BEFORE THE HEARINGS PANEL
FOR THE CENTRAL OTAGO DISTRICT PLAN

UNDER	the Resource Management Act 1991
IN THE MATTER OF	Plan Change 19 to the Central Otago District Plan
SUBMITTERS	**S Davies**

EVIDENCE OF RICHARD ANDREW FORD

Dated 16 May 2023

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1.0 Qualifications, Expertise & Disclosure

1.1 My full name is Richard Andrew Ford and I am a Licensed Cadastral Surveyor at Landpro Limited in Cromwell. This is a position I have progressed towards within the company since beginning as a graduate in 2012.

1.2 I hold a Bachelor of Surveying with First Class Honours (2013) as conferred by the University of Otago. I am also a voting member of Survey and Spatial New Zealand (MS+SNZ) and possess a license to undertake cadastral surveys as issued by the Cadastral Surveyors Licensing Board of New Zealand in 2017 and annually since.

1.3 My recent project work involves advising on and undertaking a number of residential and rural subdivisions across the Lower South Island. This includes preparing resource consent applications, undertaking engineering design, construction management and cadastral surveying.

2.0 Code of Conduct

2.1 I have read the Code of Conduct for Expert Witnesses within the Environment Court Consolidated Practice Note 2014 and I agree to comply with that Code. This evidence is within my area of expertise, except where I state I am relying on third party information. To the best of my knowledge I have not omitted to consider any material facts known to me that might alter or detract from the opinions I express.

2.2 Furthermore, I aim to uphold the principles and ethics of the Survey and Spatial New Zealand and adhere to their associated Code of Conduct.

3.0 Involvement in Project

3.1 I am very familiar with the project, with my first direct involvement being to develop the detailed design of both Stages I & II of the Lynn Lane Subdivision, which I detail shortly. I visited the site on a regular basis during the design and construction of Stage I.

3.2 The Stage II Consent was subject to Environment Court proceedings before a resource consent was issued. I presented expert evidence during this process to address topographic mapping, provision of services and earthworks.

3.3 Recently I have been involved with implementation of this Stage II project. Approval pursuant to section 223 of the Resource Management Act was certified by Central Otago District Council on 7 November 2022.

4.0 Scope of Evidence

4.1 My statement provides an overview of the proposal and assesses whether the area the Submitter seeks to be zoned LLRZ (the Relief Area) can be adequately accessed and serviced for infrastructure.

4.2 My evidence addresses the following:

- Description of the site, proposal and project background.
- s42A report / Bannockburn servicing notes
- Overview of existing access and servicing
- Address the servicing of the previous and current subdivision and proposed residential zone including provision of suitable access, reticulation of services being; potable water supply, firefighting water supply, wastewater disposal, electricity and telecommunications.

Documents Reviewed

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4.3 In preparing this statement I have reviewed the following documents:

- NZS4404:2004 New Zealand Engineering and Subdivision Standards

- 2008 Central Otago District Council Addendum to NZS4404:2004
- Resource Management Act 1991
- Operative Central Otago District Plan 2008
- Plan Change 19 of the Central Otago District Plan
- s42A Part 2 Report – authored by Liz White
- s42A Part 2 Engineering Report – authored by Julie Muir
- s42A Part 2 Appendix 2 – Rationale Cromwell Yield Assessment
- RC 160312 ('Stage I Consent') and associated reporting
- [2017] NZEnvC 193 ('Stage II Consent') and associated reporting
- My evidence for the Environment Court proceeding concerning the Stage 2 consent, dated 12 June 2017
- 2017 Site Specific Water & Wastewater Network Modelling undertaken by Rationale Limited on behalf of CODC

5.0 Executive Summary

5.1 The subject site is 16.7732ha at the southern edge of Bannockburn located on Lynn Lane. It consists of several parcels of land held in an amalgamated record of title (785688). 1.89Ha of the land is zoned RRA(4) under the Operative District Plan (ODP) with the balance of the land is zoned RU. An approved Environment Court decision (Stage II Subdivision) to allow 4 residential allotments on some of this RU zoned land is currently being implemented.

5.2 Under the Plan Change 19 (PC 19) framework, the entirety of the subject site is proposed to be zoned RU. However, Ms White's s42A part 2 report recommends reinstatement of the same 1.89Ha of currently zoned RRA(4) land to LLRZ with a minimum lot size of 2000m² under PC 19.

5.3 In a departure from PC 19 framework, submission #147 seeks to have the LLRZ zone applied to the consented Stage II subdivision area. The immediately adjacent land to the South is also sought to be zoned as LLRZ, with appropriate BLR

restrictions, in exchange for the aforementioned 1.89Ha of RRA(4) land which is utilised as productive vineyard.

5.4 It is considered from an infrastructure perspective, that the proposed relief does not introduce additional load on the network capacity beyond that already accounted for in Council's infrastructure planning. This is due to the equivalent area of land recommended to be zoned LLRZ in the s42A part 2 report being proposed to be exchanged due to its productive value.

5.5 The 2021 Cromwell water and wastewater supply scheme boundary is not coincident with the current RRA(4) boundary. Therefore, the recommended reinstatement to LLRZ in the s42A part 2 report will necessitate extraordinary connections to the network on the subject site.

5.6 In a similar manner to that operative RRA(4) zoning recommended in Ms White's s42A part 2 report to be reinstated under PC 19 to LLRZ, the Relief Area also sits outside the 2021 scheme boundary necessitating extraordinary connections.

5.7 The equivalent supply scheme boundaries in 2015 were also not coincident with the zone boundary, necessitating extraordinary connections to be required for Stage I & II subdivision. Extraordinary connections to Council's network are able to be accommodated, subject to additional scrutiny and meeting certain criteria to receive approval of the Chief Executive.

5.8 Water and wastewater network modelling was undertaken in 2017 to facilitate such connections for Stages I & II subdivision. This resulted in significant upgrades to the water reticulation network to rectify previously deficient firefighting capacity in the existing network. It also identified network capacity at that time for wastewater disposal, which was achieved through a private pumped sewer system. With only a pressure pipeline and backflow prevented boundary kit vested in Council, it helps provides attenuation of peak flows and provides emergency storage before discharge into the network assisting with addressing fundamental wastewater capacity constraints.

5.9 Considering the currently applicable access standards in Bannockburn, the proposed relief can be availed compliant legal and formed access upon subdivision. Based on my experience in nearby developments in Bannockburn, I am also of the belief that stormwater disposal, electrical reticulation and telecommunications can be dealt with adequately and will be assessed in appropriate detail by Council for engineering adequacy upon subdivision.

5.10 For the reasons considered above, I am of the opinion that infrastructure is not an impediment to the proposed rezoning of the Relief Area due to the influence of the Exchange Land offered, the level of capacity provided upon Stage II subdivision and the opportunity for appropriate future assessment for engineering adequacy upon subdivision

6.0 Proposal Background

6.1 The land subject to this submission is located on Lynn Laneand is shown in a general sense upon Figure 1 below. The land is legally described as Lot 50 DP 511592 (‘Lot 50’), Lot 51 DP 511592 (‘Lot 51’), Lot 5 DP 452123 and Lot 6 DP 452123 as held in Record of Title 785688, which are amalgamated with Lots 50 and 51.

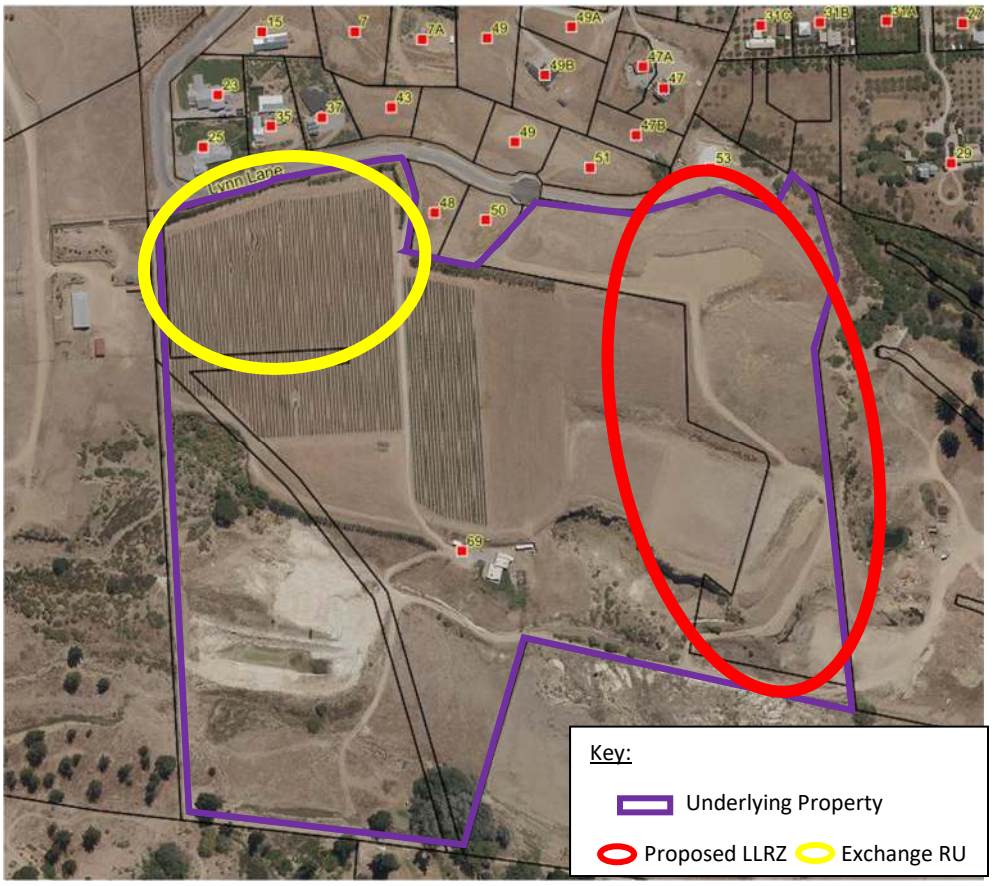

Figure 1: Location Overview Plan, (Source: CODC GIS)

6.2 S Davies has made a submission on PC19 concerning the land. The Submission seeks a Large Lot Residential zoning (LLRZ) for the eastern part of the land, as broadly depicted in Figure 1, above. This LLRZ area would encapsulate land that has been consented for residential use under the Stage II Consent, and would also extend the residentially zoned area to the south to include an additional area of approximately 2 hectares that is presently zoned Rural, also as broadly depicted in Figure 1.

6.3 The balance of Lot 50 following completion of Stage II subdivision is approximately 2 hectares and consists of most of the area proposed for residential extension. For practical purposes, this will include some small areas of Lot 51 due to the existing dog leg boundary layout.

6.4 The inclusion of this additional 2 hectare area would effectively transpose or exchange the operative RRA(4) zoning that applies to the western part of land the land (part of Lot 51), which is presently used for productive purposes (a vineyard), as shown in in Figure 2, below.

Figure 2: ODP Zoning, (Source: CODC GIS)

6.5 The relief would see this vineyard area zoned Rural, in recognition of its existing productive use, while the north eastern area would be zoned LLRZ, in recognition of its consented residential use, and the 2ha extension would provide for further residential growth.

6.6 Additionally, a building line restriction is suggested to overlay the proposed LLRZ land to ensure minimal affects of built form on the surrounding landscape and heritage features.

6.7 In my evidence I refer to the area proposed to be rezoned as LLRZ (i.e., the Stage II Consent area plus the 2ha extension) as the 'Relief Area', and the vineyard area that is zoned RRA(4) in the Operative District Plan, but proposed to be zoned Rural by the submission, as 'the Exchange Area'. I note that the section 42A report writer,

Ms White, recommends a LLR zoning for the Exchange Area and part of the Relief Area (being the part within the operative RRA(4) zone, para 115 of her report).

6.8 Attachment A depicts clearly the areas described above and shown in a general sense in figures 1 & 2.

Previous Consents

6.9 A company associated with the Submitter, Rubicon Hall Road Limited, has been involved in the subdivision and development of the Lynn Lane Residential area since 2008.

6.10 A 5 lot residential subdivision and extension of Lynn Lane was initially undertaken, followed by the establishment of walking access towards School House Road.

6.11 Subsequent extension of the Lynn Lane residential area into the current cul-de-sac head was initiated in 2016, with that particular development being split into two stages (Stages I and II) on account of the current RRA(4) boundary intersecting the development site.

6.12 Stage I provided for the creation of 6 lots in accordance with RC 160312 decision dated 25 October 2016. Stage I attained certification pursuant to section 224c of the Resource Management Act 1991 on 24 August 2017. Dwellings have since be established on 5 of the lots.

6.13 Stage II was subject to Environment Court proceedings, ([2017] NZEnvC193) with a decision issued on 30 November 2017 confirming subdivision and landuse consent for four lots. The subdivision consent is presently being implemented, with certification pursuant to section 223 of the Resource Management Act 1991 provided by CODC on 7 November 2022.

6.14 As noted above, a staged approach was applied to the 2016 development due to the presence of the RRA(4)/RU zone boundary line intersecting the development site. All allotments contained wholly within the RRA(4) zone were consented as

part of Stage I, with Stage II representing those allotments affected by the zone boundary interface. Please refer to Attachment B for Stage II consent plans that clearly show Stage I and the area of RRA(4) Exchange Land.

7.0 Servicing at Bannockburn and Section 42A Report – General Comments

7.1 Bannockburn presently suffers from network capacity constraints as outlined in Ms Muir's infrastructure report. Ms Muir also clearly highlights that uncertainty in funding, responsibilities and required standards exist for all parties due to Central Government intervention, limiting the ability to upgrade or replace suboptimal components of the network.

7.2 Despite those constraints detailed in Ms Muir's report, CODC is obliged to provide adequate services to those areas currently zoned RRA(4) (in the Operative Plan) and within the boundaries of the Cromwell water and wastewater supply scheme.

7.3 In this regard, a number of infrastructure upgrades are planned for commencement with funding in place as detailed in Ms Muir's infrastructure report. A relevant example of this is the upgrade of the Bannockburn water supply trunk main between 2024 and 2026. These upgrades are required to accommodate projected load of the PC 19 zoning and Cromwell Masterplan, ensuring network capacity has been adequately future proofed for anticipated growth in the Cromwell ward.

7.4 The basis of infrastructure planning is a broad scale approach rather than analysing individual landholdings according to site specific factors. Consequently, the development potential of an individual site often varies significantly from modelling parameters used, such as those found in the Rationale Cromwell Yield Assessment Model (s42A Part 2 Appendix 2).

7.5 Subdivision and land development in the Central Otago District is guided by NZS4404:2004 and CODC's 2008 addendum, which I note are outdated with

respect to industry practice. In many other jurisdictions the revised NZS4404:2010 is applied, which in itself is a 13 year old standard. In due course, the engineering standards applied in Central Otago will likely be updated. Considering this, development of much of the land subject to PC 19 could in fact be subject to a revised set of engineering standards and guidelines.

7.6 Therefore, many engineering aspects that may apply today should not necessarily be considered an impediment to a rezoning proposal, as future development of any rezoned land will be subject to detailed and appropriate scrutiny at the time of future development (resource consent, engineering approval, certification, etc.). This aspect is clearly articulated in para 85 of the s42A Part 2 report with respect to the Domain Road site.

7.7 Moreover, issues of design are matters that can properly be resolved at the time of subdivision consent. As an example, ensuring that an adequate width of road reserve or easement corridor is possible and available for future upgrades is important with respect to PC 19, whereas the detail relating to that future upgrade is to be assessed for engineering adequacy upon subdivision.

7.8 Market conditions often dictate the timeframe associated with implementation and feasibility of individual projects. Rather than zoning decision being solely based upon current day servicing constraints, this allows the ability for CODC to apply the current engineering framework in its assessment upon subdivision and presenting opportunities for cost sharing and targeted DC's to continue to maintain and future proof their network capacity.

7.9 The Rationale Cromwell Yield Assessment (s42A Part 2 Appendix 2) prepared for CODC to assist in determining if PC 19 and some private plan changes provide sufficient capacity for forecasted growth in the district highlights one of the key aspects influencing network capacity in Bannockburn. This assessment states that

88% of sites in Bannockburn are small brownfield sites, or less than 2 x the proposed minimum lot size prescribed within LLRZ by PC 19. This suggests that the density proposed by the LLR zone is extremely unlikely to be fully realised. The assessment recognises such by assigning 2% as the feasibility allowance in its methodology.

7.10 Current Cromwell Water and Wastewater Scheme Boundaries are shown in the Development and Financial Contributions Policy of 1 July 2021. These boundary locations have been revised from those discussed in the Environment Court for the Stage II Consent area and modelled in 2017 Rationale modelling on behalf of CODC.

7.11 This scheme boundary revision in 2021 consolidated the boundaries of each of the wastewater and water supply schemes. Previously these scheme boundaries were not coincident.

7.12 CODC possess the hydraulic models of its network and commission modelling as required. New hydraulic models for both water and wastewater are yet to be delivered to account for the PC 19 zoning and Cromwell Masterplan. Therefore, for the purposes of my assessment, I am reliant upon 2017 data relating to this particular site.

7.13 In the sections of my evidence that follow I assess the ability to provide suitable access to and service the Relief Area for infrastructure.

8.0 Access

8.1 As a general comment, access in Bannockburn exhibits a hybrid approach to application of road standards. Despite providing access to an area of primarily residential land use, roads are considered rural in nature and fall under Table 3.2 (a) of CODC's Addendum, as opposed to Table 3.1 – Urban (refer Attachment C for these road design standards). Bannockburn and Hall Roads are particularly

obvious examples of this, in that they are designed to rural road standards yet service residential areas.

8.2 When driving around Bannockburn, the most tangible example of the rural road standard this is that roads are devoid of kerb and channel found throughout nearby Cromwell, noting the exception of some short stretches where this has been installed due to steep longitudinal gradients.

8.3 In terms of the Relief Area, roads providing access are as follows:

Road Name	Standard [Table 3.2(a)]	# Lots [Table 3.2(a)]	Formation Width	Legal Width	Footpath
Bannockburn Road	Local Sealed	300 – 500	6.50m	20m	One side
Hall Road		150 – 300	6.00m		
Lynn Lane				Varies	No

Table 1 – Summary of Road Standards to Access Subject Land

8.4 I note that Lynn Lane has a formation width of generally 6.0m, with some localised narrowing near Hall Road. The legal width also varies with 20m and 15m in equal measures and a short length of 12m.

8.5 The rural roads standard also applies to right of ways within Bannockburn, where each provides access capacity for a maximum of 6 Lots. Due to the topography, some stretches of right of ways are at maximum longitudinal gradients.

8.6 In terms of the Lynn Lane development, this area was developed by an entity related to the Submitter, via two Stages (Stage I and II), as I have described earlier and shown in Attachment B. Following the completion of Stage I, the complete extent of Lynn Lane, which terminates in a cul-de-sac turning head, was vested in CODC. Access to Stage II (currently underway) is to be provided by means of Right of Way.

8.7 Stage I included a right of way to access Lot 11 DP 511592 which was approved by CODC and constructed. This also provides access to Lot 10 on Stage II. A second right of way, also constructed upon Stage I, provides access to Lot 5 DP 511592.

8.8 These rights or way are formed to a rural standard, consistent with the standard generally adopted for Bannockburn, as I have described earlier.

8.9 This rural design standard is greater than that necessary to service residential allotments and allows for adequate access to the adjacent rural land that is owned by the Submitter, which includes the Relief Area located at the terminus of the right of way. While the right of way required to access Stage II will provide access to four lots, the standard of design means that it is suitable to provide access to six lots (i.e., two additional lots), which could be two lots that could be established under a LLR zoning in the Relief Area. The requirements for establishing this right of way, including the standard of formation and matters of design, were assessed as part of the Environment Court approved Stage II consent.

8.10 In terms of detail, in accordance with the Council's right of way design standards listed in Table 3.2 (a) of the CODC addendum, the Stage I and II right of ways consist of a 4.5m formed width within a 10m wide easement parcel.

8.11 Consent conditions require the completed right of ways to be formed with a two coat chipseal and 4% single cross fall. Provision of a metalled 0.25m shoulder on the uphill side and a 2.5m berm on the downhill side allows for location of services and assists in stormwater management. A typical cross section of such formation is shown in Appendix D being plan 17166_06_Typical_ROW_Section (Drawing no. 06_01).

8.12 Due to the steep nature of the natural terrain in this area, the right of way formations providing access to Stage II have sections of maximum longitudinal gradient at 16%. Table 3.1 and 3.2(a) both list 16% and 16.7% as the appropriate maximum

grade to be applied respectively. This coincides with the recommendation of a 16% gradient to ensure suitable access for a fire appliance.

8.13 The steep existing right of way providing access to Lot 11 DP 511592 has been designed, constructed and approved in the manner described above, with the right of ways required for Stage II currently implementing the same methodology.

8.14 I note that the portions of rights of way that approach the maximum gradient are used for transit only, with vehicle crossings departing the formation from areas of flatter gradient only. Due to the rural design standards and intent of the right of way, no footpath is provided.

8.15 The area of steeper longitudinal grade reduces the extent of cut to create suitable access, minimising the effects on natural landform and assisting in maintaining slope stability. Cut batters of 1:2 have been applied to both Stages I and II with revegetation to prevent scouring during any rainfall events.

8.16 The location and geometry of the roading within the development area also plays an important role assisting in stormwater management and caters for the secondary flow path during significant storm events.

8.17 Streetlighting is present on Lynn Lane (having been provided during Stage I), however no right of ways are illuminated. The slow design speed applied to the right of way and use of headlights by vehicles to negotiate the accessway during the hours of darkness allow this as an acceptable outcome.

8.18 Upon completion of Stage II, Lynn Lane will provide access to 20 allotments, which as a cul-de-sac, would have reached capacity under the Council's urban road standards, (Table 3.1 of the CODC Addendum). Under this scenario, any further development that is accessed from Lynn Lane would require upgrade of the existing formation of Lynn Lane to the standard of a residential local in the Table 3.1.

8.19 If the Relief Area were to be accessed via Lynn Lane (noting my earlier comments that the right of way accessing Stage II is physically suitable for accessing an additional two lots) this would mean that a road width of 8.5m is required to an appropriate distance in accordance with Table 3.1 of the CODC Addendum.

8.20 However, as I have detailed earlier (para 8.1), rural road standards, Table 3.2(a) of CODC's Addendum, have generally been applied in Bannockburn. I consider that upgrading Lynn Lane to an urban standard would be inconsistent with the rural standard generally adopted for Bannockburn and consider that a 6.0m carriageway is likely to be suitable to access a greater number than 20 lots in the same manner as Hall Road.

8.21 Recent construction of Lynn Lane has maintained a 6.0m carriageway within a 15m road reserve. The possibility exists to increase the legal width of the road reserve to 20m, as Lynn Lane is located immediately adjacent to land owned by the Submitter (the Exchange Land).

8.22 Access measures currently being implemented as part of Stage II allow for adequate access to two additional allotments in the Relief Area, without any upgrades to the formation being required in accordance with Table 3.2(a) of CODC's Addendum.

8.23 I note that an alternate means of providing access to the Relief Area is also possible. As stated above, the underlying land (Lot 51) has legal road frontage where Lynn Lane is of 20m width. This legal access can be provided to the Relief Areaupon future subdivision.

8.24 Without application to CODC for subdivision or removal of an amalgamation condition, this portion of the underlying land is unable to be independently disposed of.

8.25 Upon assessment for engineering adequacy at this stage, the access route may take the form of a right of way or a corridor of land to vest as road following an appropriate route.

8.26 This assessment would also detail any upgrades to the existing road network that may be required in accordance with current or future engineering standards.

8.27 Therefore, I consider that suitable access to the Relief Area is available that can comply with all applicable Council standards.

9.0 Water Supply

9.1 As the water supply scheme boundary did not coincide with the development area upon Stage I, likely for topographic and network capacity reasons, application was required to the Chief Executive for 7 extraordinary connections to the Bannockburn Water Scheme boundary to serve Lots 1 – 5, 11 & 12 DP 511592. Stage II will require 5 additional extraordinary connections to the Cromwell water scheme to service the new residential allotments (Lots 6 – 10).

9.2 In 2016 an oversight during the original development of this area of Bannockburn was discovered. The existing dN 100mmØ mPVC pipe network extending from Hall Road created too much pressure loss to adequately service the area for firefighting requirements. This resulted in an existing fire hydrant without adequate pressure available.

9.3 In order to adequately service Stage I of the development, a looped 100mmØ main was created by extending the water supply line with dN 125mmØ PE80 PN12.5 water pipe (100mmØ internal diameter) through the development and adjoining Lot 8 DP 25888 to re-join the existing dN 150mmØ PVC main in Hall Road.

9.4 Following construction of Stage I, there is sufficient pressure and flow rate of water available in the reticulated network to service Stage II. This was calculated and reported by Rationale Limited on behalf of CODC during the application process for extraordinary connections to the Bannockburn Water Supply Scheme for Lots 1 – 5, 11 & 12 DP 511592. The documentation for which is included as Appendix

E and represents a combined document to assess the capability of the network to provide for servicing of both Stages I & II.

9.5 During construction of Stage II, extension of the dN 125mmØ PE80 PN12.5 (100mmØ internal diameter) main up the Stage II right of way to access Lot 7 will provide for standard 20mm domestic water connections to service each allotment in Stage II. This 100mmØ line will terminate in a fire hydrant to meet firefighting requirements and to be in accordance with the CODC Addendum and NZS4404:2004. The installation of this infrastructure represents an physical solution to provide water supply to both the Stage II development and the Relief Area.

9.6 2017 modelling undertaken by Rationale Limited on behalf of CODC indicated insufficient residual pressure for firefighting purposes at the Stage II terminal fire hydrant. Due to the topography and relatively short distance, I consider that an additional fire hydrant within 135m is likely to also provide sufficient pressure to cover the Relief Area and can be assessed for engineering adequacy upon subdivision and application for extraordinary connections to the network.

9.7 Ms Muir raises concerns around the firefighting storage volume afforded by the Bannockburn reservoir. In this instance, due to the large section sizes and being located on the rural border, an alternative means of fire suppression could be appropriate, such as private provision of static storage with approved couplings. This is a matter that can be explored in sufficient detail upon subdivision with alternative approaches, such as installation of sprinkler systems, or provision of on site storage, accepted by Fire and Emergency New Zealand where appropriate.

9.8 Following extensive upgrades to the water supply network required upon the Stage I subdivision and approval of extraordinary connections to the network, it is considered that water supply in the vicinity of Lynn Lane is sufficient for potable and firefighting supply purposes. The Relief Area will hence have supply adjacent to its boundary and detailed design and approval for engineering adequacy of this

area would be assessed upon future subdivision and application for extraordinary connections to the network.

10.0 Stormwater Management

10.1 An investigation into the soakage rates across the development site was undertaken during construction of Stage I with reference to each of Lots 1 – 5, 11 & 12 DP 511592 in addition to areas of road and right of way construction. Two distinct material types were found during this investigation and suitable locations for discharge from these soakpits determined.

10.2 The aforementioned investigation was undertaken by myself and Mr Christian Mans (Geotechnical Engineer formerly employed at Landpro Limited) on 10/02/2017 with the report and calculations prepared by Mr Mans appended as Appendix F.

10.3 Subject to the conditions and consistent material types encountered on site while undertaking Stage I earthworks, I consider it reasonable to assume that similar conditions will be found throughout Stage II and the Relief Area. Specific details can be dealt with upon subdivision and assessment for engineering adequacy.

10.4 Stormwater runoff generated by each of the new allotments of Stage II is to be disposed of by soakpit constructed on site. Stormwater generated by the right of way surface will be diverted to the road shoulder and drained to discharge via soakpit in the same manner as approved for Stage I.

10.5 The Relief Area is able to be subject to the same conditions, with additional land available to construct larger soakpits on the rural balance parcel and secured by easement should less favourable conditions be encountered than found for Stage I.

10.6 The secondary flow path established during Stage I is not affected by the Stage II development and will also provide for secondary flows from the majority of the Stage II development. The remaining Stage II runoff will flow into the relief area

and can be managed appropriately without creating additional risk to people or property. Any resultant overland flow paths created by development of the Relief Area will not affect these earlier stages. Again, this matter can be dealt with in detail upon assessment for engineering adequacy upon subdivision when an appropriate secondary flow path is identified.

10.7 Therefore, due to the presence of material with favourable soakage rates found across the wider area , stormwater disposal is likely to be consistent with most of Bannockburn and able to be adequately managed via soakpit and establishing appropriate secondary flow paths.

11.0 Wastewater

11.1 As the wastewater scheme boundary did not coincide with the development area upon Stage I, likely due to the influence of the topography, application was required to the Chief Executive for 2 extraordinary connections to the Bannockburn Wastewater Scheme boundary to serve Lots 4 & 5 DP 511592. Stage II also requires 5 additional extraordinary connections to the Cromwell wastewater scheme to service the new residential allotments (Lots 6 – 10).

11.2 In 2017 it was established that sufficient remaining capacity was present in the existing wastewater reticulation network, as calculated and reported by Rationale Limited on behalf of CODC. This work was commissioned as part of the extraordinary connection application process for Lots 4 & 5 DP 511592. The report and calculations of Rationale Limited are included as Appendix G and represent a combined report to assess the capability of the network to provide for servicing of both Stages I & II.

11.3 A private pumped sewer main was the preference for this development due to the difficulties in achieving a gravity system to one location which would then subject CODC to ongoing operational and maintenance costs. This system involves vesting of only a pressure pipeline in CODC and privately owned pump and

temporary storage systems connecting to the pressure pipeline by means of a boundary kit with backflow prevention.

11.4 The installation of further infrastructure consisting of a dN 63mmØ PE80 PN12.5 (50mmØ internal diameter) system and boundary kits represents an appropriate solution to service each of the new allotments of Stage II and the Relief Area for wastewater.

11.5 This pressure system currently discharges into a manhole with a dN 150mmØ uPVC PN12.5 pipe size at its outlet, which is the same size as the remaining wastewater network downstream in Bannockburn.

11.6 I consider it likely that the lack of ability to service the area with a gravity system was the primary contributing factor for the 2015 Outer Cromwell Wastewater Scheme Boundary to not be coincident with the zone boundary.

11.7 While the Rationale modelling is from 2017 and recent development will have increased the outflows of the network, there are two factors that suggest the Relief Area is able to be adequately serviced.

11.8 Provision of private pumped sewer is necessary regardless of the finished level of any proposed dwellings. This allows flexibility in building location and the provision of such a system allows attenuation of peak flows and emergency storage in advance of discharge into the CODC network.

11.9 The Exchange Land, which was captured by the Outer Cromwell Wastewater Supply Scheme Boundary in 2015, will not contribute additional outfalls give the Exchange Land will revert to a Rural zoning, and thus will not be enabled to residential development. I do note that this area of exchange land now sits outside the 2021 Cromwell Wastewater Scheme Boundary, but it has been recommended for inclusion in the PC 19 zoning by Ms White's s42A report. I address this is further detail shortly.

11.10 In a practical sense, extension of the Stage II dN 63mmØ PE80 PN12.5 (50mmØ internal diameter) system and boundary kits to service the Relief Area is feasible with only a minor change in elevation between Stage II and the Relief Area. This may necessitate an additional scour valve being installed and vested in Council, which can be addressed upon assessment for engineering adequacy upon future subdivision and application for extraordinary connection to the network.

12.0 Electricity & Telecommunications

12.1 Electricity and Telecommunications are designed by third parties and investigation undertaken for Stage I and II indicate sufficient capacity is available.

12.2

Design plans for electrical reticulation were produced for Stage II in 2017. Transformer locations and existing zoning indicate that extension of the electricity reticulation network to cover the Relief Area is possible.

12.3 The ultra-fast broadband rollout by Chorus has been undertaken in Bannockburn, resulting in fibre optic cable being available within a feasible distance to retrofit to the Relief Area. Alternately, wireless coverage is also available.

Relevance of Exchange Land

12.4 Ms Muir's report suggests that there are infrastructure capacity constraints to rezoning additional residential land at Bannockburn, wastewater constraints in particular.

12.5 While that may be so in a general sense, the Submitter's proposal does not seek to rezone new land, but to transpose an area zoned for residential purposes under the Operative District Plan, with an area that is not presently zoned for these purposes, and to zone land that is already consented for residential activity, for which infrastructure servicing has previously been assessed and development underway.

12.6 In terms of the latter, for the consented area – the Stage II Consent – infrastructure servicing has already been comprehensively investigated and assessed as part of the consent process, including upgrades undertaken upon Stage I, as I have detailed in the previous sections of my evidence. Rezoning this area from Rural to LLRZ will not impose any additional pressures on existing infrastructure, as these have already been accounted and designed for through the consent process. I note also that part of the consented area is zoned RRA(4) in the Operative Plan, and Ms White recommends that this zoning is reinstated (albeit it in its new form, the LLRZ).

12.7 In terms of the transposition, as I have detailed earlier, the existing zoned area comprises the 1.89Ha Doctor Flat Vineyard area (the Exchange Land), which is zoned RRA(4) in the Operative District Plan. The operative RRA(4) zoning and previous inclusion within the Cromwell water and wastewater scheme boundary of this vineyard land suggests there is an allowance in the existing infrastructure network to service this land for residential development in accordance with the operative zoning.

12.8 Considering a like for like approach, an approximate area of 2 hectares has the same basic yield as an area of 1.89 hectares, at maximum of 9 lots, when considering the proposed LLRZ minimum lot size of 2,000m². The Relief Area is subject to a number of constraints such as topography, landscape and heritage features (addressed in other's evidence), so is likely to achieve a lower yield than that flatter productive vineyard with road frontage availed by the Exchange Land. Hence, in my opinion, capacity constraints are not an impediment to rezoning the Relief Area as sought by the Submitter.

12.9 I note that Ms White recommends a LLRZ is applied to the Exchange Area and the part of the Stage II Consent area that is within the operative RRA(4) zone, effectively recommending a reinstatement of the operative RRA(4) zoning, albeit in its modified LLRZ form. I understand that this is to ensure there is sufficient

zoned residential land to provide for predicted growth at Bannockburn. I further understand that the intention of notified PC19 was to carry over the existing residential zones (i.e including the RRA(4)) zoned areas, which accords with Ms White's recommendations. I consider that this supports my assessment that there is capacity to service for infrastructure the Exchange Land.

13.0 Conclusion

13.1 From an engineering design perspective, Stage I and II are inextricably linked, with many of the decisions regarding servicing Stage II intended to continue the level of servicing approved for Stage I, and previous development of Lynn Lane and within the immediate locality in Bannockburn.

13.2 Providing infrastructure and servicing to the Relief Area would simply be an extension of this existing and approved infrastructure, in the same manner.

13.3 From the assessment I have undertaken above, I consider it is entirely feasible to service the Relief Area for infrastructure, applying the same approach as that taken for Stage I and II of the consented developed in the adjacent Lynn Lane area.

13.4 The infrastructure required for the Stage II consent allows for development of an additional 2 residential allotments in the Relief Area, with no physical upgrades to access formation or services required beyond provision of connections upon subdivision. The remainder of the Relief Area can be accessed and serviced by alternate means, such the provision of services via adjacent Lot 51, which is amalgamated with Lot 50 and which encapsulates the Relief Area.

13.5 Detailed design can be addressed at the time of subdivision, but based on Stage I and II, design solutions are readily available.

13.6 Capacity constraints in the network are not considered an impediment to rezoning the Relief Area, as the RRA(4) zoned Exchange Land, which is similar in area and yield, and for which services and capacity are presumed to be available presently,

will be zoned Rural, thus releasing the servicing capacity associated with the operative residential zoning of this land.

Richard Ford
BSurv (Hons), MS+SNZ

Licensed Cadastral Surveyor – Landpro Limited

16 May 2023

Appendices

Appendix A	Proposed Relief Overview Plan
Appendix B	Stage I & II Subdivisions Landpro Plan: s16235_RC_03_Rev_D
Appendix C	Road Design Standards – 2008 CODC Addendum
Appendix D	Landpro Plan: 17166_06_Typical ROW Section
Appendix E	Rationale Limited Water Modelling
Appendix F	Stormwater Report and Calculations
Appendix G	Rationale Limited Wastewater Modelling

Appendix A

Proposed Relief Overview Plan

SUBJECT TO PLAN CHANGE 19 HEARING

Lynn Lane

Lot 3
DP 398578

Lot 4
DP 398578

Lot 5
DP 398578

Lot 8
DP 25888

Lot 7
DP 303645

EXCHANGE
LAND AREA
1.89ha

ODP Zone Line

1
2
3
4
5
11
12

10
9
8
7
50

Lot 5
DP 452123

LOT 51
DP 511592

Lot 1
DP 25669

Lot 6
DP 452123

N

LEGEND

- STAGE 1 RESIDENTIAL LOTS
- STAGE 2 RESIDENTIAL LOTS
- "EXCHANGE LAND" (PROPOSED RU)
- "RELIEF AREA" (PROPOSED LLRZ)
- APPROX 2 HA AREA (PROPOSED LLRZ)
- INDICATIVE BLR LOCATION

D:\DATA L - Local working\2023\PC 19 Evidence\Rubicon Hall Road Limited\Attachments\23136_03_PC_19.dwg Plotted: 16.05.2023

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ph 03 208 4450

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PROPOSED RELIEF OVERVIEW
S DAVIES - LYNN LANE, BANNOCKBURN
CODC PLAN CHANGE 19 - STAGE 2 ZONING

Rev.	Date	Revision Details	By
-	-	-	-

Surveyed	Signed	Date	Job No.		Drawing No.
			23136		01
Drawn	Signed	Date	Scale	1:1,000 @ A1	
RAF		16.05.23		1:2,000 @ A3	
Designed	Signed	Date	Datum & Level		Rev.
			LP2000		-

Appendix B

Stage I & II Subdivisions Landpro Plan: s16235_RC_03_Rev_D

SUBJECT TO RESOURCE CONSENT

Note:
Residential land planted in grapes RRA (4).

AMALGAMATION CONDITIONS
That Lot 50 hereon, Lot 51 RC160312, Lot 5 & 6 DP 452123 be held in one certificate of title

Lynn Lane

Lot 3 DP 398578

Lot 4 DP 398578

Lot 5 DP 398578

Lot 8 DP 25888

Lot 7 DP 303645

1

2

3

4

5

100

STAGE I RC160312

12

11

10

9

8

7

RRA (4)

Existing Trees

Zone Line

Extension of Trees

50
2.0000 ha

Lot 5 DP 452123

LOT 51 RC160312

Lot 1 DP 25669

Existing Water Easements

Lot 6 DP 452123

L:\17166 - Lynn Lane Stage II - Rubicon\CAD\S16235_03_RC_REV D.dwg Plotted: 07.11.2017

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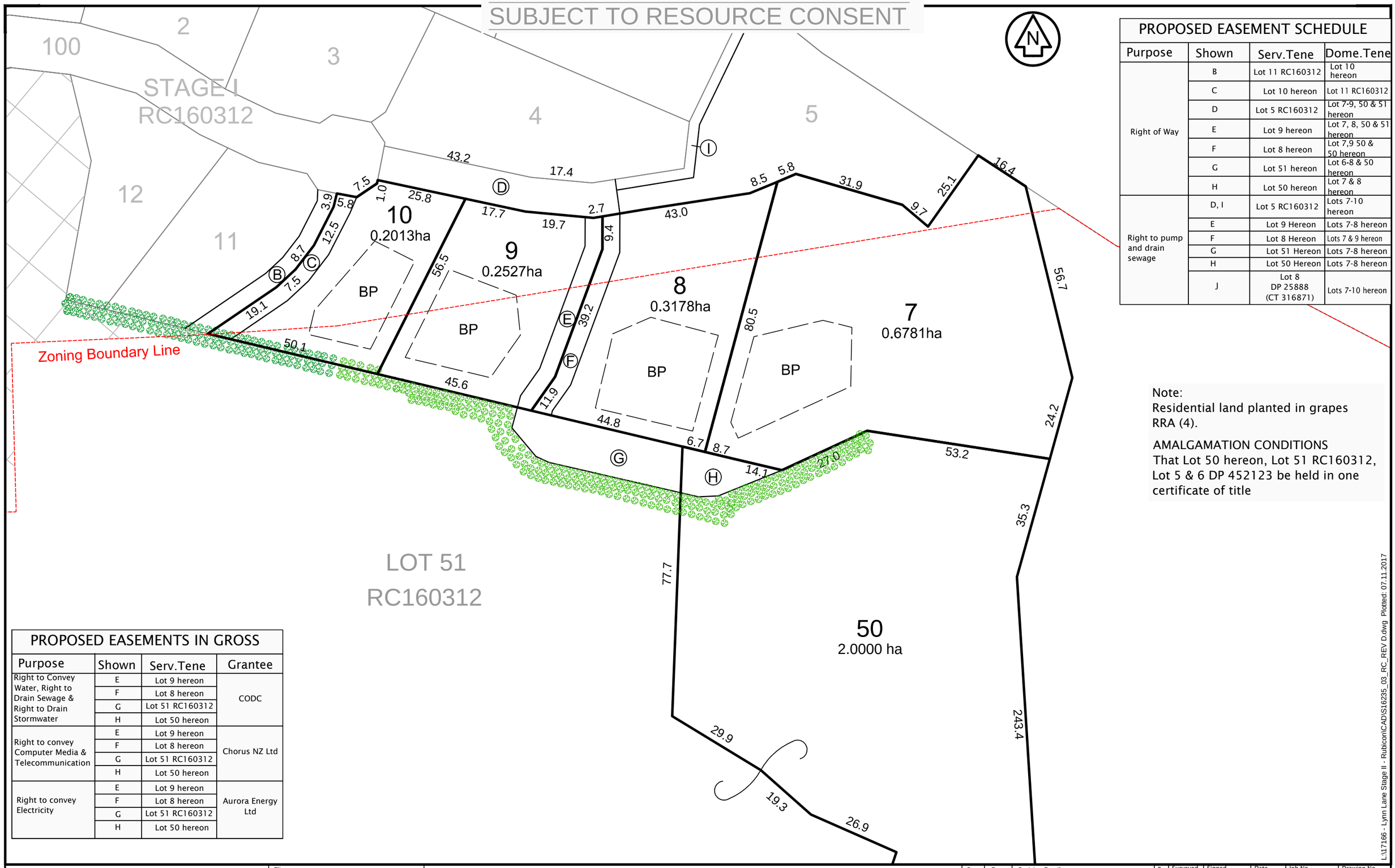
PROPOSED SUBDIVISION OF LOT 50 RC160312 AND EASEMENTS OVER LOT 51 RC160312 LYNN LANE, BANNOCKBURN

Rev.	Date	Revision Details	By
A	11.10.16	BP added, zone line added	SLC
B	30.1.17	Tree extension added	SLC
C	10.06.17	Update to Landscape Plan Building Platforms	RAF
D	07.11.17	Remove Lot 6 & BP as per Env't Court Decision	RAF

Surveyed	Signed	Date	Job No.	Drawing No.	
			S16235	03_00	
Drawn	Signed	Date	Scale		
NKA		27.09.16	1:1000 @ A1 1:2000 @ A3		
Designed	Signed	Date	Datum & Level	Rev.	
			LP2000	D	

SUBJECT TO RESOURCE CONSENT



PROPOSED EASEMENT SCHEDULE

Purpose	Shown	Serv.Tene	Dome.Tene
Right of Way	B	Lot 11 RC160312	Lot 10 hereon
	C	Lot 10 hereon	Lot 11 RC160312
	D	Lot 5 RC160312	Lot 7-9, 50 & 51 hereon
	E	Lot 9 hereon	Lot 7, 8, 50 & 51 hereon
	F	Lot 8 hereon	Lot 7,9 50 & 50 hereon
	G	Lot 51 hereon	Lot 6-8 & 50 hereon
	H	Lot 50 hereon	Lot 7 & 8 hereon
Right to pump and drain sewage	D, I	Lot 5 RC160312	Lots 7-10 hereon
	E	Lot 9 Hereon	Lots 7-8 hereon
	F	Lot 8 Hereon	Lots 7 & 9 hereon
	G	Lot 51 Hereon	Lots 7-8 hereon
	H	Lot 50 Hereon	Lots 7-8 hereon
	J	Lot 8 DP 25888 (CT 316871)	Lots 7-10 hereon

Note:
Residential land planted in grapes RRA (4).

AMALGAMATION CONDITIONS
That Lot 50 hereon, Lot 51 RC160312, Lot 5 & 6 DP 452123 be held in one certificate of title

PROPOSED EASEMENTS IN GROSS

Purpose	Shown	Serv.Tene	Grantee
Right to Convey Water, Right to Drain Sewage & Right to Drain Stormwater	E	Lot 9 hereon	CODC
	F	Lot 8 hereon	
	G	Lot 51 RC160312	
	H	Lot 50 hereon	
Right to convey Computer Media & Telecommunication	E	Lot 9 hereon	Chorus NZ Ltd
	F	Lot 8 hereon	
	G	Lot 51 RC160312	
	H	Lot 50 hereon	
Right to convey Electricity	E	Lot 9 hereon	Aurora Energy Ltd
	F	Lot 8 hereon	
	G	Lot 51 RC160312	
	H	Lot 50 hereon	

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C	10.06.17	Update to Landscape Plan Building Platforms	RAF
D	07.11.17	Remove Lot 6 & BP as per Env't Court Decision	RAF

Surveyed	Signed	Date	Job No.	Drawing No.	
			S16235	03_01	
Drawn	Signed	Date	Scale		
NKA		27.09.16	1:500 @ A1 1:1000 @ A3		
Designed	Signed	Date	Datum & Level	Rev.	
			LP2000	D	

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Appendix C

Road Design Standards – 2008 CODC Addendum

PART 3 – ROADS

Table 3.1 – Delete table and replace with:

Table 3.1 Road Design Standards – Urban (speed limit ≤ 70 km/h)

Class	Type	Area Served	Traffic Volumes ADT (1)	Design Speed, (km/h)		Road Reserve width (m)	Minimum Sealed Carriageway Width (m) Between faces of kerb				Footpath (m)	Berm (m)	Max/min gradient	Normal camber	Max super-elevation	Notes
				Flat or rolling	Hilly		Parking (2)	Traffic	Cycles (3)	Total						
Local Roads	Right of way	1 lot	NA	NA	NA	4.0 (4)	-	1 x 3.0	-	3.0 (4)	-	2 x 0.5	20% max 0.4% min	4%	NA	Not public street (4)
	Right of way	2-4	NA	NA	NA	6.0 (4)	-	1 x 4.0	-	4.0 (4)	-	2 x 1.0	16% max 0.4% min	4%	NA	Not public street (4)
	Cul de Sac	Up to 20 du	NA	NA	NA	12.0	1 x 2.5	1 x 3.5	-	6.0	1 x 1.5	2.0 + 2.5	12.5% max 0.4% min	4%	6%	No stopping on one side
	Residential	21-150 du	Up to 750	30	30	20.0	1 x 2.5	2 x 3.0	-	8.5	2 x 1.5	2 x 4.25	12.5% max 0.4% min	4%	6%	(5)
	Industrial	Up to 20 units	<300	30	30	20.0	1 x 2.5	2 x 3.5	-	9.5	1 x 1.5	2 x 4.5	10% max 0.4% min	4%	6%	No stopping on one side
	Industrial/ Commercial service lane	-	NA	NA	NA	8.0	-	2 x 3.5	-	7.0	-	2 x 0.5	10% max 0.4% min	4%	NA	(6)
	Commercial (Park precinct)	-	<2000	30	30	(7)	(7)	2 x 3.5	-	7.0	2 x 3.0	-	10% max 0.4% min	4%	NA	(7)
Collector Roads	Residential	150 – 450 du	750 - 3000	50	40	20.0	2 x 2.5	2 x 3.5	2 x 1.0	14.0	2 x 1.5	2 x 1.5	10% max 0.4% min	4%	8%	
	Industrial/ Commercial	>20 units	>300	50	40	20.0	2 x 2.5	2 x 3.5	2 x 1.0	14.0	2 x 1.5	2 x 1.5	10% max 0.4% min	4%	6%	(7)

NOTE

(1) du = dwelling units, ADT = average daily traffic
(2) Parking lane width allows for limited cycle space
(3) Where the TA gives approval to remove cycle lanes each traffic lane shall be increased to 4.0m
(4) Where a private way adjoins a collector road, it shall have a 5m traffic width and 6m road reserve width for a minimum of 6m from road boundary
(5) Parking bays set into berm footpath zones
(6) No parking both sides
(7) Width dictated by parking provisions. Parking shall be provided on both sides of street and maximized taking into account traffic considerations
(8) No constructed carriageway is required for 'Leg-In'.

Table 3.2 (a) – Delete table and replace with:

Table 3.2(a) Road Standards – Rural

Type of Road	Topography	Traffic (ADT) or Number Lots	Number of Traffic Lanes	Carriageway Width (m)	Shoulder Width (m)	Design Speed (kph)	Maximinum Longitudinal Grade	Minimum Road Reserve Width (m)	Type of Surface
Collector	Flat	> 500	2	7.0	0.25 metal	100	4%	20	Seal
	Rolling		2	7.0		100	6%	20	Seal
	Mountainous		2	7.0		70	10%	20	Seal
Local Sealed	Flat	300-500	2	6.5	0.25 metal	100	4%	20	Seal
	Rolling		2	6.5		90	6%	20	Seal
	Mountainous		2	6.5		60	10%	20	Seal
	Flat	150-300 > 15 lots	2	6.0	0.25 metal	100	4%	20	Seal
	Rolling		2	6.0		80	6%	20	Seal
	Mountainous		2	6.0		50	10%	20	Seal
Local Gravelled	Flat	<150 ≤ 15 lots	2	6.0	Nil	80	Flat	15	Gravel
	Rolling		2	6.0		70	6.5%	20	Gravel
	Mountainous		2	6.0		50	10%	20	Gravel
Local Access A	Flat	50-150	2	5.5	Nil	70	Flat	15	Gravel
	Rolling		2	5.5		50	10%	20	Gravel
	Mountainous		2	5.5		30	12.5%	20	Gravel
Local Access B	Flat	< 50	1	4.5	Nil	70	Flat	15	Gravel
	Rolling		1	4.5		50	10%	20	Gravel
	Mountainous		1+	4.5+		30	12.5%	20	Gravel
Right of Way	Flat	< 6 lots	1	4.5	Nil	20	8%	10	Gravel
	Rolling		1	4.5		20	12.5%	10	Gravel
	Mountainous		1+	4.5+		20	16.7%	10	Seal

NOTES

(1) Roads with ADT exceeding 2,500 require specific design.
(2) All roads that provide access to more than 6 potential lots shall vest in the Council as legal road.
(3) Flat topography includes level or gently rolling country which offers few obstacles to the construction of a road. Rolling topography is rolling, hilly or foothill country where the slopes generally rise and fall moderately gently with occasional steep slopes. Mountainous topography includes rugged hilly and mountainous country and river gorges. Often involves long, steep grades and limited sight distances. Passing bays to be provided in mountainous terrain for Access B and ROW's.
(4) Normal camber of 4% on sealed roads and 5-8% on gravel roads.
(5) All unsealed local roads to be constructed in accordance with Council's Standards for Gravel Roads for inclusion in Central Otago District Council Roading Hierarchy – November 2000 or superseding documents.
(6) Widening of carriageway shall be in accordance with Austroads Guide to Geometric Design of Rural Roads

Appendix D

Landpro Plan: 17166_06_Typical ROW Section

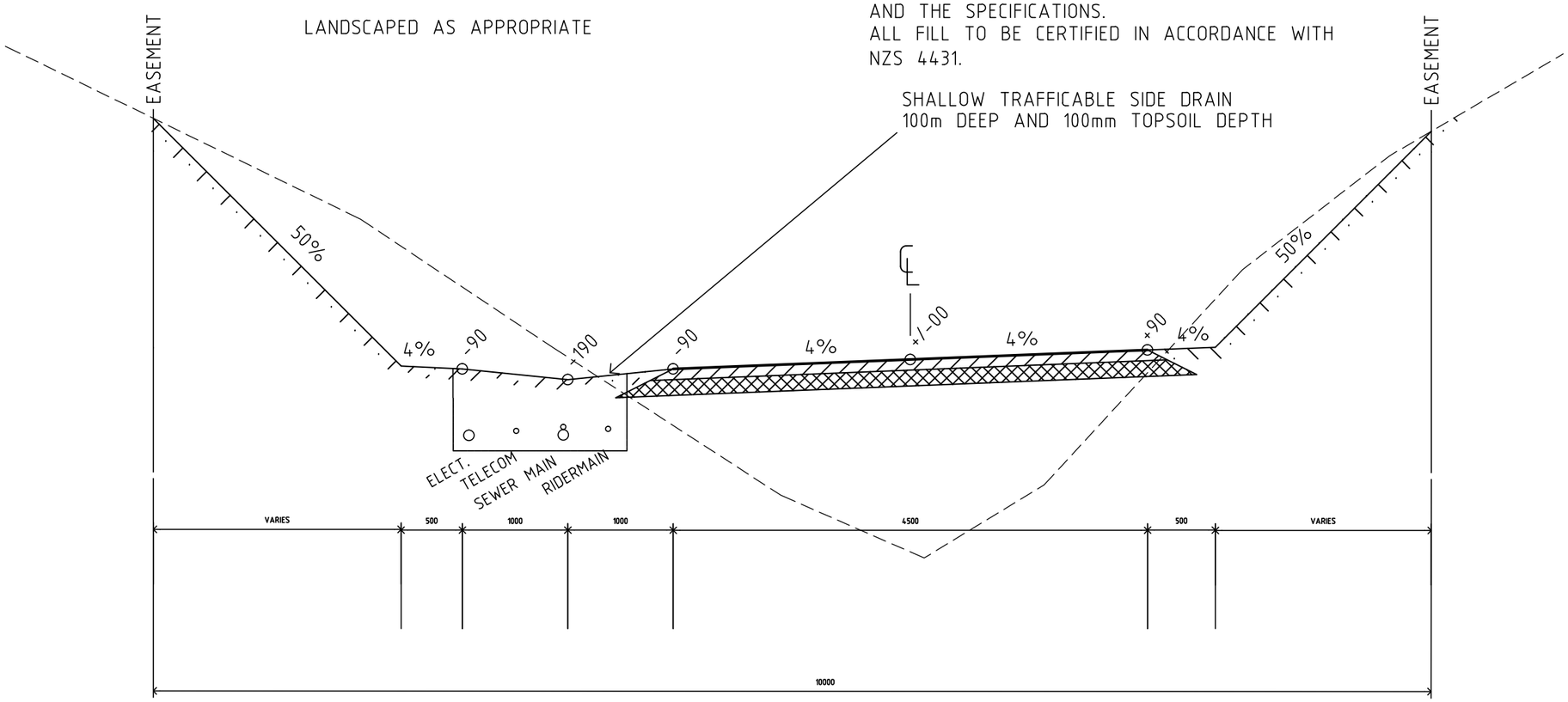
BERMS AND BATTERS
100mm TOPSOIL
SOW GRASS SEED - PARTS BY WEIGHT
4 PARTS PERENNIAL RYEGRASS
2 PARTS CHEWINGS FESCUE
1 PART BROWN TOP

1 PART CRESTED DOGS TAIL

LANDSCAPED AS APPROPRIATE

PAVEMENT DESIGN
2 COAT CHIP SEAL - GRADES 3 AND 5 CHIP.

100mm TNZ M/4 AP40.
150mm AP 65.
MINIMUM CBR = 7
SURFACING TO BE IN ACCORDANCE WITH TNZ M/1, P/3, P/4, M/6, M/13, P/17 AND THE SPECIFICATIONS.
PAVEMENT TO BE IN ACCORDANCE WITH TNZ M/4, B/2 AND THE SPECIFICATIONS INCLUDING TESTING.
EARTHWORKS TO BE IN ACCORDANCE WITH TNZ F/1, AND THE SPECIFICATIONS.
ALL FILL TO BE CERTIFIED IN ACCORDANCE WITH NZS 4431.



STAGE II TYPICAL RIGHT OF WAY

ISSUED FOR ENVIRONMENT COURT EVIDENCE 10.06.2017

L:\17166 - Lynn Lane Stage II - Rubicon\CAD\17166_06_Typical_ROW_Section.dwg Plotted: 10.06.2017

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TYPICAL CROSS SECTION - RIGHT OF WAY
PROPOSED SUBDIVISION
LYNN LANE, BANNOCKBURN

Rev.	Date	Revision Details	By
-	-	-	-

Surveyed	Signed	Date	Job No.	Drawing No.	
-		-	17166	06_01	
Drawn	Signed	Date	Scale	1:25 @ A1 1:50 @ A3	
RAF		10.06.17			
Designed	Signed	Date	Datum & Level	Rev.	
-		-	LP 2000	-	

Appendix E

Rationale Limited Water Modelling

13 February 2017

Nathan Archer
Landpro
PO Box 302
Cromwell
9342

Dear Nathan

Re: Capacity Check, Lynn Lane Development Bannockburn, Cromwell

As per your email of 15 December 2016 and further updated details, we have assessed the proposed wastewater loads and water demands through the hydraulic models. More specifically, we have assessed the proposed infrastructure against the requirement to supply FW2 Firefighting supply as per SNZ PAS 4509:2008 (the Code of Practice) and the Central Otago District Council Addendum to NZS4404:2004.

In summary, the proposed infrastructure can service the proposed development and in the case of water the recommended connections help improve network performance. Specifically:

- Water, FW2 minimum pressure is 34 m head above the 10 m minimum for firefighting.
- Water, peak day minimum pressure is 42 m head, above the 30 m required.
- Water, FW2 maximum velocity is 2.06 m/s.
- There are no wastewater overflows.

The maximum velocity of 2.06 m/s is slightly outside the 2.0 m/s allowance under NZS4404:2004 but is within the 3.0 m/s which may be accepted in special circumstances. It is also a significant improvement on the predevelopment FW2 maximum velocity of 3.3 m/s on the adjacent existing pipes, because of the proposed ringed main and therefore we believe is acceptable.

Water

The water capacity has been assessed using the calibrated Cromwell water supply model v1.1. This model is calibrated to peak, average and minimum demand scenarios from December 2013 to May 2014.

This is outlined in the maps below.

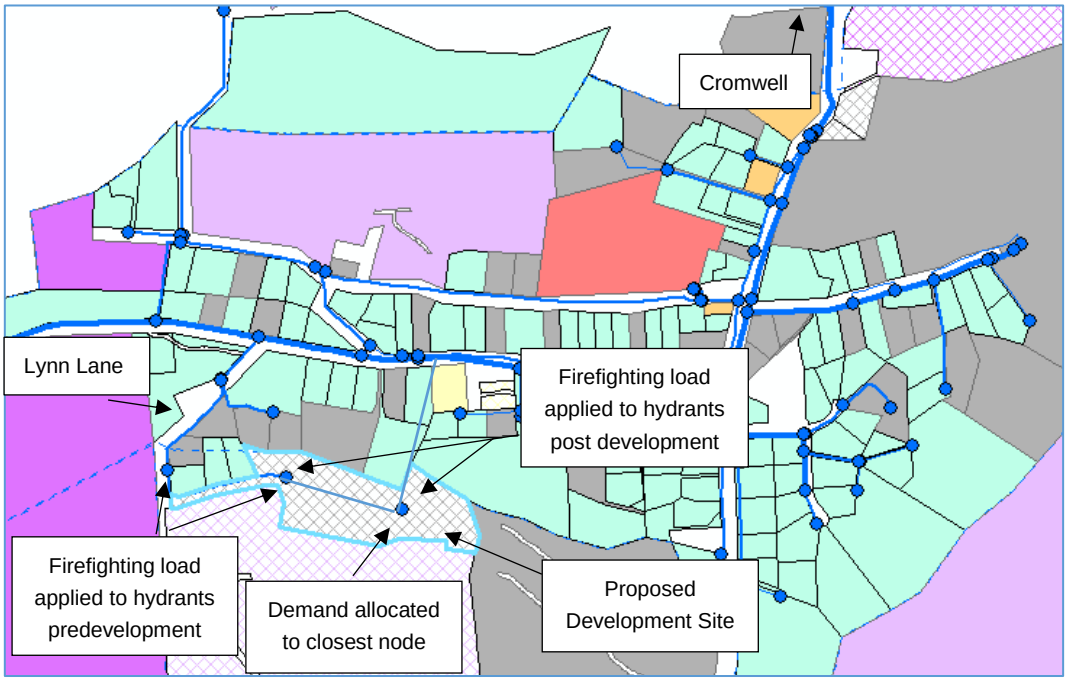


Figure 1: Stage One Water Supply

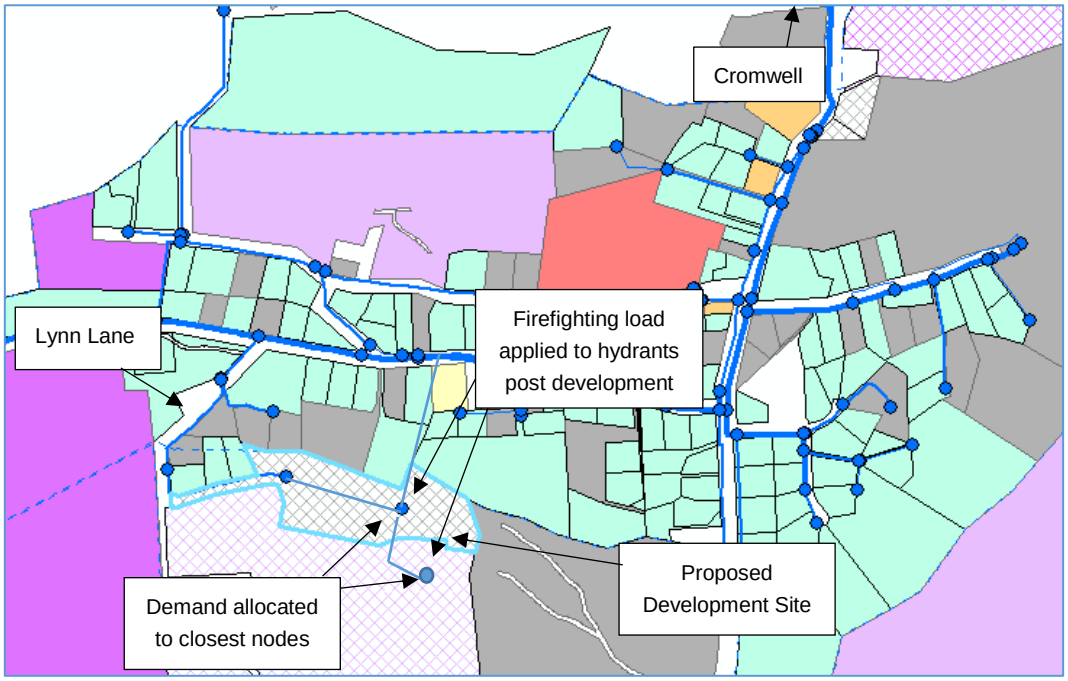


Figure 2: Stage Two Water Supply

We have completed this investigation based on stage one of the development potentially containing the following loads:

Table 1 – Water Supply Load Details.

Load Type	Total Units	Load/Person /Day (l/d)	People per unit	Peak day factor	Total Demand (l/s)
Residential, Stage One	7	500	3.0	3.0	0.36
Residential, Stage Two	5	500	3.0	3.0	0.26

The following assumptions were used:

- The firefighting flows have been modelled in addition to the minimum peak demand. The minimum peak demand for the proposed development has been assessed from the Central Otago District Council Addendum to NZS4404:2004.
- The peak hour factor is already incorporated into the model through the daily profile.
- The total demand has been added to the fire hydrants in the proposed development as shown in Figures 1 and 2.
- The ground level of the proposed fire hydrant invert is 280.0 m in stage one and 290.0 m in stage two.
- The stage one post development fire hydrant is on the end of a new 100 mm diameter main extending 168 m from Lynn Lane and connecting to a new 100 mm diameter ring main extending 275 m to Hall Road.
- The stage two post development fire hydrant is extended from stage one with 65 m of new 100 mm diameter main.

The model has been used to assess the firefighting requirements as per the Code of Practice, which defines fire water classification coverage as per Table 2.

Table 2 - Definition of FW2 Firefighting Requirements.

Scenario	Required Water flow within 135 m	Additional water flow within a distance of 270 m	Maximum hydrants to provide flow	Firefighting Time (min)	Volume (m^3)
FW2	12.5 l/s	12.5 l/s	2	30	45

These scenarios have been modelled based on the peak day calibrated model with demand scaled up to 12,000 m^3 per day. The model is currently calibrated to a peak demand of approximately 9,000 m^3 per day. This increased demand scenario has been used to allow for a potential rebound in demand following the significant reductions achieved by demand management, including volumetric charging, in recent years. This level of demand is significantly lower than the total bulk supply exceeding 14,000 m^3 per day experienced in 2009/10 and 2011/12.

- FW2 was modelled with a total firefighting demand of 12.5 l/s taken from the two hydrants as identified in Figures 1 and 2.
- The minimum residual (running) pressure required by the Code of Practice is 100 kPa (10.2 m).

Modelled Scenarios and Results

The model indicates that the minimum pressure in the proposed infrastructure under minimum peak demand is 42 m. This is deemed to be a sufficient level of service under normal peak season demands. The delivery pressure may reduce if demand increases significantly.

An assessment of capacity for firefighting purposes has been carried out for the following scenarios to determine if the proposed infrastructure is sufficient to service the development based on the above assumptions.

Table 3 – Firefighting Modelled Scenarios

Scenario	Description	Minimum Residual Pressure at peak flow.	Minimum Residual Pressure at fire flow.	Result
1	FW2 -12.5l/s from the two downstream nodes within Lynn Lane, predevelopment.	43 m	14 m	Fail
2	Stage One - FW2 -12.5l/s from the two downstream nodes in Lynn Lane and the proposed development.	42 m	34 m	Pass
3	Stage Two - FW2 -12.5l/s from the two downstream nodes in the proposed development.	42 m	34 m	Pass

Detailed maps of the results are also attached to this letter.

The Code of Practice defines that 45 m^3 of firefighting storage is to be reserved specifically for FW2 firefighting purposes. The Bannockburn reservoir has an operating capacity of approximately 500 m^3 and a normal operating volume of 126 m^3. Under normal operating conditions, this results in a reserved storage of 374 m^3. This reserved storage is sufficient to supply FW2 fire flows of 45 m^3 in addition to the 126 m^3 of normal peak demand over the firefighting period of 60 minutes.

The maximum velocity is 2.06 m/s is slightly outside the 2.0 m/s allowance under NZS4404:2004 but is within the 3.0 m/s which may be accepted in special circumstances: It is also a significant improvement on the predevelopment FW2 maximum velocity of 3.3 m/s on the adjacent existing pipes, because of the proposed ringed main and therefore we believe is acceptable.

From the observed results, it can be concluded that the infrastructure proposed to service the development does provide sufficient capacity to attain FW2 firefighting flows.

Wastewater

Wastewater capacity has been assessed using the calibrated Bannockburn wastewater model v1.0. This model is calibrated to three peak day scenarios including wet day events from September 2014 to January 2015. This model doesn't include the new connection to Cromwell.

The development is shown in the map below.

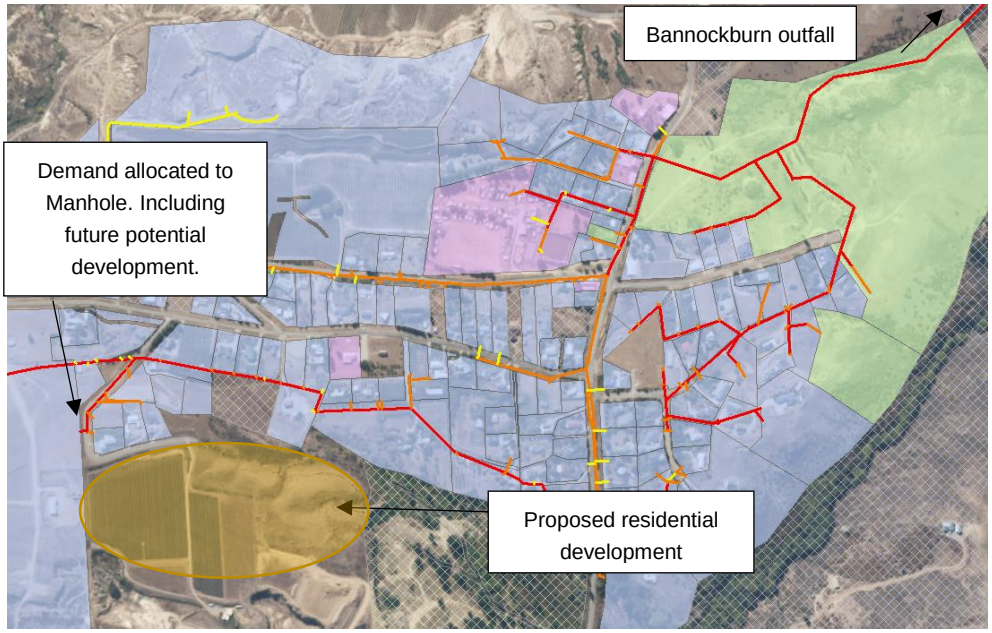


Figure 3: Wastewater

We have conducted this investigation based on the completed development potentially containing the following load:

Table 4 – Wastewater Load Details.

Load Type	Units	Total Units	People per unit	Load/Person / Day (l/d)	ADWF (m^3/d)	Approx. Peaking Factor	Rainfall Catchment Area (Ha)
Residential	Units	12	3	250	9.0	2.3	-

The following assumptions were used:

- The design of the internal reticulation has not been assessed. The total load has been added to the nearest existing downstream manhole.
- No additional rainfall catchment area has been added for the proposed development as this area has been included in the existing development loads below.

Modelled Scenarios and Results

The model has been run to the following standard.

- 2014 peak day population sanitary loadings and diurnal patterns.
- Residential load, based on water meter usage and a reduction factor added when calibrated, approximate peaking factor of 2.3
- 10-year return, 12-hour duration storm.

All relevant sections of the network have been checked for capacity using the following criteria:

- No overflow allowed at any network element.
- No pump station overflows based on the duty pump capacity.
- Theoretical capacity based on flow and pipe details.

The key findings are shown below and a detailed map of the results are attached to this letter:

- There are no related network elements overflowing.
- The Bannockburn pump station does not overflow.
- The theoretical capacity of the downstream network is not exceeded.

Summary

In summary, the proposed infrastructure can service the proposed development and in the case of water the recommended connections help improve network performance. Specifically:

- Water, FW2 minimum pressure is 34 m head above the 10 m minimum for firefighting.
- Water, peak day minimum pressure is 42 m head, above the 30 m required.
- Water, FW2 maximum velocity is 2.06 m/s.
- There are no wastewater overflows.

It should be noted that the models are an attempt to simulate a physical system using hydraulic equations and various assumptions, hence they bear some uncertainty. CODC's GIS data was used to develop the models and we can offer no guarantee on the accuracy of this information. The demands, network layout and diurnal patterns approximate the patterns in the townships that have been agreed with CODC. The internal design of the proposed development hasn't been checked to ensure alignment with the Firefighting Supply Code of Practise in terms of fire hydrant location and elevation of sections.

Due to the potential changes in demand occurring in this area, the validity of this letter should be checked any time in the future it is used.

Yours sincerely,

Nichola Greaves

Infrastructure Advisor
Rationale Limited

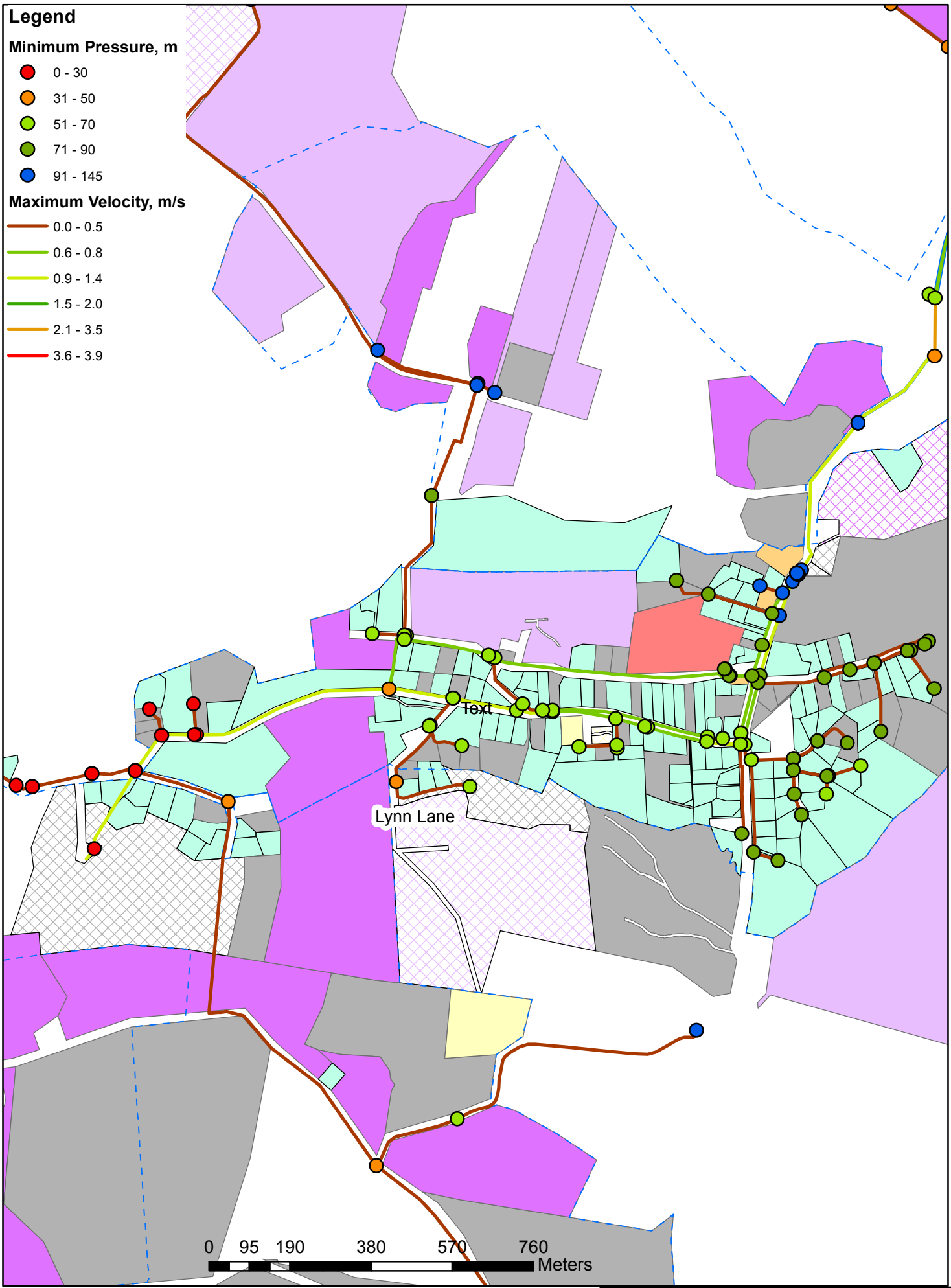
Encl. Results: Lynn Lane, Predevelopment.pdf

Results: Lynn Lane, Fire Fighting Predevelopment.pdf

Results: Lynn Lane, Fire Fighting Proposed Development Stage one.pdf

Results: Lynn Lane, Fire Fighting Proposed Development Stage two.pdf

Results: Lynn Lane, Wastewater.pdf



Cromwell Water Capacity
Predevelopment Lynn Lane Bannockburn
Peak Day

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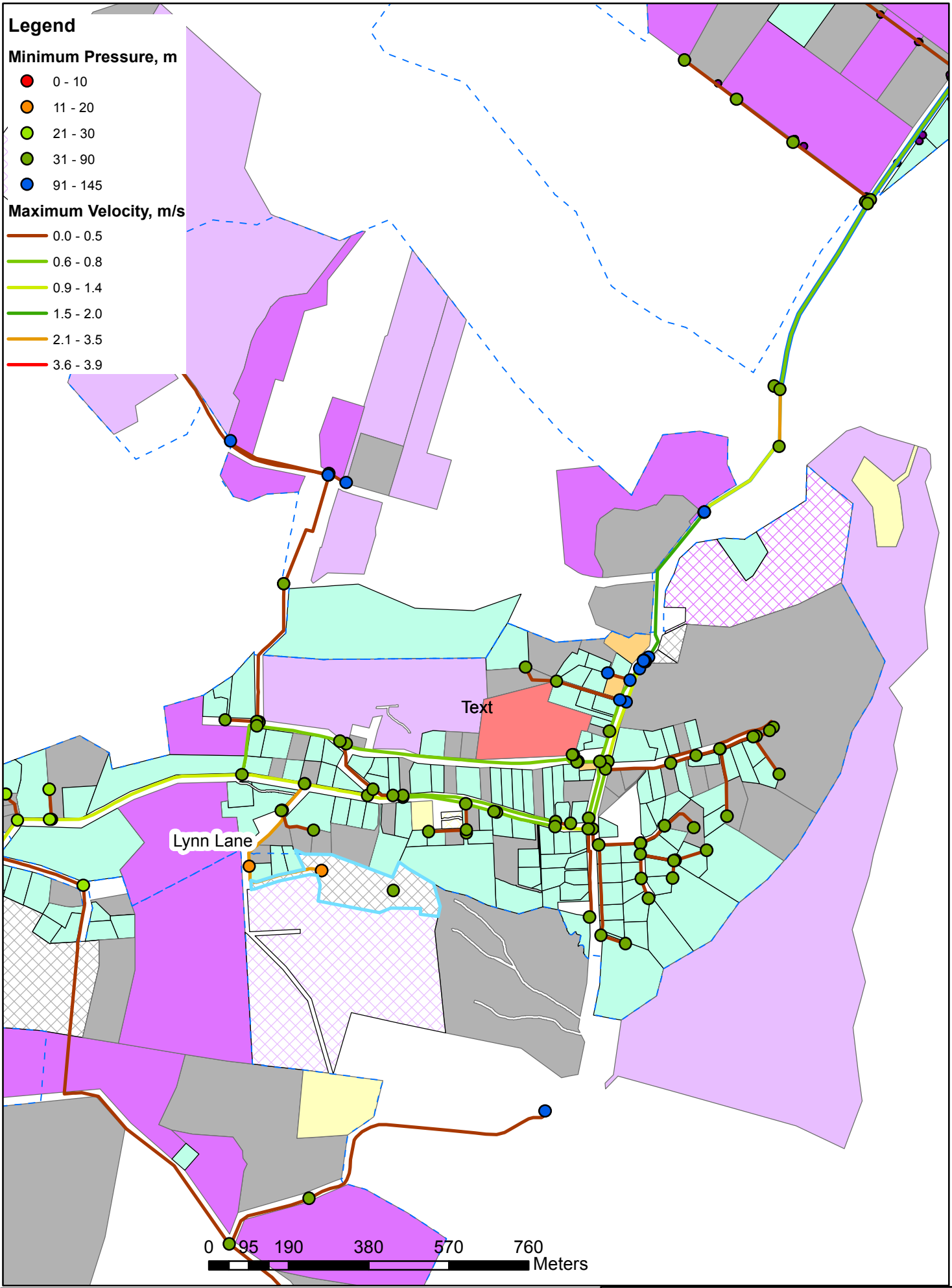
W E
S

MIKE URBAN

Drawn By:	Nichola Greaves
Date:	12/19/16
Approved:	Tom Lucas



Cromwell Water Capacity
Predevelopment Lynn Lane Bannockburn
Fire Fighting

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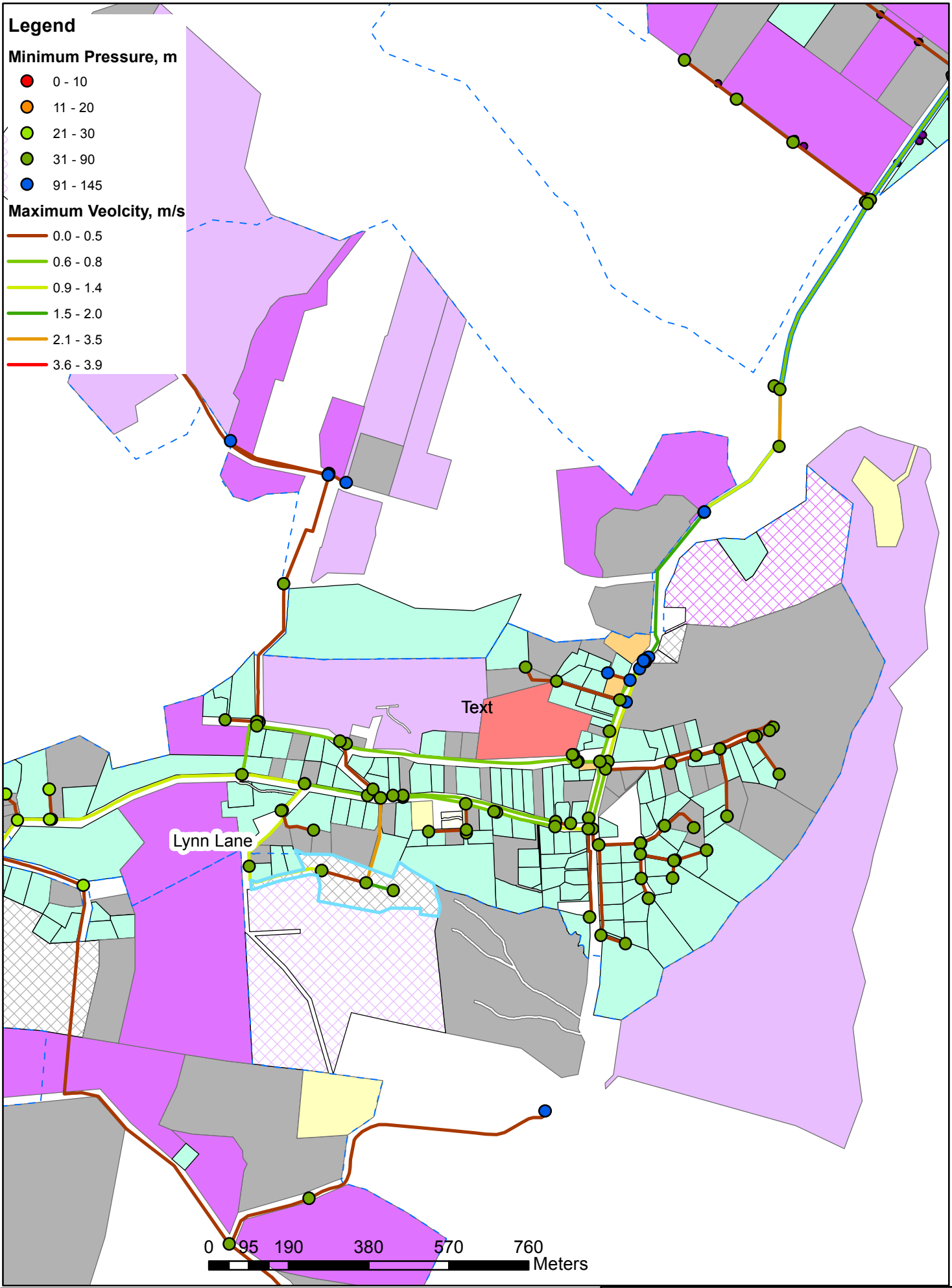
MIKE URBAN

Drawn By:	Nichola Greaves
Date:	12/19/16
Approved:	Tom Lucas



Cromwell Water Capacity
Stage One Lynn Lane Bannockburn
Fire Fighting

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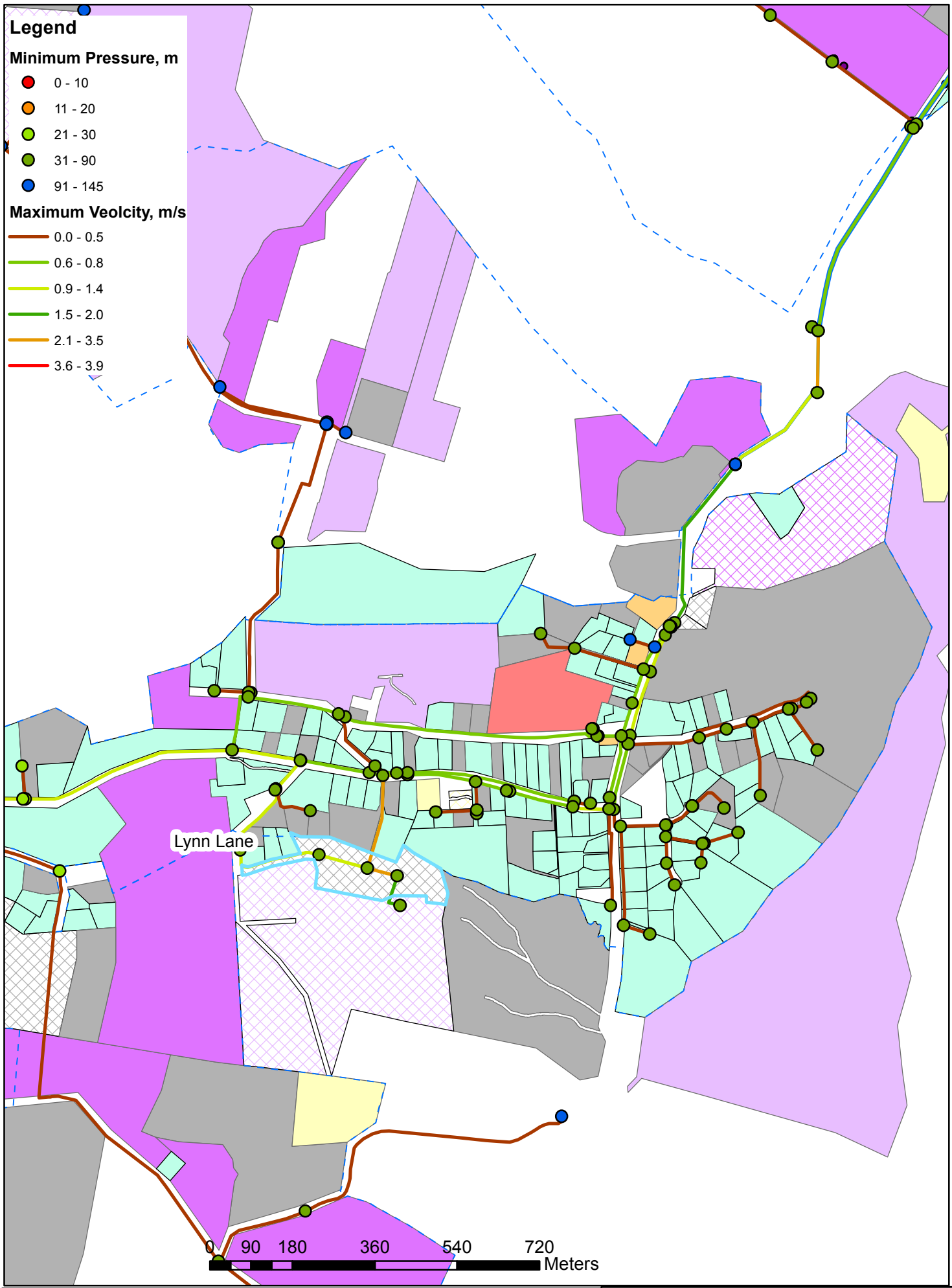
MIKE URBAN

Drawn By:	Nichola Greaves
Date:	10/2/17
Approved:	Tom Lucas



Cromwell Water Capacity
Stage Two Lynn Lane Bannockburn
Fire Fighting

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MIKE URBAN

Drawn By:	Nichola Greaves
Date:	12/19/16
Approved:	Tom Lucas

Appendix F

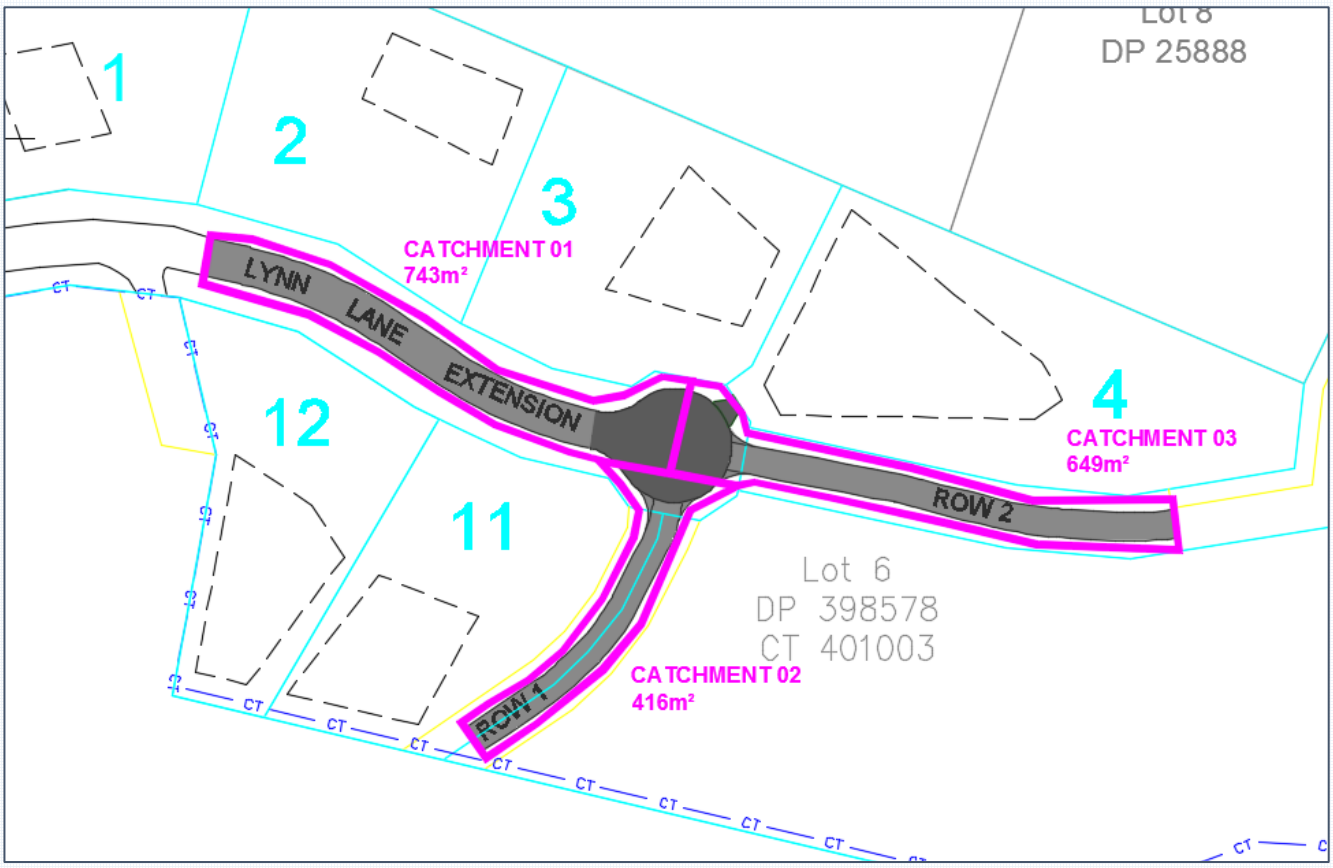
Stormwater Report and Calculations

LANDPRO Make the most of your land	PROJECT: **Lyn Lane Subdivision**	PAGE: 1 of 6
		JOB NO: S16235
	DESCRIPTION: **Stormwater Management**	BY: C. Mans
		DATE 10.02.2017

Information and Parameters:

As part of the Lyn Lane subdivision in Bannockburn the client has requested a calculation of stormwater volumes as well as sizing advise for in ground soakage disposal. Soakage tests (as per 9.0.2 of E1/VM1) were carried out on lots 1-5, 11-12 and along the proposed road formation for a total of 10 tests. Sizing of the soak will be carried out as per E1/VM1 9.0.5.

The client has requested design of rock soak pits for management of stormwater from the roads as well as rock soak pit volume advice for the residential lots. A site sketch with road areas is included which will be used to locate and size the soak pits. For the individual lots, the national average house size (floor area) of 149m^2 has been modified by 30% to account for external hard surfaces and the greater affluence of the area, a design area of 194m^2 has been used.



Excavation of the soakage holes presented sediments typical of lacustrine deposition environments, two distinct soils were encountered, a sandy gravel with typical high soakage rate and a fine sandy silt with an expected slow soakage rate. A table summarising the test findings are shown over, the soakage test result from lot 11 returned high (1140mm/hr) and has been discarded as an outlier.

Soil Type	Sandy SILT	Sandy GRAVEL
No. of Tests	5	4
Max. Soak Rate (mm/hr)	190	591
Min. Soak Rate (mm/hr)	63	190
Mean Soak Rate (mm/hr)	73	430
Standard Dev. (STDV) (mm/hr)	11	161
Design Soak Rate (mm/hr) (Mean – STDV)	**61**	**269**

The soil horizons were observed in the road cutting with bedding thickness >2m and due to the undulating nature of the site, all sites and road drainage areas should be able to access a sandy gravel bed for disposal with minimal effort.

Furthermore, it is recommended that the sandy gravel be targeted of stormwater disposal and hence the soakage rate of 269mm/hr has been selected as the design soakage rate. The conservative rate (mean – 1 standard deviation) is chosen to provide some conservatism and to accommodate some flexibility in positioning of soak pits. The Sandy SILT layers should be avoided.

Given the layout, a combined soakage pit at the culdesac is recommended for catchments 01 and 02 (1159m^2). A second soakage pit is proposed at the base of catchment 03 (649m^2). A design area for the lots of 194m2 is recommended with (as previously indicated) with no specific location required other than targeted at a sandy gravel horizon. A third right of way has not yet been formalised, however, the client has requested sizing for an additional 824m^2

The rainfall intensity is 15.6mm/hr for a 10-year event of 60 minute duration, NIWA table below:

NIWA Taihoro Nukurangi — High Intensity Rainfall System V3

Calculator Help

Results for Lynn Ln Development

Intensity-Duration-Frequency results (produced on Tuesday 17th of January 2017)
Sitename: Lynn Ln Development
Coordinate system: NZMG
Easting: 2207298
Northing: 5561548
Rainfall intensities (mm/h)

		Duration									
ARI (y)	**aep**	**10m**	**20m**	**30m**	**60m**	**2h**	**6h**	**12h**	**24h**	**48h**	**72h**
1.58	0.633	21.6	14.7	11.8	8.1	5.6	3.1	2.2	1.5	0.8	0.6
2.00	0.500	24.0	16.5	13.2	9.0	6.2	3.4	2.4	1.6	0.9	0.6
5.00	0.200	33.6	22.8	18.4	12.5	8.4	4.5	3.1	2.1	1.2	0.8
10.00	0.100	41.4	28.5	22.8	15.6	10.3	5.4	3.6	2.4	1.3	1.0

Calculations for Culdesac + Right of Way 1:

Run-Off Coefficient	C = 0.85	asphalt
Rainfall Intensity (mm/h)	I = 15.6	from NIWA tables for ARI 10 event at 1-hour duration
Area (ha)	A = 0.1159	catchments 1 & 2
Run-Off Discharged from Catchment (m^3)	$R_c = CIA$	
	$R_c = 15.37$	
Area of base of Soak Pit (m^2)	$A_{sp} = 34$	proposed soak pit dimensions (WxLxD) 2m x 17m x 0.5m
Soakage Rate (mm/hr)	$S_r = 269$	mean soakage rate – 1 standard deviation for sandy gravel tested
Volume Disposed by Soakage (m^3)	$V_{soak} = A_{sp}S_r/1000$	
	$V_{soak} = 9.15$	
Volume Storage Required in Soak Pit (m^3)	$V_{stor} = R_c - V_{soak}$	
	$V_{stor} = 6.36$	
Rock Pit Volume (m^3)	$P_v = 17$	
Rock Pit Storage Capacity (m^3)	$P_s = PV \times 0.38$	rock pit pore space from 9.0.6
	$P_s = 6.46$	
	$P_s \approx V_{stor}$	

∴ P_s exceeds V_{stor} for the proposed soak pit dimensions of 2m x 17m x 0.5m (WxLxD), providing adequate storage for an ARI 10 rain event of 60 minute duration based on the conservative soakage rate for sandy gravels tested on site.

Calculations for Right of Way 2:

Run-Off Coefficient	C = 0.85	asphalt
Rainfall Intensity (mm/h)	I = 15.6	from NIWA tables for ARI 10 event at 1-hour duration
Area (ha)	A = 0.0649	catchments 3
Run-Off Discharged from Catchment (m^3)	$R_c = CIA$	
	$R_c = 8.61$	
Area of base of Soak Pit (m^2)	$A_{sp} = 19$	proposed soak pit dimensions (WxLxD) 2m x 9.5m x 0.5m
Soakage Rate (mm/hr)	$S_r = 269$	mean soakage rate – 1 standard deviation for sandy gravel tested
Volume Disposed by Soakage (m^3)	$V_{soak} = A_{sp}S_r/1000$	
	$V_{soak} = 5.11$	
Volume Storage Required in Soak Pit (m^3)	$V_{stor} = R_c - V_{soak}$	
	$V_{stor} = 3.50$	
Rock Pit Volume (m^3)	$P_v = 9.5$	
Rock Pit Storage Capacity (m^3)	$P_s = PV \times 0.38$	rock pit pore space from 9.0.6
	$P_s = 3.61$	
	$P_s \approx V_{stor}$	

∴ P_s exceeds V_{stor} for the proposed soak pit dimensions of 2m x 9.5m x 0.5m (WxLxD), providing adequate storage for an ARI 10 rain event of 60 minute duration based on the conservative soakage rate for sandy gravels tested on site.

Calculations for Right of Way 3 (not formalised):

Run-Off Coefficient	C = 0.85	asphalt
Rainfall Intensity (mm/h)	I = 15.6	from NIWA tables for ARI 10 event at 1-hour duration
Area (ha)	A = 0.0824	right of way 3, area provided by client
Run-Off Discharged from Catchment (m^3)	R_c = CIA	
	R_c = 10.93	
Area of base of Soak Pit (m^2)	A_{sp} = 19	proposed soak pit dimensions (WxLxD) 2m x 12m x 0.5m
Soakage Rate (mm/hr)	S_r = 269	mean soakage rate – 1 standard deviation for sandy gravel tested
Volume Disposed by Soakage (m^3)	$V_{soak} = A_{sp}S_r/1000$	
	V_{soak} = 6.46	
Volume Storage Required in Soak Pit (m^3)	$V_{stor} = R_c - V_{soak}$	
	V_{stor} = 4.47	
Rock Pit Volume (m^3)	P_v = 12	
Rock Pit Storage Capacity (m^3)	P_s = PV x 0.38	rock pit pore space from 9.0.6
	P_s = 4.56	
	$P_s \approx V_{stor}$	

∴ P_s exceeds V_{stor} for the proposed soak pit dimensions of 2m x 12m x 0.5m (WxLxD), providing adequate storage for an ARI 10 rain event of 60 minute duration based on the conservative soakage rate for sandy gravels tested on site.

Calculations for Individual Lots:

Run-Off Coefficient	C = 0.85	asphalt
Rainfall Intensity (mm/h)	I = 15.6	from NIWA tables for ARI 10 event at 1-hour duration
Area (ha)	A = 0.0194	mean NZ house size + 30%
Run-Off Discharged from Catchment (m^3)	R_c = CIA	
	R_c = 2.57	
Area of base of Soak Pit (m^2)	A_{sp} = 4	proposed soak pit dimensions (WxLxD) 2m x 2m x 1m
Soakage Rate (mm/hr)	S_r = 269	mean soakage rate – 1 standard deviation for sandy gravel tested
Volume Disposed by Soakage (m^3)	$V_{soak} = A_{sp}S_r/1000$	
	V_{soak} = 1.08	
Volume Storage Required in Soak Pit (m^3)	$V_{stor} = R_c - V_{soak}$	
	V_{stor} = 1.50	
Rock Pit Volume (m^3)	P_v = 4	
Rock Pit Storage Capacity (m^3)	P_s = PV x 0.38	rock pit pore space from 9.0.6
	P_s = 1.52	
	$P_s \approx V_{stor}$	

∴ P_s exceeds V_{stor} for the proposed soak pit dimensions of 2m x 2m x 1m (WxLxD), providing adequate storage for an ARI 10 rain event of 60 minute duration based on the conservative soakage rate for sandy gravels tested on site.

Appendix G

Rationale Limited Wastewater Modelling

13 February 2017

Nathan Archer
Landpro
PO Box 302
Cromwell
9342

Dear Nathan

Re: Capacity Check, Lynn Lane Development Bannockburn, Cromwell

As per your email of 15 December 2016 and further updated details, we have assessed the proposed wastewater loads and water demands through the hydraulic models. More specifically, we have assessed the proposed infrastructure against the requirement to supply FW2 Firefighting supply as per SNZ PAS 4509:2008 (the Code of Practice) and the Central Otago District Council Addendum to NZS4404:2004.

In summary, the proposed infrastructure can service the proposed development and in the case of water the recommended connections help improve network performance. Specifically:

- Water, FW2 minimum pressure is 34 m head above the 10 m minimum for firefighting.
- Water, peak day minimum pressure is 42 m head, above the 30 m required.
- Water, FW2 maximum velocity is 2.06 m/s.
- There are no wastewater overflows.

The maximum velocity of 2.06 m/s is slightly outside the 2.0 m/s allowance under NZS4404:2004 but is within the 3.0 m/s which may be accepted in special circumstances. It is also a significant improvement on the predevelopment FW2 maximum velocity of 3.3 m/s on the adjacent existing pipes, because of the proposed ringed main and therefore we believe is acceptable.

Water

The water capacity has been assessed using the calibrated Cromwell water supply model v1.1. This model is calibrated to peak, average and minimum demand scenarios from December 2013 to May 2014.

This is outlined in the maps below.

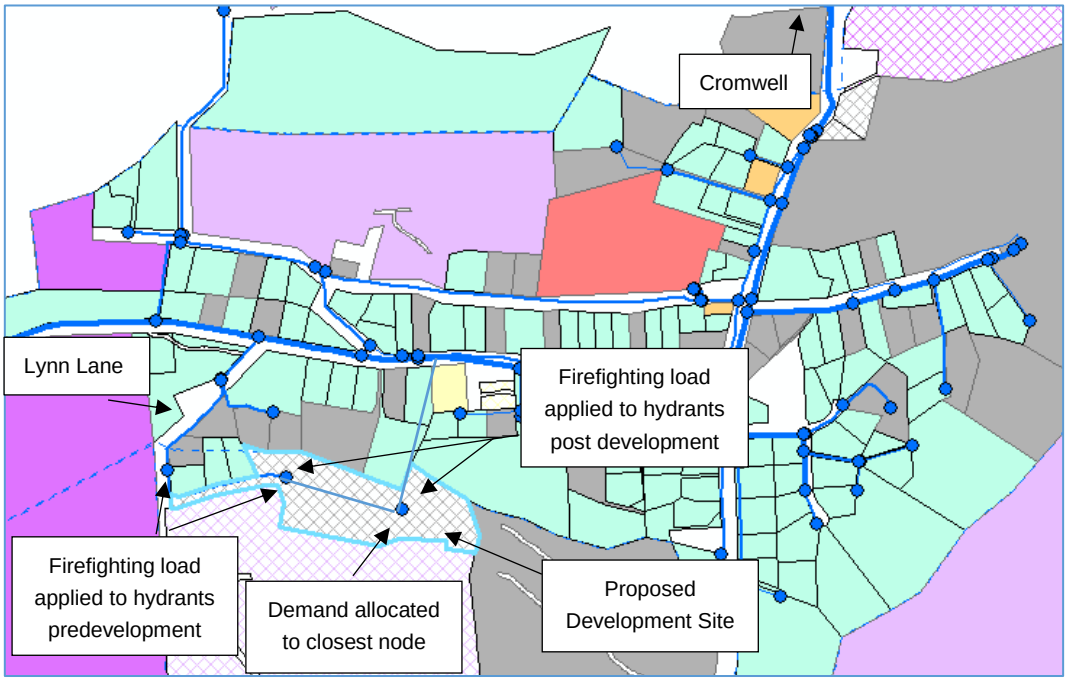


Figure 1: Stage One Water Supply

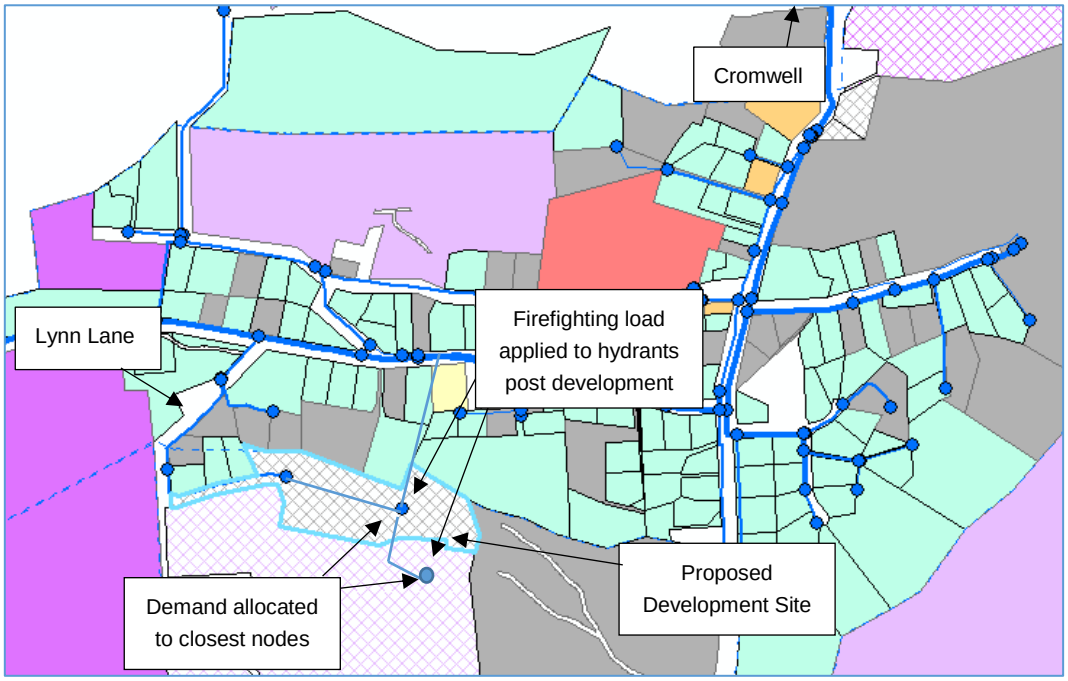


Figure 2: Stage Two Water Supply

We have completed this investigation based on stage one of the development potentially containing the following loads:

Table 1 – Water Supply Load Details.

Load Type	Total Units	Load/Person /Day (l/d)	People per unit	Peak day factor	Total Demand (l/s)
Residential, Stage One	7	500	3.0	3.0	0.36
Residential, Stage Two	5	500	3.0	3.0	0.26

The following assumptions were used:

- The firefighting flows have been modelled in addition to the minimum peak demand. The minimum peak demand for the proposed development has been assessed from the Central Otago District Council Addendum to NZS4404:2004.
- The peak hour factor is already incorporated into the model through the daily profile.
- The total demand has been added to the fire hydrants in the proposed development as shown in Figures 1 and 2.
- The ground level of the proposed fire hydrant invert is 280.0 m in stage one and 290.0 m in stage two.
- The stage one post development fire hydrant is on the end of a new 100 mm diameter main extending 168 m from Lynn Lane and connecting to a new 100 mm diameter ring main extending 275 m to Hall Road.
- The stage two post development fire hydrant is extended from stage one with 65 m of new 100 mm diameter main.

The model has been used to assess the firefighting requirements as per the Code of Practice, which defines fire water classification coverage as per Table 2.

Table 2 - Definition of FW2 Firefighting Requirements.

Scenario	Required Water flow within 135 m	Additional water flow within a distance of 270 m	Maximum hydrants to provide flow	Firefighting Time (min)	Volume (m^3)
FW2	12.5 l/s	12.5 l/s	2	30	45

These scenarios have been modelled based on the peak day calibrated model with demand scaled up to 12,000 m^3 per day. The model is currently calibrated to a peak demand of approximately 9,000 m^3 per day. This increased demand scenario has been used to allow for a potential rebound in demand following the significant reductions achieved by demand management, including volumetric charging, in recent years. This level of demand is significantly lower than the total bulk supply exceeding 14,000 m^3 per day experienced in 2009/10 and 2011/12.

- FW2 was modelled with a total firefighting demand of 12.5 l/s taken from the two hydrants as identified in Figures 1 and 2.
- The minimum residual (running) pressure required by the Code of Practice is 100 kPa (10.2 m).

Modelled Scenarios and Results

The model indicates that the minimum pressure in the proposed infrastructure under minimum peak demand is 42 m. This is deemed to be a sufficient level of service under normal peak season demands. The delivery pressure may reduce if demand increases significantly.

An assessment of capacity for firefighting purposes has been carried out for the following scenarios to determine if the proposed infrastructure is sufficient to service the development based on the above assumptions.

Table 3 – Firefighting Modelled Scenarios

Scenario	Description	Minimum Residual Pressure at peak flow.	Minimum Residual Pressure at fire flow.	Result
1	FW2 -12.5l/s from the two downstream nodes within Lynn Lane, predevelopment.	43 m	14 m	Fail
2	Stage One - FW2 -12.5l/s from the two downstream nodes in Lynn Lane and the proposed development.	42 m	34 m	Pass
3	Stage Two - FW2 -12.5l/s from the two downstream nodes in the proposed development.	42 m	34 m	Pass

Detailed maps of the results are also attached to this letter.

The Code of Practice defines that 45 m^3 of firefighting storage is to be reserved specifically for FW2 firefighting purposes. The Bannockburn reservoir has an operating capacity of approximately 500 m^3 and a normal operating volume of 126 m^3. Under normal operating conditions, this results in a reserved storage of 374 m^3. This reserved storage is sufficient to supply FW2 fire flows of 45 m^3 in addition to the 126 m^3 of normal peak demand over the firefighting period of 60 minutes.

The maximum velocity is 2.06 m/s is slightly outside the 2.0 m/s allowance under NZS4404:2004 but is within the 3.0 m/s which may be accepted in special circumstances: It is also a significant improvement on the predevelopment FW2 maximum velocity of 3.3 m/s on the adjacent existing pipes, because of the proposed ringed main and therefore we believe is acceptable.

From the observed results, it can be concluded that the infrastructure proposed to service the development does provide sufficient capacity to attain FW2 firefighting flows.

Wastewater

Wastewater capacity has been assessed using the calibrated Bannockburn wastewater model v1.0. This model is calibrated to three peak day scenarios including wet day events from September 2014 to January 2015. This model doesn't include the new connection to Cromwell.

The development is shown in the map below.

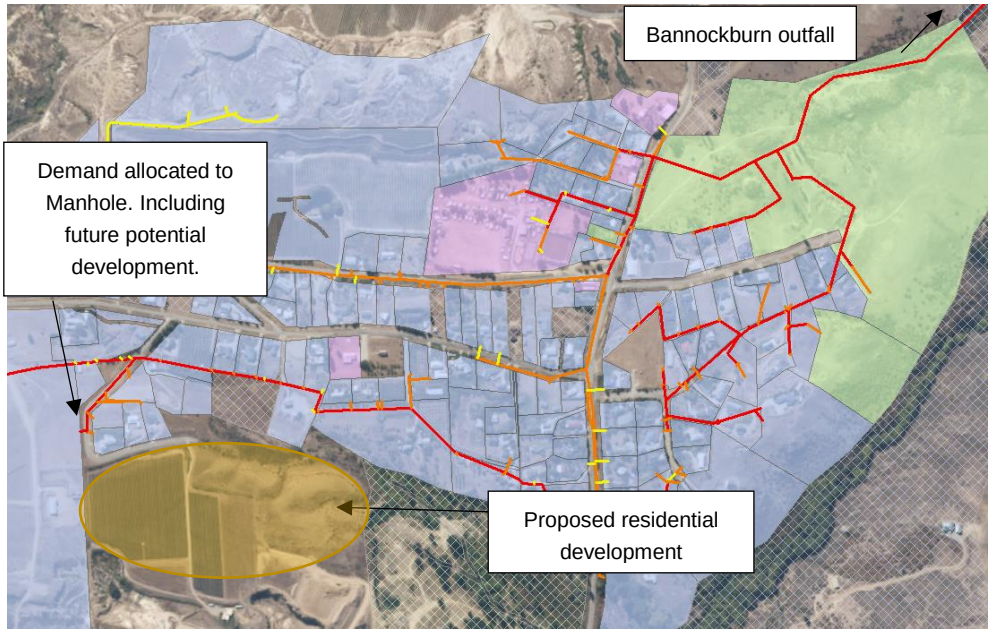


Figure 3: Wastewater

We have conducted this investigation based on the completed development potentially containing the following load:

Table 4 – Wastewater Load Details.

Load Type	Units	Total Units	People per unit	Load/Person / Day (l/d)	ADWF (m^3/d)	Approx. Peaking Factor	Rainfall Catchment Area (Ha)
Residential	Units	12	3	250	9.0	2.3	-

The following assumptions were used:

- The design of the internal reticulation has not been assessed. The total load has been added to the nearest existing downstream manhole.
- No additional rainfall catchment area has been added for the proposed development as this area has been included in the existing development loads below.

Modelled Scenarios and Results

The model has been run to the following standard.

- 2014 peak day population sanitary loadings and diurnal patterns.
- Residential load, based on water meter usage and a reduction factor added when calibrated, approximate peaking factor of 2.3
- 10-year return, 12-hour duration storm.

All relevant sections of the network have been checked for capacity using the following criteria:

- No overflow allowed at any network element.
- No pump station overflows based on the duty pump capacity.
- Theoretical capacity based on flow and pipe details.

The key findings are shown below and a detailed map of the results are attached to this letter:

- There are no related network elements overflowing.
- The Bannockburn pump station does not overflow.
- The theoretical capacity of the downstream network is not exceeded.

Summary

In summary, the proposed infrastructure can service the proposed development and in the case of water the recommended connections help improve network performance. Specifically:

- Water, FW2 minimum pressure is 34 m head above the 10 m minimum for firefighting.
- Water, peak day minimum pressure is 42 m head, above the 30 m required.
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- There are no wastewater overflows.

It should be noted that the models are an attempt to simulate a physical system using hydraulic equations and various assumptions, hence they bear some uncertainty. CODC's GIS data was used to develop the models and we can offer no guarantee on the accuracy of this information. The demands, network layout and diurnal patterns approximate the patterns in the townships that have been agreed with CODC. The internal design of the proposed development hasn't been checked to ensure alignment with the Firefighting Supply Code of Practise in terms of fire hydrant location and elevation of sections.

Due to the potential changes in demand occurring in this area, the validity of this letter should be checked any time in the future it is used.

Yours sincerely,

Nichola Greaves

Infrastructure Advisor
Rationale Limited

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Wastewater Capacity Check, 12 lots Lynn Lane Bannockburn, 13/2/17.