Water Supply Report
Peppertree Estate
Gundy Rd - Scone

Prepared for

Charles David Pty Ltd

MM Hyndes Bailey

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Contents

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1 EXECUTIVE SUMMARY

As part of the Development Application for Peppertree Estate the requirements of reticulated water to the development have been investigated.

The report confirms that a residential subdivision of 423 lots can be serviced by the 2ML high level reservoir east of Scone via a 250Φ HDPE80 delivery main, with the use of a pressure reducing valve.

A reticulation system comprising 150Φ and 100Φ PVC U pipes can adequately meet the minimum requirements of pressure and flow for peak hour demand and fire fighting.

2 BACKGROUND

MM Hyndes Bailey has been engaged by developer Charles David Pty Ltd to submit a development application for a 423 block subdivision known as Peppertree Estate.

It is proposed that the water supply for this subdivision be serviced by the Upper Hunter Council's 2 ML high level reservoir which also services the high level residential areas in the east of Scone.

The rural residential subdivision known as Bakewell Rural Residential Subdivision, located off Gundy Rd to the south of the reservoir also draws its water supply from this reservoir. This subdivision may serve up to 70 rural residential blocks in the future. A separate report addressing the water supply for this subdivision was prepared earlier in 2017. This report assessed the delivery main requirements for both the full development of Peppertree Estate and the Bakewell subdivision.

This previous study found that a 250Φ HDPE 80 PN16 polyethylene delivery main would be necessary to service the Peppertree residential estate.

3 OBJECTIVES

The objective of this study is to assess the reticulation network required to service each residential block within the proposed Peppertree Estate.

4 LOCATION

The location of the proposed Peppertree Estate subdivision and Bakewell rural residential subdivision is shown in Figure 1 Location Plan below.

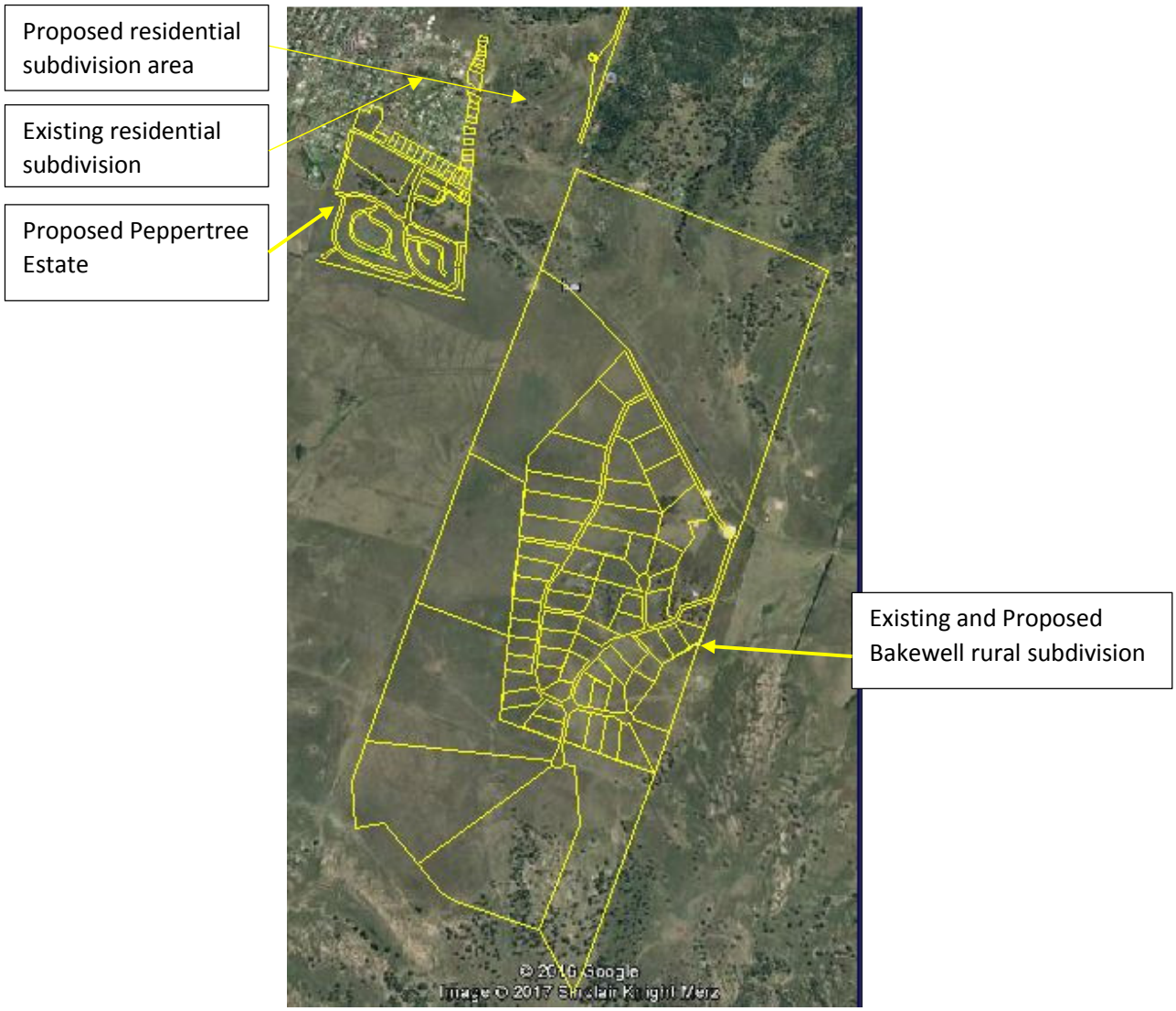

Figure 1 Location Plan

5 SCONE WATER RETICULATION SYSTEM

Up until recently, Scone water supply was serviced by the Barton Street reservoirs. A 2ML high level reservoir has now been constructed which will serve existing and future residential lots in the east of Scone where development is occurring at higher levels.

The BWL of the high level reservoir operates is RL317.55 while TWL is RL322.55. Adopting a maximum static head of 80m means that developments above RL242.5m will need to be serviced by the high level reservoir. Developments such as Peppertree estate which lie below this level can be serviced by the HL reservoir with appropriate pressure reducing valves.

Based on a peak day demand of 2500kL/day/tenement (refer Annex'A'), the 2ML reservoir is capable of serving 800 residential allotments.

6 NETWORK PROPOSAL

6.1 DEVELOPMENT PROPOSAL

The layout of the proposed subdivision is shown below as Figure 2.

Figure 2 Peppertree Estate

6.2 Trunk Main Proposals

Peppertree estate is located at levels below RL 242.5 which will exceed the 80m maximum head requirement for residential lots. To be serviced by the HL Reservoir will therefore require a pressure reducing valve on the delivery main immediately before reticulation network for the residential lots.

As noted in the previous report, it is proposed to construct a trunk main along a similar alignment of the existing main servicing the rural residential development. The size of the main from the reservoir to Gundy Rd has been designed with sufficient capacity to serve both Peppertree Estate and the proposed 70 lot Bakewell rural residential subdivision.

It is proposed to construct a 250nom Φ HDPE 80 PN16 polyethlene pipe manufactured in accordance with AS/NZS 4130:2003 for the trunk main from the reservoir to Peppertree Estate.

6.3 Design Criteria for Analysis

The water supply report for Bakewell rural residential development outlined comprehensive details on the adoption of appropriate design criteria for both rural residential and residential subdivisions in Scone. An extract of this study appears as 'Annex A' to this report.

Based on that analysis, the following design criteria have been adopted for analysis.

	Flow rate l/s	Minimum Pressure kPa
Residential Development	0.086	200
Rural Residential Development	0.124	200
Fire Flow –10l/s at most hydraulically disadvantaged hydrant		
Residential Development	0.7	150
Rural Residential Development	0.1	150

Table 1 Design Criteria

The peak hour flow rates for residential developments have been increased by 5% to account for additional unit developments in the subdivision.

7 WATER NETWORK

7.1 CAVEATS

No allowance has been made for any connections from the trunk main to serve any other properties other than the two developments the subject of this report.

7.2 NETWORK STANDARDS

It is proposed that PVC-U PN18 pressure pipes complying with AS/NZS 1477 be used for the reticulation within the subdivision. The pipes will be located within the footpath area on the standard alignment adopted by Upper Hunter Council.

Stop valves will be placed on branch mains as close as possible to its connecting point but within the footpath or median. Generally valves will be located so that no more than 50 properties can be isolated for maintenance purposes at any time.

Hydrants will be placed at high points and low points and otherwise at no more than 100m spacings.

7.3 ANALYSIS MODELLING

7.3.1 Model

An analysis of the proposed water supply network has been undertaken using EPANET developed by the "US Environmental Protection Agency". The model determines the residual pressure in the network, based on the pipe sizes, friction loss and demand level inputs into the model.

Friction losses have been determined by reference to AS 2200-1978 Design Charts for Water and Sewerage which recommends a k value for Colebrook White formula of between 0.003 – 0.015. AS2200 comments that adoption of a roughness coefficient should take into account, biological growths and incrustations that develop with age as well as friction losses associated with valves and fittings. Hunter Water Corporation recommend a k value for Colebrook-White formula of 0.06 for polyethelyene and PVC.

As the EPANET model uses the Hazen-Williams formula it is necessary to adopt the equivalent C value for this formula. AS 2200-1978 gives a C value of 145 which has been used in the model.

7.3.2 Peak Hour Modelling

Annex 'B' shows the layout of the water supply network proposed.

As previously indicated, a pressure reducing valve will be required to be located immediately before the reticulation network as indicated in Annex 'B'. This PRV needs to be set to reduce the pressure by 34m of head to ensure the maximum allowable static head in the reticulation system does not exceed 80m for the lowest lot developed and at the same time, achieve a minimum operating pressure of 20m at the most hydraulically disadvantaged location in the network for peak hour demand flows.

The network analysis shows the following results (refer Table 2) for the most hydraulically disadvantaged water service in the network, located in the S-E corner of the development (refer Annex'B'), taking into account a 34m reduction in pressure. Maximum velocities in the network were well within acceptable standards.

Criteria	**Min. Head**	**Min Head allowable**	**Max Velocity**
Peak Hour analysis			
Minimum pressure	20.17m	20m	
Maximum velocity			1.39m/s

Table 2 Key Results (peak hour analysis)

The network recommended in Annex'B' includes a 150Φ connection at the entry road as well as a second 150Φ connection at the eastern extremity of the development on Gundy road. This second connection is necessary to provide a 150Φ loop main to achieve a minimum operating pressure at the S-E extremity of the development. This additional connection has also allowed the reduction of the delivery main in Gundy Rd immediately adjacent to the development from 250Φ (as previously recommended in the Bakewell Report) to 150Φ.

7.3.3 Modelling for Fire Fighting Demand Criteria

An analysis of the network based on 10l/s fire flow at the most hydraulically disadvantaged location (refer Annex'B') gives the following result.

Criteria	**Minimum Head**	**Allowable Head**
Fire analysis		
Minimum pressure	16.9m	15m

Table 3 Key Results (fire)

8 CONCLUSION

i. The existing 2ML high level reservoir has sufficient capacity to service 800 residential properties.

ii. Peppertree Estate can be serviced by the HL 2ML reservoir with a 250Φ HDPE80 PN16 trunk main providing a pressure reducing valve capable of reducing the pressure by 34m, is installed immediately before the subdivision water network .

iii. The water reticulation system designed (refer Annex'B') is capable of meeting the design criteria for peak hour demand and fire fighting as set out in the report.

Yours faithfully,

Bruce Macfarlane
Consulting Engineer
MM Hyndes Bailey & Co.

9 REFERENCES

- Water Supply Report – Bakewell Rural Subdivision – Scone MM Hyndes Bailey June 2017

- WSA 03: 2002 – Water Supply Code of Australia

- Hunter Water Corporation Water and Sewer Design Manual, Section 2 Water Network

- Water Directorate Fire Flow Design Guidelines

- AS2419.1 – 2005 Fire Hydrant Installations.

- Public Works Department, Water Supply Investigation Manual, 1986.

- Upper Hunter Council, Drought Management Plan 2014.

- Muswellbrook Council Water Supply Demand Management Plan 2015.

ANNEX 'A'
Extract from Water Supply Report Bakewell Rural Subdivision- Scone

DEMAND

Upper Hunter Council has requested that the Bakewell rural subdivision be serviced with a water supply system equivalent to residential standards.

In accordance with the "Water Supply Code of Australia (WSA03-2002:2.3)" where Water Authorities do not specify their requirements, delivery main systems can be designed for the peak hour demand derived as follows:

- Estimate the annual average daily demand,

Apply a peak day demand factor to ascertain the peak day demand, and

- Determine the peak hour demand by applying a peak hour factor.

Minimum pressure in the main at the property meter is recommended to be 20m. This pressure needs to be adjusted higher to take account of allotments that slope steeply up from the road.

AVERAGE ANNUAL DAY DEMAND

Several sources have been referenced to ascertain the appropriate design criteria to use in the analysis of the delivery main requirements.

Upper Hunter Drought Management Plan

Based on information provided in Upper Hunter Drought Management Plan, an Average Annual Day Demand (AADD) for residential properties in Scone and Aberdeen has been derived as follows:

Residential population Scone/Aberdeen 2011/12	6916 (Table 2)
Growth rate	0.8% (Table 1)
Estimated Residential population	
Scone/Aberdeen 2013/14	7027

Residential consumption Scone/Aberdeen 2013/14	898ML (Table 5, Drought Mgt Plan)
Annual residential consumption per person 2013/14	127.8 kL/person/yr
Applying a factor of 2.4 persons /tenement gives	306.7 kL/tenement/yr

Hunter Water Corporation

The Hunter Water Corporation Design Manual provides the following figures for comparison:

Average Daily Demand for urban houses Cessnock and Maitland	285 kL/yr
Average Daily Demand for Rural houses	350kL/yr.

Muswellbrook Shire Council Demand Management Plan

Muswellbrook Shire Council's Demand Management Plan indicates a climate corrected average residential demand of 267kL/prop/yr for 2013/14 (Table 11, Sec 2.7).

Recommended Average Annual Daily Demand

Based on the information above, it is recommended that the following AADD be adopted for design purposes:

- Residential development 300kL/prop/yr
- Rural residential development 350kL/prop/yr.

PEAK DAY DEMAND

Water Supply Code of Australia

The Water Supply Code of Australia (WS03-2002:2.3) recommends applying a peak day factor of 2 for populations < 2000, where no other data is available. Based on the recommendations outlined in 0 this would result in peak day demands of

- Residential Development 1645 L/prop/day, and
- Rural Residential Development 1920 L/prop/day.

Hunter Water Corporation

Hunter Water Corporation design manual applies a peak day factor (Table 2.2) and a diversity factor which varies depending on the size of the development. This leads to the following peak day demands:

- Residential development 2563 L/prop/day
- Rural Residential Development 3673 L/prop/day

Muswellbrook Shire Demand Management Plan

The Muswellbrook Shire Demand Management Plan shows the 2013/14 residential peak day demand as 2000 L/prop/day. (Table 12, Sec 2.7.2). The report notes that 2013/14 was the driest year which accounted for the highest peak day demand in the previous 7 years.

Recommended Peak Day Demand

Based on the information assessed above, it is recommended that the following conservative peak demands be adopted as the basis of design:

	Residential KL/prop/day	**Rural Residential KL/prop/day**
Peak Day Demand	2500	3600

PEAK HOUR DEMAND

Peak Hour Factor

The WSA Code recommends, in the absence of other data, a peak hour factor of 5 for populations of less than 2000 be applied to the peak day demand.

On the other hand, Muswellbrook Shire Council has adopted a peak hour factor of 2.968 In assessing the water network of Rural residential lots adjacent to Muswellbrook.

Hunter Water Corporation design manual shows the diurnal residential pattern of demand from which a peak hour factor of 1.98 can be derived. (Table 2.4, Appendix 2B). A diversity factor must also be applied for developments less than 80. This gives rise to a peak hour factor of 2.22 for the rural residential lots.

Recommended Peak Hour Demand

It is considered that the climate conditions at Muswellbrook more truly reflect the peak demand conditions in summer in Scone and a peak hour factor of 2.968 is recommended for use in determining the recommended peak hour demands. Based on this factor and

the recommendations of Section 0 above, the following peak hour demands are derived for the purposes of analysis.

- Residential development 0.086 l/s
- Rural residential development 0.124 l/s

INSTANTANEOUS DEMAND

Public Works Standards require the network to be designed for an instantaneous demand of 0.15l/s while maintaining a minimum residual head of 12m. For trunk mains supplying more than 1000 tenements, the PWD standard requires a demand of 0.1L/s/tenement.

FIRE FLOWS

AS2419.1 Fire hydrant installations Part 1 specifies that a water supply system is to be capable of delivering to the most hydraulically disadvantaged hydrant a flow of 10l/s at a minimum pressure of 150kPa with a base demand level defined as the 95th percentile demand in the reticulation network.

There is insufficient detailed information available for the Scone demand patterns to determine rigorously, the 95% flow. Hunter Water adopts the 95th percentile flow for residential demand as 80% of the peak hour demand for residential properties. In the absence of detailed data for Scone, it is proposed to analyse the fire requirements using flows of 80% of the peak hour flows derived in Sec 0. This results in the following base flow data for fire analysis:

- Residential development 0.07 l/s
- Rural residential development 0.10 l/s

ANNEX 'B'

PROPOSED WATER SUPPLY NETWORK

DRAWING: WATER_001 (VER E)