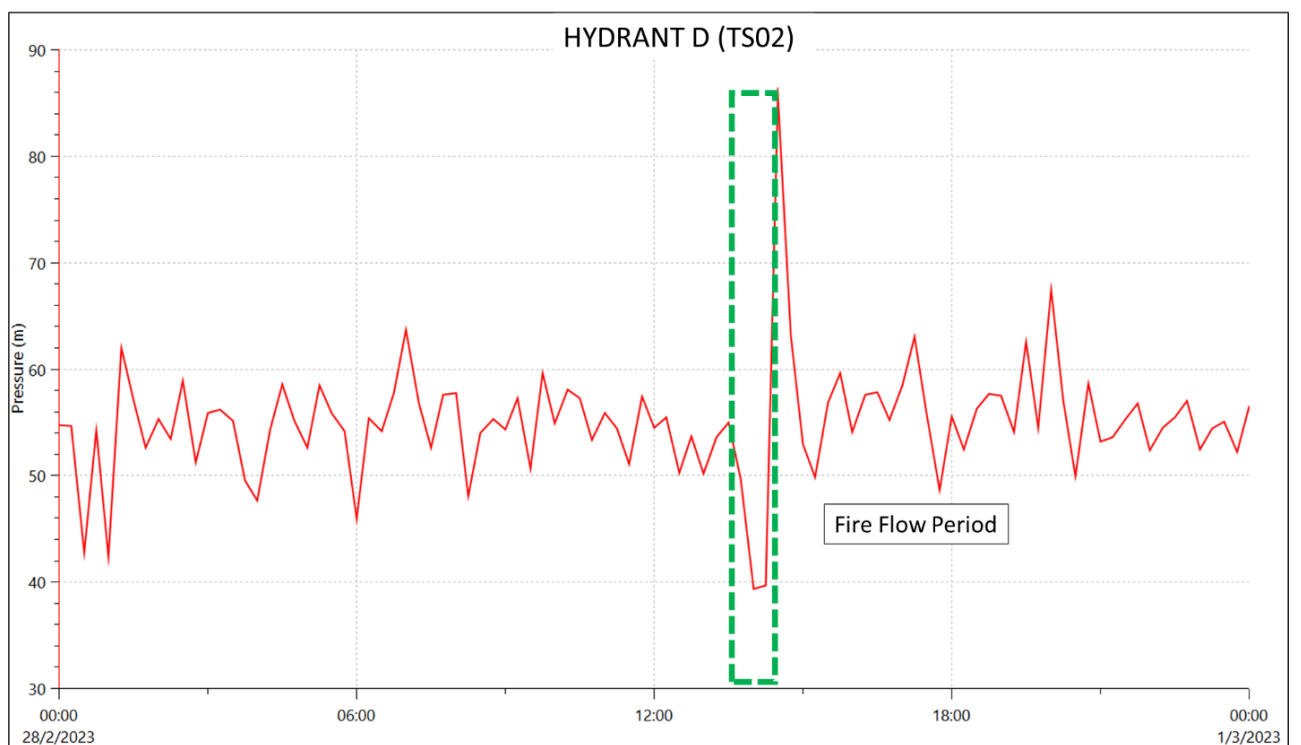
Residual pressure at Critical Hydrant A



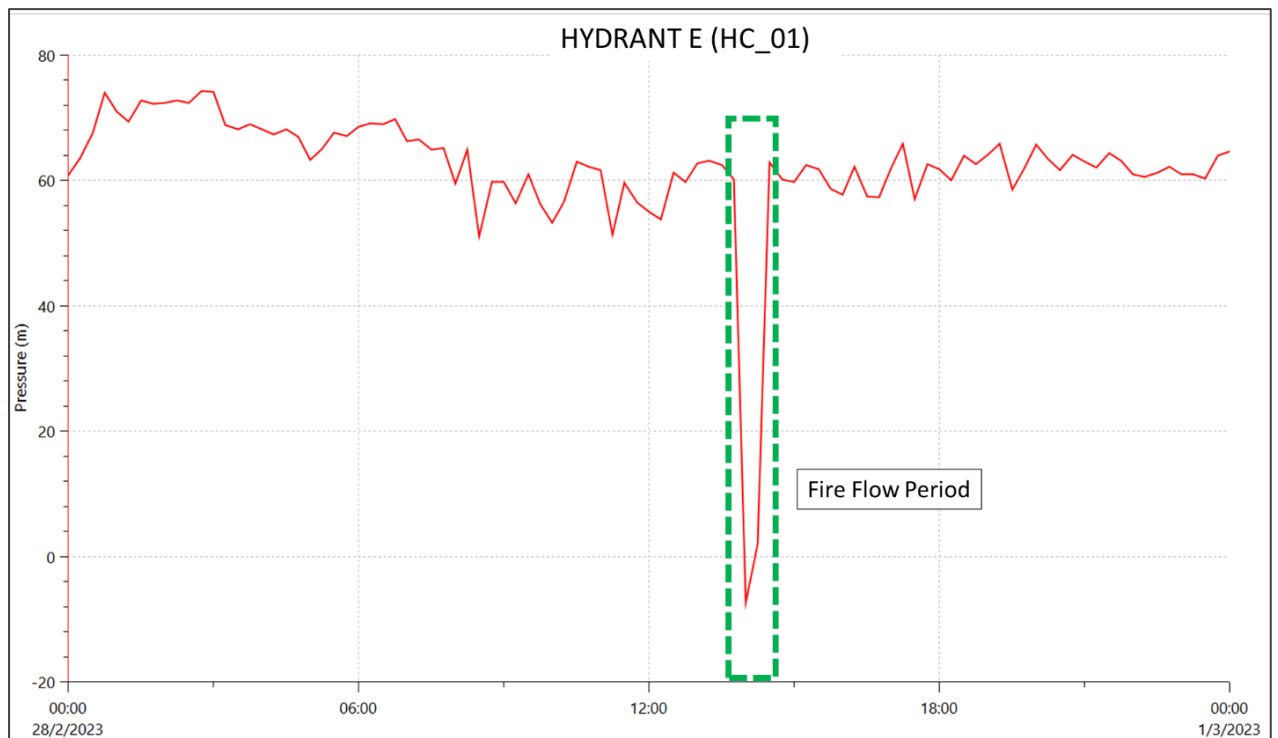
Residual pressure at Critical Hydrant B



Residual pressure at Critical Hydrant C



Residual pressure at Critical Hydrant D



Residual pressure at Critical Hydrant E