APPENDIX E – WATER MODELLING REPORT

Tonkin & Taylor

T&T Ref: 51556.019
21 March 2012

Paterson Pitts Partners (Wanaka)
P.O. Box 283
Wanaka 9343

Attention: Mike Botting

Dear Mike

Results of water modelling for proposed Ballantyne Investments rezoning development, Ballantyne Road, Wanaka

Following your email dated 19 March 2012, and in accordance with your request and our conditions of engagement, we have run our WaterGEMS Wanaka water supply model to check the levels of service for the proposed development at several lots between Ballantyne Road and the Wanaka-Luggate Highway (SH 84), Wanaka. This work was performed for Paterson Pitts Partners as our client.

This modelling is an update of work previously undertaken for this site in 2010 (T&T ref. 51556.010, letter issued 26 July 2010).

Modelling proceeded on the basis of the land uses and densities as detailed in the drawings provided by you (Common Ground Studio drawing SK 10020-T2-02, titled *"Indicative Land Use and Density"* issued February 2012, attached), and summarised in the "Demands" section below.

Development setting

The proposed development is in the Beacon Point pressure zone, which is supplied from the Beacon Point Reservoir via the Anderson Road 250 mm/200 mm NB PVC main. The Wanaka water supply network near the proposed development is shown in Figure 1 (next page).

Tonkin & Taylor Ltd - Environmental and Engineering Consultants, 33 Parkhouse Rd, Wigram, Christchurch, New Zealand
PO Box 13-055, Christchurch, Ph: 64-3-363 2440, Fax: 64-3-363 2441, Email: chch@tonkin.co.nz, Website: www.tonkin.co.nz

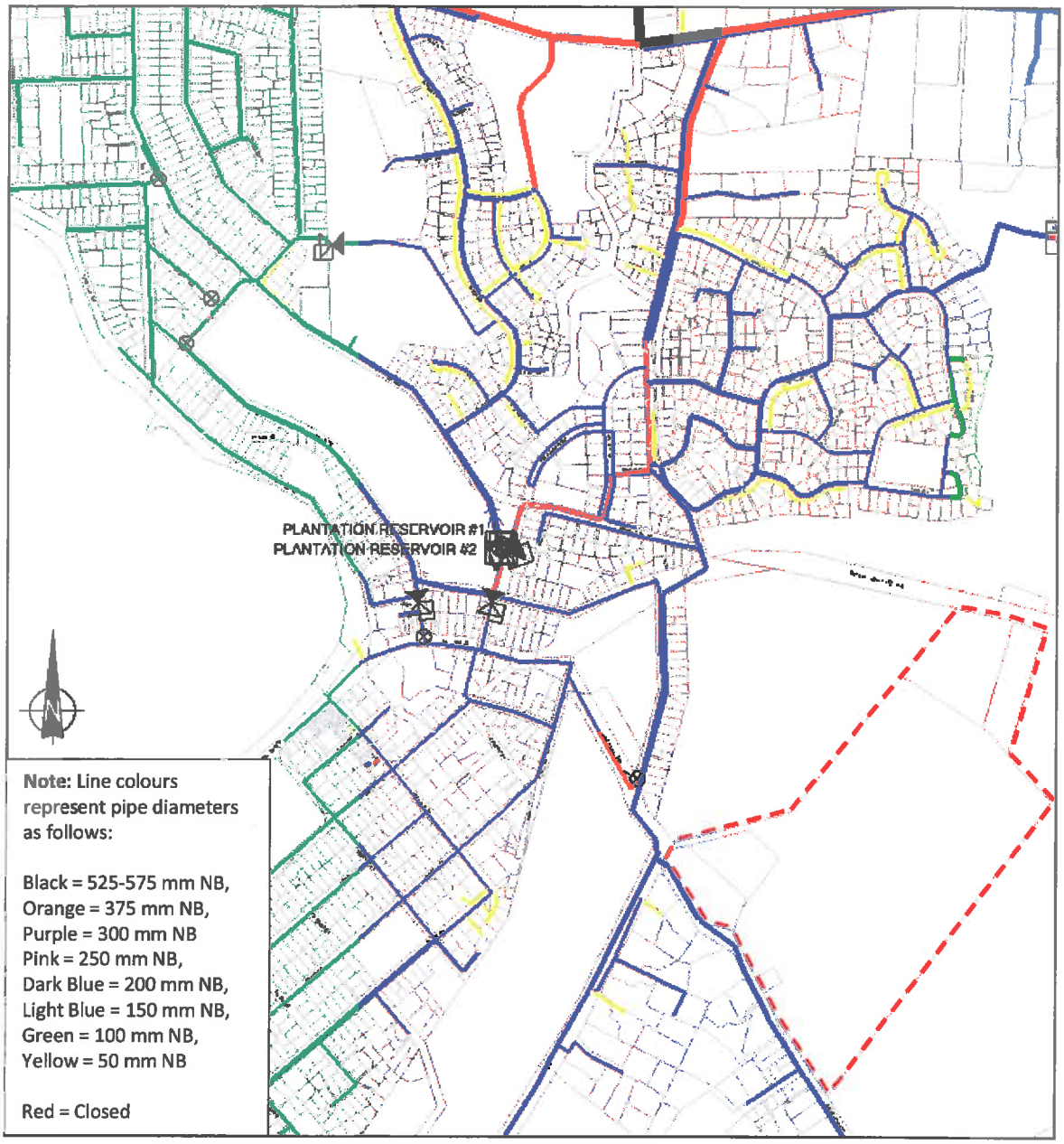


Figure 1 *Wanaka water supply network near the proposed rezoning development (development site outlined in red) [Not to scale]*

Modelling methodology

The modelled demand scenarios used to determine levels of service for the Wanaka water supply network were

- **Peak day demand** - To determine whether available fire flows meet fire fighting requirements[1], and
- **Peak hour demand** - To determine whether minimum residual pressures at each connection are ≥ 300 kPa[2].

We have proceeded with modelling on the basis that proposed upgrades to the network to supply the Three Parks development (Albert Town ring main as per our modelling for the Wanaka Future Options Study, Feb 2008) will be completed prior or in conjunction with the Ballantyne Investments development. These upgrades consist of a 300 mm NB PVC main down a southern section of Anderson Road (between Link Way and SH84) (previously modelled as a 200 mm NB main) and then along SH84. These upgrades are required to enable levels of service requirements to be met within the development.

There is assumed to be no connection between this 300 mm NB main and the existing 200 mm trunk main at the junction of Anderson Road and SH84, as this was found to have a detrimental effect on pressures and fire flows in the Cardrona Valley Road area.

We have previously assessed (in 2010) the minimum required reticulation sizes to enable levels of service requirements to be met within the development to be a 300 mm NB PVC trunk main running north to south, with 150 mm and 100 mm NB PVC distribution mains running off this trunk main. We have assumed a similar pipe diameter layout to the 2010 modelling, and the modelled development reticulation is shown in Figure 2 (above). Reticulation sizes have not been optimised for this update of the modelling results. It is possible that smaller reticulations sizes may now be acceptable with the reduced level of demand.

We have assumed that fire hydrants will be installed at appropriate intervals along the mains to ensure that all properties would be within 135 m of a hydrant, as per SNZ PAS 4509:2008.

We have also assumed connection to Ballantyne Road via two PRVs. These PRVs are intended to open during fire flow events only, because opening during normal operation results in increased fire flow along McPherson Street and reduced pressures to the Cardrona Valley Road area.

Modelled hydrant and junction elevations are as per the existing ground contours (as sourced from LiDAR data provided by QLDC).

Note: Modelling has been undertaken using the existing WaterGEMs model rather than the Mike URBAN model recently commissioned by QLDC. This is because the Mike URBAN model has not yet been fully completed and is preliminary only. Initial work with the Mike URBAN model suggests similar modelling results are likely to be obtained by the two models.

---

[1] Fire flow requirements are in accordance with SNZ PAS 4509:2008, *"New Zealand Fire Service Fire Fighting Water Supplies Code of Practice"*.

[2] The minimum residual pressure requirement is as set out in Queenstown Lakes District Council Amendments and Modifications (2005) to NZS 4404:2004, *"Land Development and Subdivision Engineering"*.

Demands

For the residential parts of the development, the average daily flow (ADF) demand was calculated assuming an average population of 3 people per residential dwelling and an average daily water consumption of 700 l/person.day, as per QLDC requirements. Design demands and development densities are presented in Table 1 below.

As per your email communication on 19 March 2012 and as per our previous modelling for this development, we have assumed the following:

- For low density residential zoning: 10 units per ha
- Medium density residential zoning: 25 units per ha
- Business areas: a design average day flow of 0.7 *l*/sec per ha

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 Design average demands for Ballantyne Investments Ltd development

Land use zone	Design flow per area/unit	Area (ha)	Average daily flow (ADF)	Peak day flow (PDF)	Peak hour flow (PHF)
			l/sec	*l/sec*	*l/sec*
Business	0.7 *l/sec.ha*	1.35	0.95	3.12	6.24
Low Density Residential	700 *l/day.person*	10.6 (i.e. 106 units)	2.58	8.50	17.00
Medium Density Residential	700 *l/day.person*	23.9 (i.e. 597 units)	14.52	47.92	95.85
	TOTAL	**35.85**	**18.05**	**59.54**	**119.09**

Demands calculated for the previous modelling in 2010 were a PDF of 72.15 *l*/sec and a PHF of 144.29 *l*/sec.

We have added the above demand into our WaterGEMS dynamic network analysis model for Wanaka, last updated February 2010. Demands were distributed (based on indicative land use key in site plan layout) across the network within the development at 16 junctions (refer Table 2 and Figure 2 below).

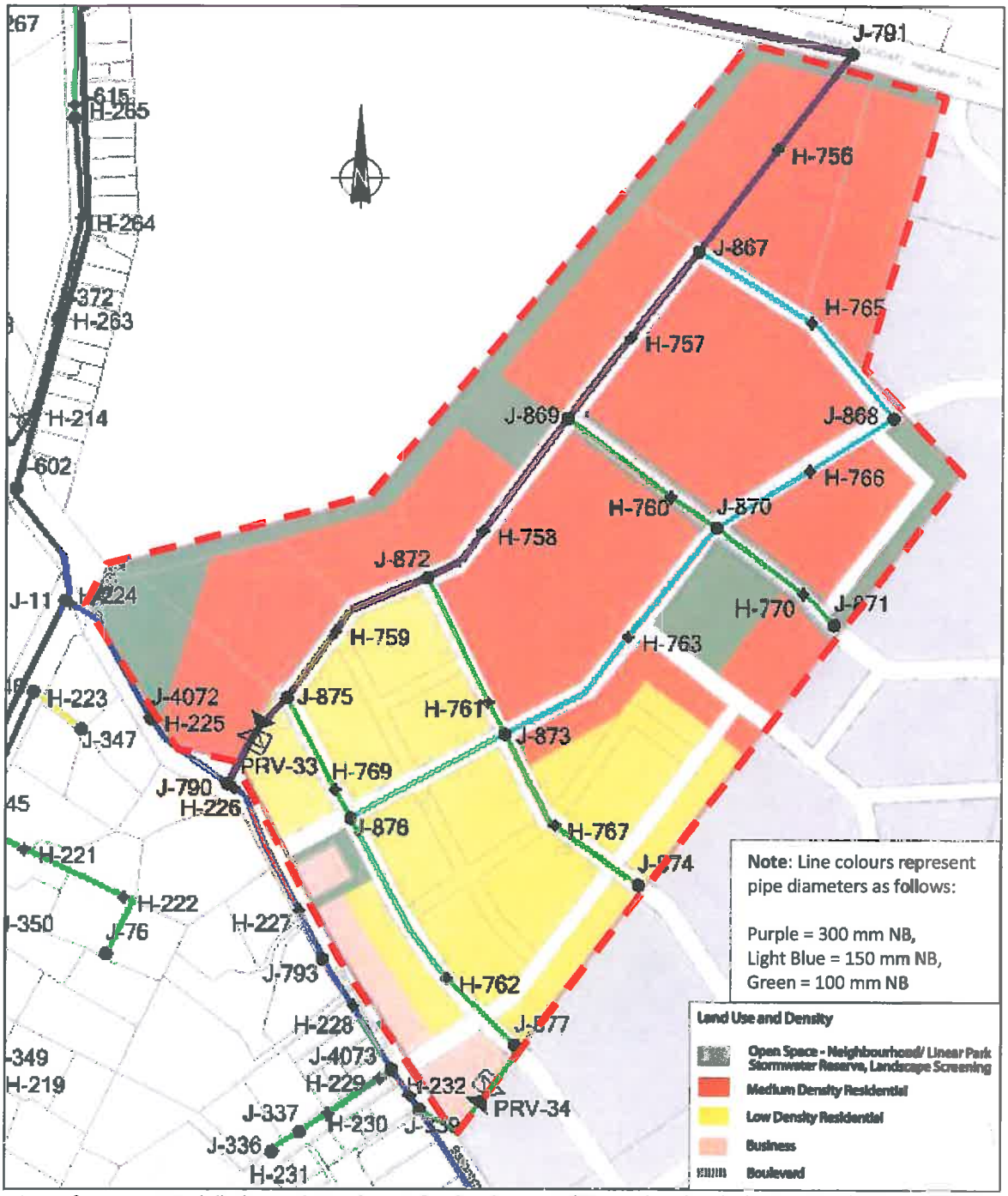


Figure 2 *Modelled reticulation layout for development (Site outlined in dashed red line) [Not to scale]*

Modelling results

We have not included connections between the development reticulation and the Ballantyne Road 200 mm NB PVC main, as modelling shows that these connections would result in a significant drop in the available levels of service in the Cardrona Valley Rd area (due to higher headlosses in the McPherson St trunk main).

Modelling results are presented in Tables 2 & 3 below. Note that these results relate to the Ballantyne Investments Ltd development alone with 2009 design demands, and do not include demands from other proposed developments recently modelled by Tonkin & Taylor.

Table 2 Demand distribution and minimum pressures

Nodes assessed for pressure	Peak hour demand (l/sec)	Residual pressure [1] (kPa)
J-791	8.63	460 ≥ 300 **OK**
J-867	14.38	380 ≥ 300 **OK**
J-868	12.46	350 ≥ 300 **OK**
J-869	14.38	360 ≥ 300 **OK**
J-870	11.5	330 ≥ 300 **OK**
J-871	6.71	310 ≥ 300 **OK**
J-872	9.82	340 ≥ 300 **OK**
J-873	11.52	310 ≥ 300 **OK**
J-874	4.42	300 ≥ 300 **OK**
J-875	12.58	310 ≥ 300 **OK**
J-876	6.84	300 ≥ 300 **OK**
J-877	5.86	320 ≥ 300 **OK**

(1) A minimum residual peak hour pressure of 300 kPa is required as per QLDC amendments to NZ 4404:2004.

Table 3 Fire flow availability

Hydrant assessed for fire flow	Fire flow available (*l/sec*) [(1)(2)(3)]
Within development:	
H-756	183 ≥ 25 **OK**
H-757	167 ≥ 25 **OK**
H-758	154 ≥ 25 **OK**
H-759	144 ≥ 25 **OK**
H-760	87 ≥ 25 **OK**
H-761	84 ≥ 25 **OK**
H-762 *	60 ≥ 50 **OK**
H-763	96 ≥ 25 **OK**
H-765	115 ≥ 25 **OK**
H-766	100 ≥ 25 **OK**
H-767	46 ≥ 25 **OK**
H-769 *	87 ≥ 50 **OK**
H-770	46 ≥ 25 **OK**
On Ballantyne Road	
H-225	173 ≥ 25 **OK**
H-226	156 ≥ 25 **OK**
H-227 *	127 ≥ 50 **OK**
H-228 *	115 ≥ 50 **OK**
H-232 *	108 ≥ 50 **OK**

* = Hydrant is within commercial area.

(1) A total of 50 l/sec is required from within 270 m of each unsprinklered commercial/business building (Class FW3 fire fighting), as per SNZ PAS 4509:2008. 25 l/sec must be available from one hydrant within 135 m.

(2) A total of 25 l/sec is required from within 270 m of each unsprinklered residential dwelling (Class FW2 fire fighting) as per SNZ PAS 4509:2008. 12.5 l/sec must be available from one hydrant within 135 m.

(3) A minimum of 12.5 l/sec is required from each hydrant.

Modelling shows that, during the design peak hour demand scenario, the residual pressures in the development will be at least 300 kPa. Hence, the Queenstown Lakes District Council (QLDC) requirement for minimum pressures being ≥ 300 kPa is **met** within the proposed development.

Modelling also shows that in the commercial area in the south of the development, a minimum of Class FW3 fire flow **can be** achieved during the design peak day demand scenario, as required for an unsprinklered commercial/business development. All hydrants can deliver at least 50 l/sec within 270 m. Additionally, modelling shows that for the residential portions of the development, a minimum of Class FW2 fighting **can be** achieved during the design peak day demand scenario, as required for an unsprinklered residential development. All hydrants can deliver at least 25 l/sec within 270 m.

To achieve the fire flows in the table above, PRV-34 (from Ballantyne Road to the development) has been preliminarily set to have a downstream hydraulic grade of 340 m RL.

Effects of connection on network capacity

Modelling shows that connection of this development with full development demand would **reduce** the minimum pressures in the Cardrona Valley Road area by **120 kPa**, during the 2009 design peak hour scenario, due to increased headlosses along the Anderson Road mains. This results in the West Meadows development and properties on Stone Street, Niger Street and Orchard Road receiving pressures less than 300 kPa. A minimum pressure of 210 kPa occurs at the western end of West Meadow Drive. Hence, QLDC minimum residual pressure requirements would **not be met** in other areas of the network with connection of the Ballantyne Investments development, **without** upgrades to the network.

It is possible that in the short to medium term that a development with a lower level of demand and a connection to Ballantyne Road **may** increase pressures slightly to the Cardrona Valley Road area (due to the improved connectivity). However, this connection would reduce pressures to the Cardrona Valley Road area once demand increased within the Ballantyne Investments development.

Modelling shows that connection of this development has **minimal negative effect** on the fire flows in the remainder of the network, **provided** that a PRV is installed between the proposed development and Ballantyne Road. This connection would **improve** fire flows to Ballantyne Road and some parts of Cardrona Valley Road. These modelling results are based on a preliminary hydraulic grade setting of 362 m RL at PRV-33 (from the development to Ballantyne Road).

Additional comments

The effects on current network capacity by connection of the Ballantyne Investments development are minimised by not immediately connecting to the Ballantyne Rd trunk main. Modelling shows that connection to the Ballantyne Rd main would result in increased headloss through the McPherson St trunk main reducing the pressures in the Cardrona Valley Rd area. Future network upgrades would dictate when connection to Ballantyne Rd is appropriate.

Since the last modelling report for this development in 2010, Queenstown Lakes District Council has commissioned an upgrades study for this area of the Wanaka water supply network (T&T ref. 50553.305 in March 2011, and 50553.306 in September 2011). Considerable assessment was undertaken of potential upgrades to improve pressures and fire fighting to the Cardrona Valley Road area, which included assessment of the potential 72.15 l/sec demand from the previously advised Ballantyne Investments development. This report should be read in consideration of the results of those upgrade reports.

We are currently unable to quantify the effects of this development's connection on the adjacent developments further due to uncertainties in the overall strategy for upgrades in Wanaka at the time of preparing this report. This development should be considered further as part of the overall network upgrades strategy for the Wanaka water supply network.

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.

This report has been prepared for the benefit of Paterson Pitts Partners (Wanaka) 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 our prior review and agreement.

In addition, the modelling results presented in this report show the available levels of service for the **current** Wanaka network, based on the **2009 design demands**, and are not a guarantee of available levels of service in the future.

We trust this modelling report meets your requirements. Please contact Dominic Fletcher (dfletcher@tonkin.co.nz) on 03 363 2472 if you wish to discuss these results or any other aspect of this modelling report.

Yours sincerely,

TONKIN & TAYLOR LTD

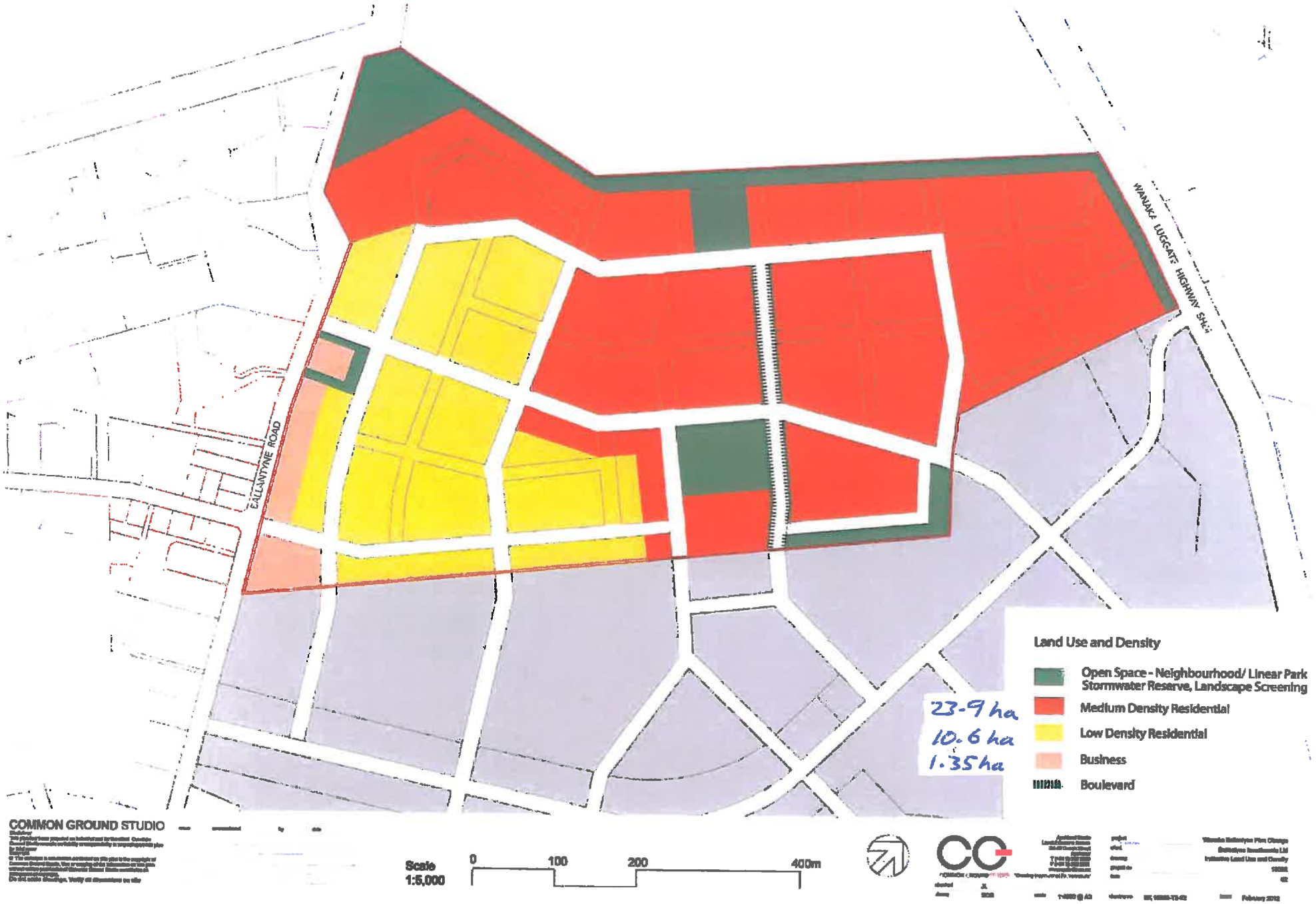
Grant Lovell
CHRISTCURCH GROUP MANAGER

Report prepared by:
Pieter Vanderpoel
CIVIL ENGINEER

Technical review by:
Dominic Fletcher
T&T PROJECT MANAGER

Attachments:
Common Ground Studio drawing SK 10020-T2-02, titled *"Indicative Land Use and Density"* dated February 2012.

21-Mar-12
p:\51556\51556.0190\workingmaterial\2012-03-20.pev.ltr.water modelling results - updated report.doc


EALLANTYNE ROAD
WANAKA LUGGATE HIGHWAY SH6
Land Use and Density
Open Space - Neighbourhood/ Linear Park
Stormwater Reserve, Landscape Screening
Medium Density Residential
Low Density Residential
Business
Boulevard
23-9 ha
10.6 ha
1.35 ha
COMMON GROUND STUDIO
Scale
1:5,000
0
100
200
400m