BEFORE THE HEARINGS PANEL FOR THE PROPOSED QUEENSTOWN LAKES DISTRICT PLAN

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of the Hearing Stream 12 – Upper Clutha Mapping Annotations and Rezoning Requests

STATEMENT OF EVIDENCE OF MR JOHN FRANCIS McCARTNEY ON BEHALF OF M BERESFORD

INTRODUCTION

1. My name is John McCartney. I am a consulting civil engineer and hold the position of Senior Civil and Environmental Engineer with the consulting engineering company Hadley Consultants Limited, based in Queenstown.

2. I hold the qualifications of Bachelor of Engineering (Civil) from the University of Canterbury. I have 25 years experience in the design and construction of civil infrastructure with particular expertise in site investigation and assessment along with the design and construction of development infrastructure including roading, water supply, wastewater and stormwater disposal systems. I have experience in the design and implementation of infrastructure works for both private companies and for Local Authorities throughout New Zealand.

3. Although this is a Council hearing, I confirm that I have read and agree to comply with the Code of Conduct for Expert Witness. This evidence is within my area of expertise except where I state that I am relying on what I have been told by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

SCOPE OF EVIDENCE

4. Hadley Consultants Limited (HCL) has been engaged by the Suburban Estates Ltd (SEL) to assess and report on engineering related matters involving potential rezoning of land.

5. The rezoning request has been made as part of the review of the Queenstown Lakes District Council (QLDC) District Plan. The request is part of Stream 12 of the review process and the submission is number 149. The rezoning request is to amend the zoning of part of the site to low density residential.

6. The land is legally described as Section 2 SECT 5 Blk XIV Lower Wanaka SD. The site is located to the west of Peninsula Bay in Wanaka and covers around 51 hectares in total. The land is referred to locally as Sticky Forest.

7. QLDC engineering staff have assessed the rezoning request and prepared evidence. Mr Ulrich Glasner opposes the rezoning due to the potential upgrades that may be required to the QLDC wastewater infrastructure[1].

8. Mr Glasner also states in his statement of evidence that the site may be able to be fed from the Beacon Point reservoir but pressure boosting would be required. This would need to be installed either by the developer or by contributing to the upgrade of an existing pump station[2].

9. I note that Mr Glasner's evidence assumes a total yield from the rezoning of 765 additional residential units[3].

10. Hadley Consultants have been engaged to assess and respond to the points raised about infrastructure issues in Mr Glasner's evidence and to more generally detail appropriate servicing responses to the general development of the site.

11. My evidence today is limited to infrastructure issues and in particular the feasibility of servicing the site with stormwater, wastewater and water supply services.

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[1] "Statement Of Evidence Of Ulrich Wilhem Glasner On Behalf Of Queenstown Lakes District Council Infrastructure - 20 March 2017" - paragraphs 6.12 and 6.13.
[2] Ibid - paragraph 6.14.
[3] Ibid - paragraph 6.11.

12. From information supplied to me on behalf of SEL, the likely lot yield from the development will create approximately 150 dwellings. This is significantly less, approximately one fifth, than that assumed by Mr Glasner.

WATER SUPPLY

13. The Beacon Point Reservoir and Treatment Plant lies immediately adjacent to the south east corner of the site. This reservoir services much of the east side of Wanaka and includes at least part of the CBD.

14. The rising main that supplies the treatment plant and reservoir runs from Lake Wanaka to the reservoir through the land subject to the requested zone change.

15. The Beacon Point Reservoir has a capacity of 3,500m³ and was constructed in 2004. At the time of design and construction sufficient space was made available on the site of the reservoir for a second 2,000m³ storage tank to be constructed at some point in the future when required. A copy of the Beacon Point Reservoir as-built drawing confirming the available site for the future additional storage at the site is attached as Attachment A.

16. Mr Glasner has confirmed that there should be sufficient water to supply the site[4]. This confirmation was on the basis that there could be up to 765 allotments[5]. We agree with this analysis and note that:

- The dwelling yield will be a lot lower than assumed by Mr Glasner.
- There are significant upgrades to the water supply in Wanaka signalled in the QLDC Long Term Plan (LTP) that will further allow more water to be available from the Beacon Point reservoir to service land in the vicinity of the reservoir. These upgrades include an additional reservoir at Mt Iron and capacity increases at the Western Reservoir[6].

[4] Ibid - paragraph 6.14.
[5] Ibid - paragraph 6.11.
[6] Refer QLDC 10 Year Plan 2015-2025 – Volume 1 - Pages 38-39

17. The fact that less dwellings will arise from the any rezoning of the subject land and the future increases in capacity of the Wanaka Water Supply infrastructure signalled in the QLDC LTP give comfort to the view that water is able to be supplied to the site from existing Council infrastructure.

18. I agree with Mr Glasner's comments regarding the site elevation in relation to the Beacon Point Reservoir and the need for booster pumps to enable reticulation on the higher parts of the site[7].

19. This requirement is similar to the requirement on the neighbouring Northlake land where water modelling has shown that any dwelling over RL 350 will require booster pumping. A copy of the Tonkin + Taylor report "Northlake Developments Water Supply Modelling" dated 10 February 2016 is attached as Attachment B.

20. I note that with the neighbouring Northlake site also needing some pressure boosting for future stages of development, the opportunity exists to gain efficiencies by increasing the number of dwellings to be serviced by either a booster pump or a higher level reservoir.

21. The provision of booster pumping has occurred in a number of areas within the district and does not hinder the ability to develop the subject land.

WASTEWATER

22. The site lies at the top of a ridge and as such has fall to both the west and east. Preliminary indications are that any development will occur such that approximately half of the natural fall of the land is towards the west and half to the east.

23. Due to this topography, it is likely that a wastewater pump station will be required in order to ensure that there was only one point of wastewater discharge from the site.

24. Subject to detailed design, available pipe routes and Council preference, the wastewater flows could drain to either the west or the east.

[7] "Statement Of Evidence Of Ulrich Wilhem Glasner On Behalf Of Queenstown Lakes District Council Infrastructure - 20 March 2017" - paragraph 6.14.

25. Mr Glasner has stated that possible upgrades to the QLDC wastewater infrastructure that are currently unbudgeted for include:

> *(a) upgrade of the Outlet Road wastewater pump station;*
> *(b) additional rising main (2.2 km); and*
> (c) *upgrade/additional main along Aubrey Road to ABT#2 wastewater pump station approximately 2.8km away.*[8]
>
> *This development may also trigger an upgrade of ABT#2 wastewater pump station.*[9]

26. I again note that the assumed dwelling yield in Mr Glasner's evidence is 765 whereas the actual lot yield will be much lower and in the order of approximately 150 dwellings. This much lower yield will likely lead to fewer, if any, unbudgeted upgrades being required due to this development.

27. Outlet Road is to the east of the subject land. Due to the extent of upgrades required, as indicated by Mr Glasner, the wastewater flows could be directed to drain to the west via existing or upgraded reticulation through the Peninsula Bay subdivision and flow to the Lakeside Road No. 1 Pump Station. From this pump station the wastewater flows are currently pumped into Wanaka CBD and eventually out to the main Wanaka treatment plant near the Wanaka Airport.

28. I note that in the QLDC LTP, there is a budgeted upgrade of the Lakeside Road No. 1 Pump Station and the provision of a rising main along Aubrey Road[10]. This will mean that in future, flows currently draining to the Lakeside Road No. 1 Pump Station will be go more directly to the treatment plant utilising only the Albert Town No. 2 Pump Station instead of passing through the Wanaka CBD and through three other pump stations.

29. The rezoning of the subject land will therefore assist with enabling a more efficient wastewater layout as flows from the subject land will get to the treatment plant utilising less infrastructure than if land in some other locations around Wanaka was developed in preference to this locality.

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[8] Ibid - paragraph 6.12.
[9] Ibid - paragraph 6.13.
[10] Refer QLDC 10 Year Plan 2015-2025 – Volume 1 - Pages 46-47

30. In response to the point raised by Mr Glasner regarding the possibility of this rezoning triggering an upgrade to the Albert Town No. 2 Pump Station (referenced as ABT#2), I understand that currently the Albert Town No. 2 Pump Station is the main pump station for Wanaka in that all wastewater flows from Wanaka Township pass through this pump station in order to reach the treatment plant near Wanaka Airport[11].

31. As such, it is not the location of any particular future subdivision that will drive the requirement for the upgrade of this pump station, but the overall growth in Wanaka Township.

32. Development contributions will be paid if and when allotments are created. These development contributions will allow QLDC to recover the cost of any future upgrades that are required to enable growth in Wanaka. Should the continued growth of Wanaka trigger an upgrade requirement for the Albert Town No. 2 Pump Station then this will be able to be added to the list of future works in subsequent LTP or Annual Plan processes and appropriate Development Contributions levied against the future allotments.

STORMWATER

33. As previously outlined, the site lies at the top of a ridge and has fall to both the east and the west.

34. In order to prevent the concentration of runoff onto neighbouring land and in the absence of any significant reticulation nearby the site, it is expected that the provision of stormwater drainage for the site will necessarily involve usage of Low Impact Design principles.

35. Low-impact development (LID) is a term used to describe a land planning and engineering design approach to manage stormwater runoff. LID emphasizes conservation and use of on-site natural features to protect water quality. This approach implements engineered small-scale hydrologic controls to replicate the pre-development hydrologic regime of watersheds through infiltrating, filtering, storing, attenuating and detaining runoff close to its source.

[11] Refer QLDC GIS Mapping system: http://maps.qldc.govt.nz/qldcviewer/

36. This approach has been used to some extent on the Peninsula Bay subdivision to the west of the subject land and is currently being implemented on the Northlake development to the east of the subject land. I am aware that it is being implemented and used elsewhere in Wanaka and the District.

37. I would expect that this approach could be successfully implemented on the subject land following detailed investigations, analysis and design. The approach to stormwater runoff would be a key driver in developing an overall development plan for the site as runoff interception prior to flows departing site would be required. We note that there are several points around the perimeter of the site where both large and small ephemeral water courses are expected to form during a prolonged and heavy rainfall event. These will need to be managed to ensure that there is no concentration of flows onto neighbouring land following development.

CONCLUSIONS

38. A suitable water supply for the site is available and feasible to undertake. This has been confirmed in principle by Mr Glasner and is further reinforced when taking account of the likely lower number of dwellings to be created and the future overall capacity increases in the Wanaka water supply.

39. Development of the subject land could be done in such a way as at to be in keeping with the already planned wastewater upgrades. This involves reticulating wastewater flows to the west and towards the existing Lakeside Road No. 1 Pump Station. Already flagged future upgrades of this pump station and rising main means that future wastewater flows from the subject land will be managed much more efficiently than if growth occurs in other parts of Wanaka where the wastewater flows pass through three or more pump stations prior to reaching the main Albert Town No. 2 Pump Station and subsequent pumping to the treatment plant near Wanaka Airport.

40. Any growth in Wanaka will lead to the requirement for upgrades of the Albert Town No 2 Pump Station. The future development of the site is a

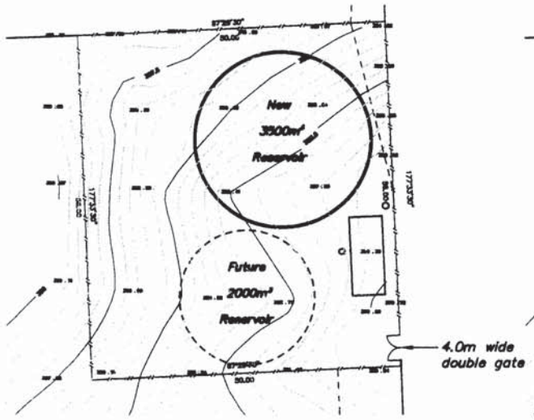
response to growth and not a driver of growth and as such is not solely responsible for the triggering of upgrades to the pump station.

41. Stormwater is currently being managed using Low Impact Design principles adjacent to the subject land and at other developments around Wanaka. Subject to recommendations and appropriate evolution of lot layout concepts, I expect that this approach will be able to implemented on the subject land in order to adequately manage stormwater runoff.

Attachment A Beacon Point Reservoir Site Plan.

Attachment B Tonkin + Taylor report “Northlake Developments Water Supply Modelling” dated 10 February 2016

John McCartney
4 April 2017



FENCING LAYOUT PLAN
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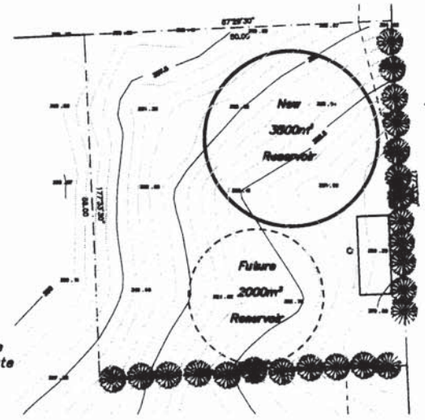
1:1000 at A3



PLANTING LAYOUT PLAN
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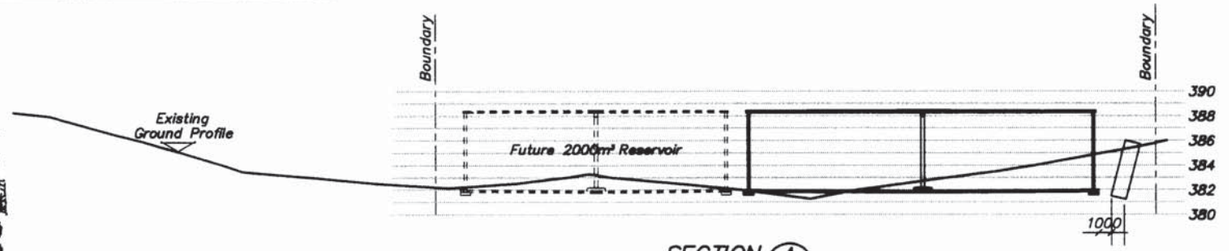
1:1000 at A3



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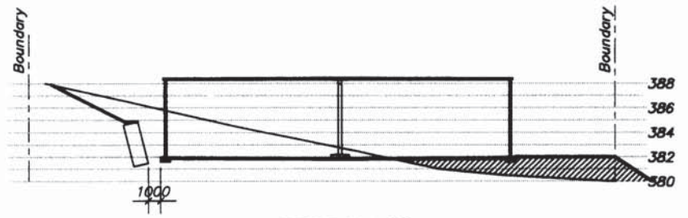

SECTION B
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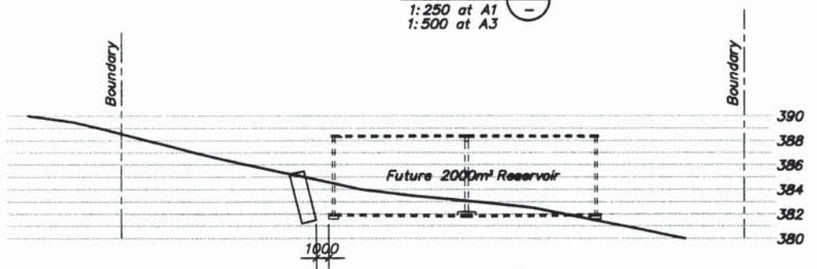

SECTION C
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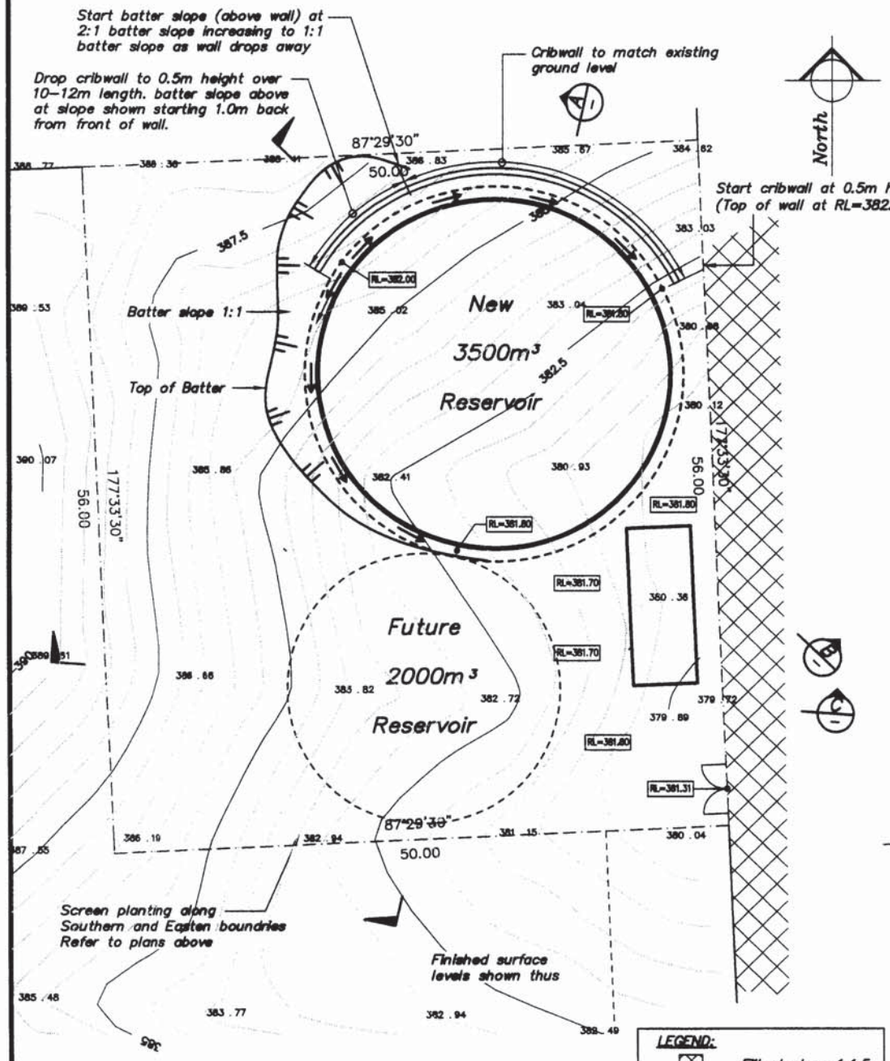

LAYOUT PLAN
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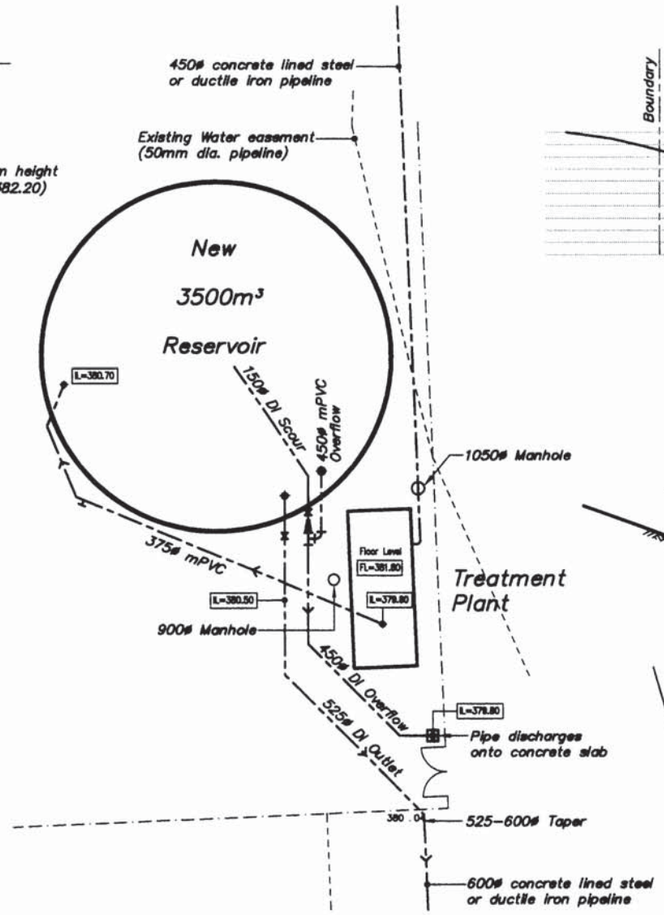
Legal Description: Lot 13 DP 300734

LEGEND:
- Fill at slope 1:1.5
- Rising Main
- Gravity Main
- Crib Wall
- Fencing



PIPELINE LAYOUT PLAN
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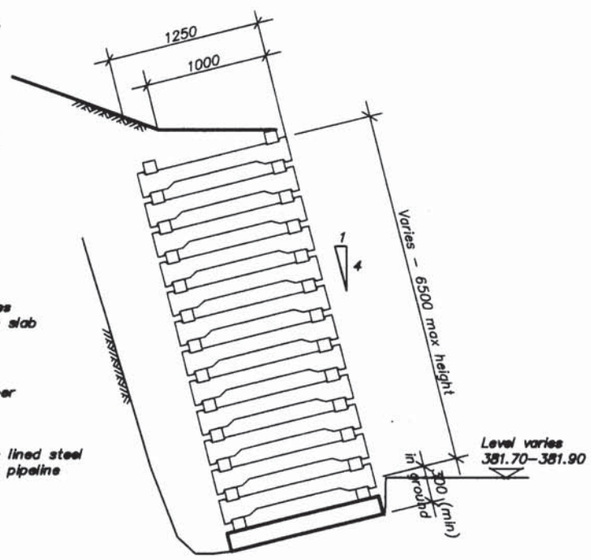

TYPICAL CRIB WALL SECTION
1:25 at A1
1:50 at A3
1200 SERIES CRIB WALL

A	As-Built		JJ/MK
No.	Revisions		Date / Appvd
Designed	A.Steel	Date 4/03	Print Date
Drawn	J.Knox	Apr'03	
Checked			
Approved			
File		Ref cRES--L1	

Client: Queenstown Lakes District Council

Project: CONTRACT No 417
WANAKA WATER SUPPLY BEACON POINT SYSTEM

Sheet Title: NEW RESERVOIR SITE LAYOUT PLAN AND TYPICAL SECTIONS

Job No.	Sheet No.	Revision
57388	R1 of shts	A

Duffill Watts King ltd

Attachment A

Tonkin+Taylor

Job No: 50553.324
10 February 2016

Queenstown Lakes District Council
Private Bag 50072
Queenstown 9348

Attention: Rob Darby

Dear Rob

Northlake Developments Water Supply Modelling

1 Introduction

Tonkin and Taylor Ltd (T+T) was engaged[1] by Queenstown Lakes District Council (QLDC) to undertake water supply modelling for the proposed Northlake subdivision in Wanaka. The scope of work completed by T+T includes modelling of interim and ultimate development scenarios to determine whether levels of service in the area can be met by the proposed water supply reticulation sizing and layout.

11 stages of development are proposed across four different landowners (Northlake Investments Limited, Urquhart, Allenby Farms Limited and Gilbertson). Initial modelling connected the first four stages (owned by Northlake Investments Ltd.) into the existing Northlake reticulation off Aubrey Road. The ultimate scenario expanded on this initial modelling to include all of Stages 1-11. These zones were all connected into the current network through connections to the Beacon Point outflow pipe and Aubrey Road. Refer to Appendix A for maps of the proposed layout and a contour plan of the area.

2 Network setting

Existing development in the Northlake area is confined to an approximately 30 hectare block north of Aubrey Road. This area, as well as areas surrounding Aubrey Road, is serviced by the Beacon Point inlet booster stations on the bank of Lake Wanaka, and corresponding reservoir, situated at an elevation of 382 m RL. The existing Northlake development water reticulation network connects into the current Wanaka network at three locations along the 375 mm Aubrey Road main – via two 150 mm mains which reticulate water throughout the development and one 100 mm lateral.

2.1 Criteria and assumptions

The purpose of the water supply modelling was to determine whether the proposed Northlake Development reticulation sizing and layout would allow QLDC levels of service and firefighting requirements to be met. The following demand scenarios were modelled to determine this:

[1] Email between Dominic Fletcher (T+T) and Rob Darby (QLDC) dated Wednesday 13 January 2016.

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P +64-3-363 2440 F +64-9-307 0265 E chc@tonkintaylor.co.nz

- Peak day demand – To determine whether available fire flows achieve the firefighting requirements as per NZS 4509:2008.
- Peak hour demand – To determine whether minimum residual pressures at each connection are ≥ 300 kPa.

The firefighting water classification for the development is FW2 (12.5 l/s within a distance of 135 m from any point in the network with an additional 12.5 l/s available within a distance of 270 m).

2.2 Design demands

The average daily demands (ADF) for each of Stages 1-11, as well as the existing Northlake developed area off Aubrey Road, were calculated by assuming a water allocation of 700 l/person/day and 3 people per lot (refer Appendix B). Development demands during the peak day and peak hour demand scenarios were calculated as follows:

- Peak day flow (PDF) = 3.3 x ADF.
- Peak hour flow (PHF) = 6.6 x ADF.

Table 1 Calculated demands for the existing development and Scenarios One and Two (refer Appendix B for individual stage demands)

Area	ADF (l/s)	PDF (l/s)	PHF (l/s)
Existing Northlake development	1.31	4.33	8.66
Scenario One (Stages 1-4)	13.17	43.47	86.95
Scenario Two (Stages 1-11)	30.31	100.02	200.04

3 Modelled scenarios

Two scenarios were modelled, an initial scenario and ultimate scenario. Modelling assumed the current Wanaka peak day design network demands and reticulation and did not take into consideration future network upgrades or demand increases beyond those mentioned below for the Northlake Development.

3.1 Initial Scenario: Stages 1-4

The initial scenario extended the existing 150 mm rising mains servicing the current network development north of Aubrey Road into Stages 1-4. These 150 mm mains were then connected via a 300 mm main (refer Appendix C for network layout). Modelling of this scenario was undertaken to determine whether the proposed interim reticulation upgrades would meet levels of service for the areas and the effect, if any, on the existing network.

3.2 Ultimate development: Stages 1-11

The ultimate scenario consisted of all 11 proposed stages across the Northlake, Allenby, Gilbertson and Urquhart developments. The modelled network extended the 300 mm main in the initial scenario to connect both into the Beacon Point reservoir outlet pipe to the west of the development, as well as into the existing 375 mm Aubrey Road falling main to the east of the development. Three laterals of diameter size 100 mm and 150 mm extended off the 300 mm main to service Stages 6-8.

4 Modelling results

4.1 Scenario One: Stages 1-4

Modelling determined that the Beacon Point Reservoir (382 m RL) and corresponding network infrastructure has sufficient capacity to meet the additional 47.80 l/s demand of Stages 1-4 with little impact on pressure and demand to the surrounding current network. However, minimum residual pressures of 300 kPa were not met at areas of higher elevation (above 343 m RL). This is due to the reservoir elevation relative to the higher levels of the development and is not considered as a result of head losses in the network (refer Appendix C for results).

It is noted that minimum residual pressures in the current network off Aubrey Road were not all greater than 300 kPa prior to the addition of the Scenario 1 upgrades. This is considered due to the high elevation of certain areas of the network in comparison to the elevation of the Beacon Point reservoir.

Modelling of available firefighting flows took into consideration local head loss at each fire hydrant. Results determined that the required firefighting category FW2 (25 l/s) was available throughout the network for Stages 1-4.

Table 2 Residual pressures and fire flows at each junction throughout the existing development north of Aubrey Road and proposed Scenario One network

Area	Junction ID	Elevation (m RL)	Minimum Residual Pressure(kPa)	Available Fire flow (l/s) (Inc. hydrant losses)
Existing Network	922	332	481 ≥ 300 OK	> 50 l/s OK
	912	348	265 < 300 NOT OK	46 ≥ 25 l/s OK
	919	352	206 < 300 NOT OK	41 ≥ 25 l/s OK
	918	356	147 < 300 NOT OK	34 ≥ 25 l/s OK
	917	348	196 < 300 NOT OK	40 ≥ 25 l/s OK
	916	348	216 < 300 NOT OK	42 ≥ 25 l/s OK
	911	348	216 < 300 NOT OK	43 ≥ 25 l/s OK
	956	346	235 < 300 NOT OK	44 ≥ 25 l/s OK
	910	331	383 ≥ 300 OK	>50 l/s OK
	923	331	383 ≥ 300 OK	40 ≥ 25 l/s OK
	914	331	441 ≥ 300 OK	>50 l/s OK
	915	333	422 ≥ 300 OK	43 ≥ 25 l/s OK
	925	346	294 < 300 NOT OK	43 ≥ 25 l/s OK
	924	346	255 < 300 NOT OK	36 ≥ 25 l/s OK
	920	343	235 < 300 NOT OK	44 ≥ 25 l/s OK
Northlake	927	331	363 ≥ 300 OK	> 50 l/s OK
Stage 1	928	343	284 < 300 NOT OK	> 50 l/s OK
	926	347	137 < 300 NOT OK	38 ≥ 25 l/s OK
	930	329	324 ≥ 300 OK	> 50 l/s OK
Stage 2	933	351	206 < 300 NOT OK	47 ≥ 25 l/s OK
Stage 3	932	351	196 < 300 NOT OK	45 ≥ 25 l/s OK
	929	352	196 < 300 NOT OK	40 ≥ 25 l/s OK
Stage 4	931	329	314 ≥ 300 OK	39 ≥ 25 l/s OK

4.2 Scenario Two: Ultimate development

Modelling indicated that with the additional demand for the ultimate development on top of current network operations, the Beacon Point reservoir would drain to empty towards the peak hour of the day without further network upgrades. This means levels of service are unable to be met throughout the ultimate development without upgrades to the current network.

The third pump at the Beacon Point inlet was included as a duty assist pump for modelling purposes, with the same duty head as the two existing operational pumps. Operation of all three pumps enabled network demands to be met, noting that specific assessment of the current intake ability to enable three pumps to operate concurrently has not been undertaken as part of this modelling work.

With the third operational pump at the intake, the required levels of service and firefighting flows in the area were not achieved for the higher areas in the development due to the elevation difference with the Beacon Point Reservoir (refer Appendix D). Table 3 below details the minimum residual pressures and fire flows achievable at each modelled junction in the development.

The results show that with three operating pumps, the required network demands and levels of service are achievable for the Gilbertson and Urquhart developments and Stages 1-4 of the Northlake Investments Limited development. However, due to the high elevation of the Allenby Farms Ltd development and Stages 6-8 of the Northlake Investments Ltd development, the same requirements cannot be met without localised pressure boosting or an additional upper reservoir. In general, this applies to all development and network connections at or above 355 m RL.

The proposed development pipe network is adequate to meet the additional development demands but only with localised boosting to higher areas of the network and upgrades to the current Beacon Point reservoir. An additional reservoir situated at the highest point in the network (414 m RL) could provide adequate levels of service to all areas below 384 m RL. However, the highest point in the proposed development is 393 m RL and therefore localised boosting would be required to meet areas of elevation higher than 384 m RL in the proposed development.

A small area in the existing network Northlake (around Junctions 918 and 919, refer Appendix B) does not meet levels of service for pressure due to its relative elevation to the Beacon Point Reservoir. Localised pressure boosting or connection to a higher pressure zone would be necessary to enable the 300 kPa minimum pressure requirement to be met in this location.

Table 3 Levels of service throughout the ultimate development with an additional pump at the Beacon Point intake

Area	Junction ID	Elevation (m RL)	Minimum Residual Pressure (kPa)	Available Fire Flow (l/s)
Existing Network	922	332	491 ≥ 300 OK	> 50 l/s OK
	912	348	324 ≥ 300 OK	> 50 l/s OK
	919	352	284 < 300 NOT OK	50 ≥ 25 l/s OK
	918	355	245 < 300 NOT OK	44 ≥ 25 l/s OK
	917	348	304 ≥ 300 OK	50 ≥ 25 l/s OK
	916	348	324 ≥ 300 OK	> 50 l/s OK
	911	348	324 ≥ 300 OK	> 50 l/s OK
	956	346	334 ≥ 300 OK	> 50 l/s OK
	910	331	481 ≥ 300 OK	> 50 l/s OK
	923	331	481 ≥ 300 OK	45 ≥ 25 l/s OK

Area	Junction ID	Elevation (m RL)	Minimum Residual Pressure (kPa)	Available Fire Flow (l/s)
	914	331	481 ≥ 300 OK	> 50 l/s OK
	915	333	471 ≥ 300 OK	47 ≥ 25 l/s OK
	925	346	353 ≥ 300 OK	41 ≥ 25 l/s OK
	924	346	334 ≥ 300 OK	41 ≥ 25 l/s OK
	920	343	363 ≥ 300 OK	> 50 l/s OK
Stage 1(Northlake)	927	331	491 ≥ 300 OK	> 50 l/s OK
	928	343	461 ≥ 300 OK	> 50 l/s OK
	926	347	314 ≥ 300 OK	> 50 l/s OK
	930	329	500 ≥ 300 OK	> 50 l/s OK
Stage 2 (Northlake)	933	351	383 ≥ 300 OK	> 50 l/s OK
Stage 3 (Northlake)	932	351	383 ≥ 300 OK	> 50 l/s OK
	929	352	383 ≥ 300 OK	> 50 l/s OK
Stage 4 (Northlake)	931	329	491 ≥ 300 OK	48 ≥ 25 l/s OK
Stage 5 (Allenby Farms Ltd)	934	345	343 ≥ 300 OK	> 50 l/s OK
	935	350	304 ≥ 300 OK	> 50 l/s OK
	936	355	255 < 300 NOT OK	48 ≥ 25 l/s OK
	937	362	196 < 300 NOT OK	40 ≥ 25 l/s OK
	938	366	167 < 300 NOT OK	34 ≥ 25 l/s OK
	939	359	245 < 300 NOT OK	45 ≥ 25 l/s OK
	945	370	118 < 300 NOT OK	23 < 25 l/s NOT OK
Stage 6 (Northlake Investments Ltd.)	950	346	334 ≥ 300 OK	50 ≥ 25 l/s OK
	946	372	98 < 300 NOT OK	16 ≤ 25 l/s NOT OK
Stage 7(Northlake Investments Ltd.)	951	357	226 < 300 NOT OK	34 ≥ 25 l/s OK
	952	359	206 < 300 NOT OK	30 ≥ 25 l/s OK
	953	361	186 < 300 NOT OK	27 ≥ 25 l/s OK
Stage 8 (Northlake Investments Ltd.)	949	393	0 < 300 NOT OK	0 ≤ 25 l/s NOT OK
	948	378	39 < 300 NOT OK	0 ≤ 25 l/s NOT OK
	947	374	78 < 300 NOT OK	8 ≤ 25 l/s NOT OK
Stage 9 (Urquhart)	954	329	481 ≥ 300 OK	32 ≥ 25 l/s OK
	955	329	402 ≥ 300 OK	23 ≤ 25 l/s NOT OK
Stage 10 (Gilbertson)	943	328	510 ≥ 300 OK	> 50 l/s OK
	944	329	500 ≥ 300 OK	> 50 l/s OK
Stage 11 (Gilbertson)	942	326	530 ≥ 300 OK	> 50 l/s OK

5 Conclusion

There is sufficient capacity for the Beacon Point reservoir to meet both peak day demand and fire flow levels of service requirements of Stages 1-4 of the Northlake Development with the proposed network. However, due to the elevations in the development, not all areas are able to achieve minimum residual pressure. Localised pressure boosting for areas above 350 m RL elevation would be necessary to ensure a minimum residual pressure of at least 300 kPa is achieved throughout the network (for Stages 1 -4 reticulation only).

Three Beacon Point intake pumps are required to operate (duty-assist-assist type operation) to meet current design network demands with the additional design demand from the full development (Stages 1 - 11) on the design peak day.

Provided the increased network demand can be met by Beacon Point intake (i.e. an additional operational pump at the Beacon Point intake), levels of service can be met within the development for the proposed areas below 355 m RL (i.e. Stages 1 - 4 and 9 - 11). Localised boosting (i.e. pump stations and/or upper reservoir) to areas of higher elevation (i.e. Stages 5 – 8) in the proposed development and isolated areas in the existing Northlake development network is required to enable levels of service requirements to be met.

The proposed development pipe network capacity is adequate for the design demands modelled and when combined with pressure boosting measures (to overcome the elevation difference between the development area and the Beacon Point Reservoir). Specific pressure boosting measures (i.e. upper reservoir and/or pump station(s)) have not been modelled.

6 Applicability and closure

The model is a numerical representation of the physical reality, and subsequently bears some uncertainty. The demands and peaking factors used are based on assumptions regarding the patterns of water use in the township, and are an approximation of the physical reality. Hence, actual demands within the network may differ from those modelled.

The modelling results presented in this report show the levels of service for the proposed developments to the Wanaka network, based on adopted design demands and particular network upgrades, and are not a guarantee of available levels of service in the future. In addition, modelling has been undertaken using the current partially calibrated Mike Urban dynamic model for Wanaka. QLDC are in the process of developing a new water supply model and results may vary between the existing and new models.

This report has been prepared for the benefit of Queenstown Lakes District Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without out prior review and agreement.

Tonkin & Taylor Ltd

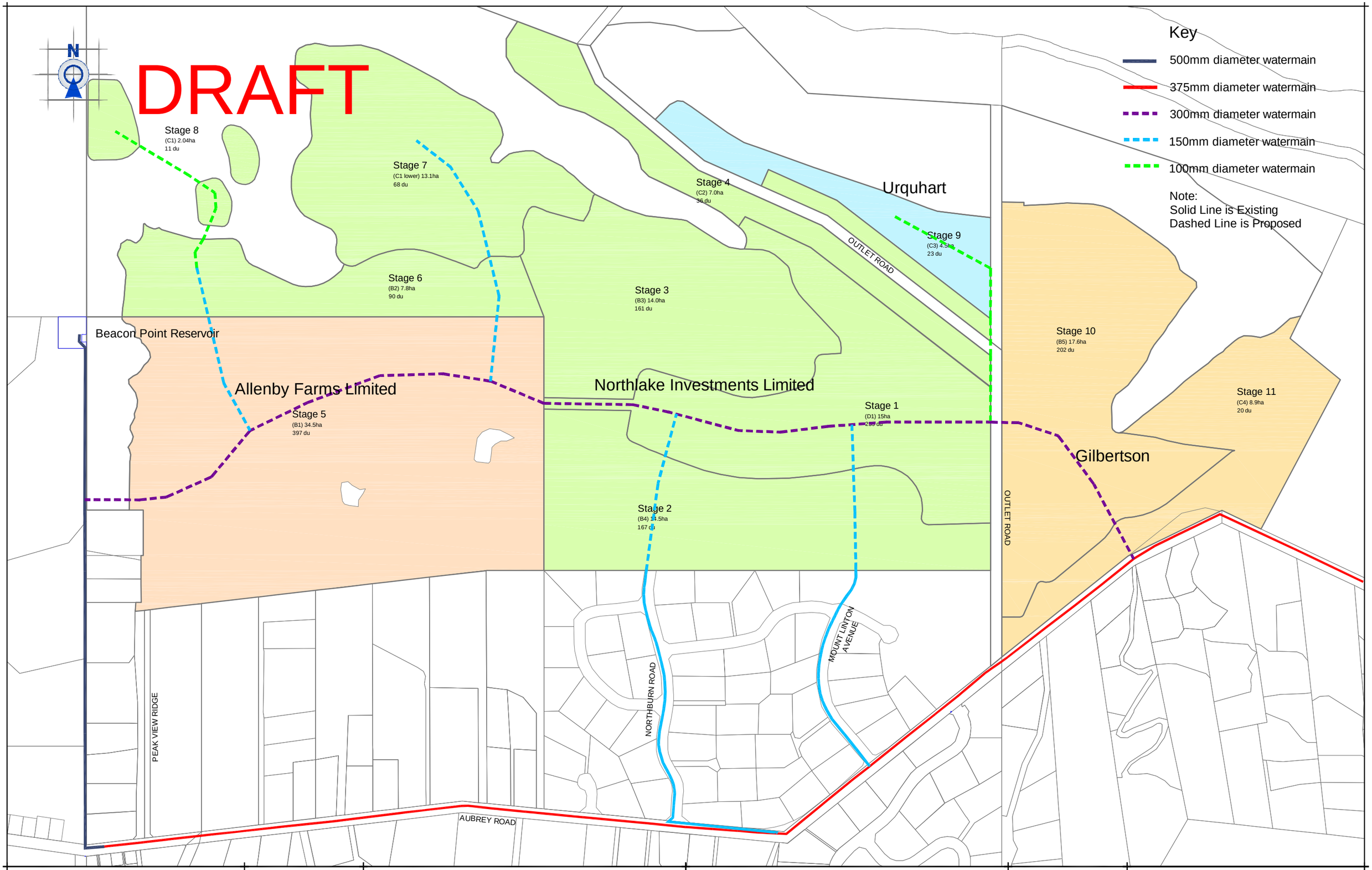
Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
.....	.....
Michaela Aspell	Grant Lovell
Civil Engineer	Project Director

Technical review by: Dominic Fletcher (Water Resources Engineer)

MLAA
p:\50553\50553.3 - wanaka\50553.3240 - northlake\workingmaterial\2016-02-10.mlaa.ltr rpt.northlake developments v4.docx

Appendix A: Draft Development Plans (Winton Partners)



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Client & Location:

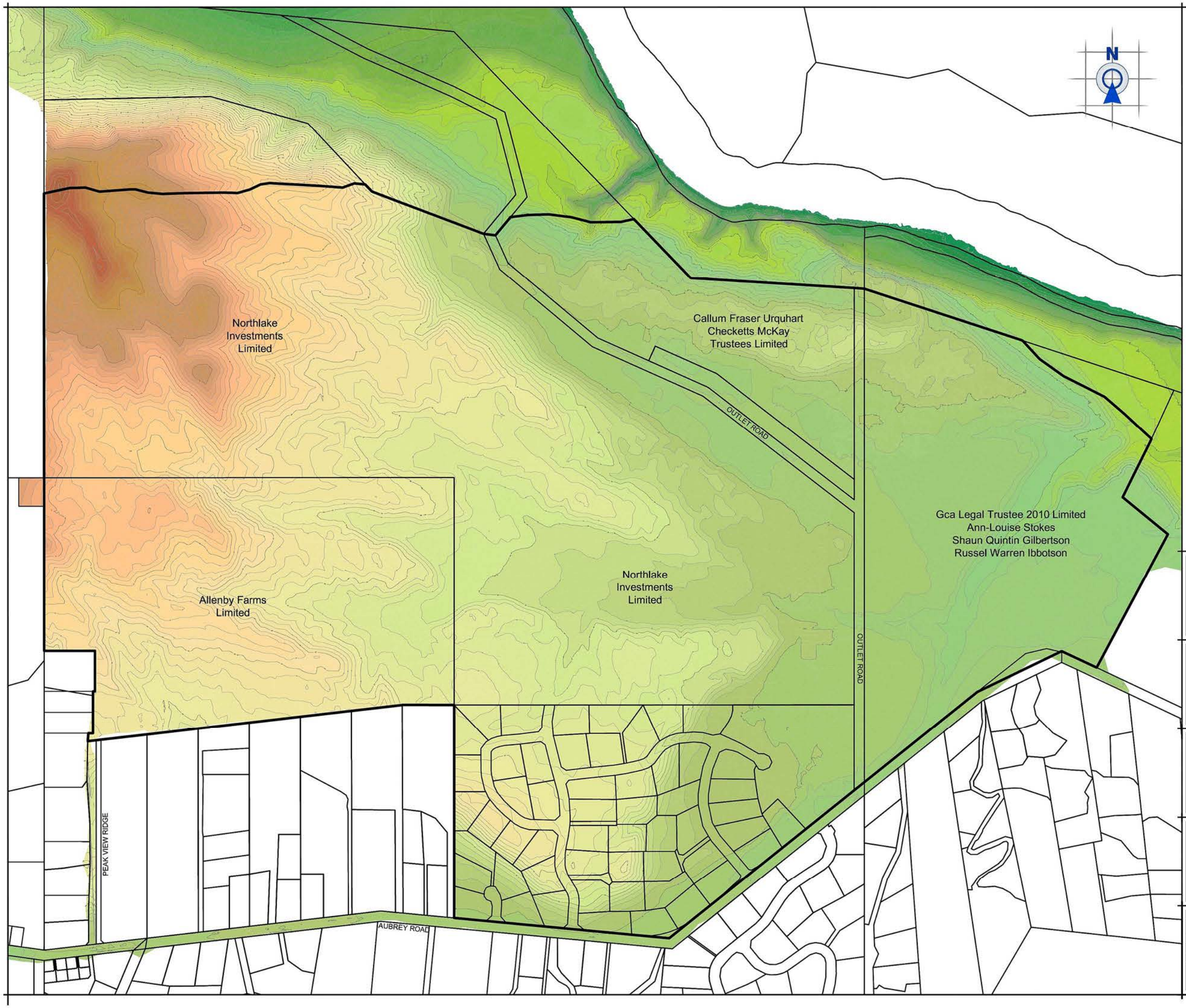
Winton Partners
NORTHLAKE

Purpose & Drawing Title:

Northlake Stages 1 - 11
Primary Watermains

Surveyed by:	-	Original Size:	Scale:
Designed by:	MJB	A3	1:6000 @ A3
Drawn by:	MJB		DO NOT SCALE
Checked by:	MJB		
Approved by:	MJB		
Job No: W4481-7		Sheet No: 2e	Revision No: 1 / Date Created: 17/12/2015

L:\DATA\4400\4481-7 STAGES 1-3\ACAD\MODELLING\W4481-7 008 NORTH LAKE - 3 WATERS MODELLING.DWG



KEY

- 430 - 420m
- 420 - 410m
- 410 - 400m
- 400 - 390m
- 390 - 380m
- 380 - 370m
- 370 - 360m
- 360 - 350m
- 350 - 340m
- 340 - 330m
- 330 - 320m
- 320 - 310m
- 310 - 300m
- 300 - 290m
- 290 - 280m
- 280 - 270m
- Zone Boundary
- Parcel Boundaries

Contour Interval = 2m

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Client & Location:

Winton Partners
WANAKA

Purpose & Drawing Title:

Northlake
Contour Plan

Surveyed by:	-	Original Size:	Scale:	
Designed by:	-	A3	1:7000 @ A3	
Drawn by:	RP		DO NOT SCALE	
Checked by:	MJB			
Approved by:	-			
Job No: W4481-7	Drawing No: 006	Sheet No: 102	Revision No: 0	Date Created: 17/12/2015

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Appendix B: Modelling Design Demands

Job no. 50553.324
Description Northlake Developments Water Supply Modelling Demands
Computed 15/01/2015 mlaa

NORTHLAKE SUBDIVSION

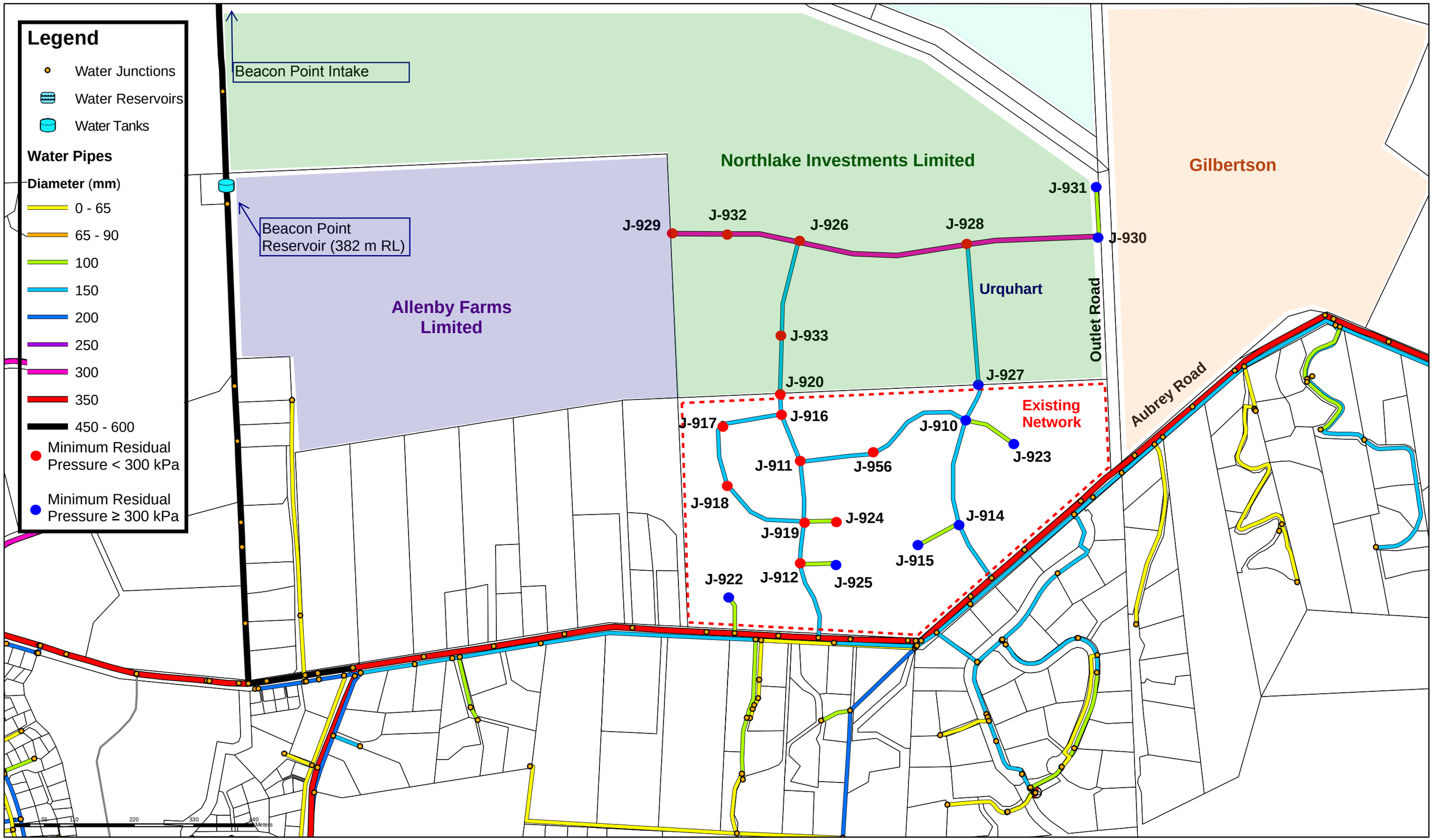
Density 3 people/lot
Water allowance 700 l/person/day

Stage	No. of lots	ADF (l/s)	PDF (l/s)	PHF (l/s)
1	225	5.47	18.05	36.09
2	145	3.52	11.63	23.26
3	140	3.40	11.23	22.46
4	32	0.78	2.57	5.13
Scenario 1 (1-4)	542	13.17	43.47	86.95
5	345	8.39	27.67	55.34
6	78	1.90	6.26	12.51
7	59	1.43	4.73	9.46
8	9	0.22	0.72	1.44
9	20	0.49	1.60	3.21
10	176	4.28	14.12	28.23
11	18	0.44	1.44	2.89
Scenario 2 (1-11)	1247	30.31	100.02	200.04

EXISTING NETWORK NORTH OF AUBREY ROAD

Density (people/lot)	3
Water allowance (l/person/day)	700
Number of lots	54
ADF (l/s)	1.31
PDF (l/s)	4.33
PHF (l/s)	8.66

Appendix C: Initial Scenario: Stages 1-4



Initial Scenario: Stages 1-4 Water Supply Reticulation

MIKE URBAN

Tonkin+Taylor

N
W E
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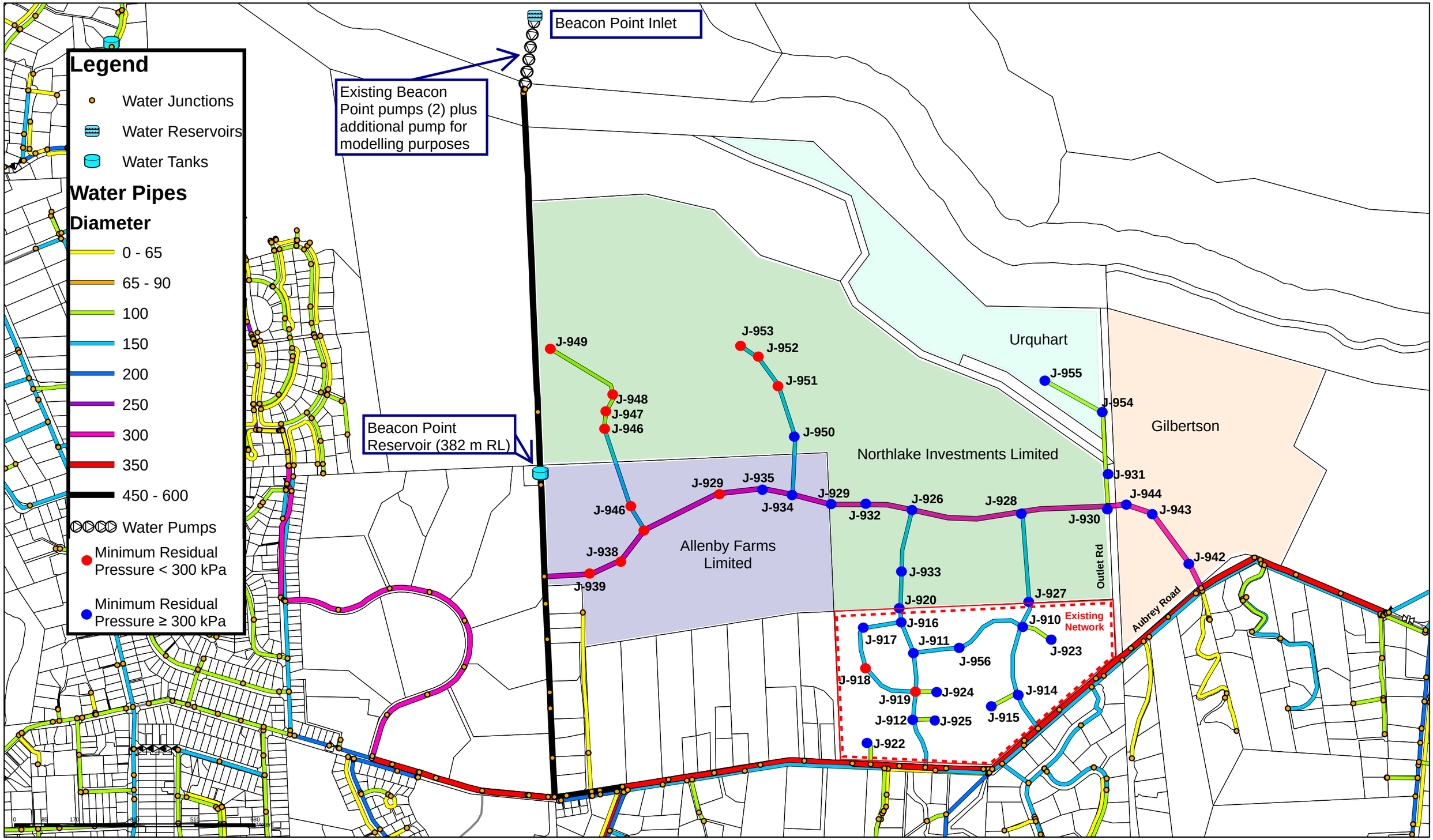
Drawn By:	MLAA
Date:	04/02/2016
Approved:	
Scale:	1:6,500

Appendix D: Ultimate scenario (All Stages)



Ultimate Development
Water Supply Reticulation
- with additional inlet pump

MIKE URBAN

Tonkin+Taylor

N
W E
S

Drawn By:	MLAA
Date:	04/02/2016
Approved:	
Scale:	1:10,000