WATER SUPPLY DESIGN REPORT

EPANET Model

In accordance with:

AS/NZS 3500.1:2021 *Plumbing and Drainage Part 1: Water services*

AS 2419.1:2021 *Fire hydrant installations part 1: System design, installation and commissioning*

Water Supply Code of Australia WSA 03 – 2011-3.1 MRWA Edition V2.0 and TasWater's Supplement to this Code.

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REVISION HISTORY					
Revision Number	**Revision Description**	**Prepared By**	**Reviewed By**	**Authorised By**	**Date Prepared**
0	For Approval	Rachel Horner	Jane Sargison	Matthew Horsham	30/05/2024

SUMMARY

The proposed development at 647 East Derwent Highway, Risdon includes adhesion of the property title with 2 Piper Road, and construction of 54 multiple dwellings, along with associated driveway and hydraulic services. The proposed private water supply network to service the development is connected to the existing private infrastructure and has been modelled in EPANET.

The existing site, 2 Piper Road, is serviced by an existing DN150 water connection with DN100 master meter and DN100 fire assembly, and features 113 existing residential units (two and three bedroom) and communal facilities, serviced by a DN100 water supply loop through the existing site. A new DN63 ID50 offtake from the existing DN100 supply line is proposed to service the additional development, along with extension of the existing separate DN100 fire service line to supply the additional hydrants.

The property is serviced by the Risdon Vale Reservoir, which is located between the 100m and 110m contour lines. The existing connection is approximately 480m from the reservoir by pipe length. TasWater recommends a 5m/km loss from the reservoir to the property connection when estimating available pressure at the property connection based on the pressure in the supply zone. Over 480m length, this is a pressure loss of 2.4m. For the purposes of modelling the supply network for the site, the available static pressure is estimated to be 100m, which is sufficiently conservative to account for the approximate elevation of the reservoir and the 2.4m loss to the connection.

Water demands for the proposed development have been modelled in EPANET based on the modelling procedure described in Appendix A and B of the TasWater Supplement to Water Supply Code of Australia WSA 03 – 2011-3.1 MRWA Edition V2.0 (TasWater Supplement).

The probable simultaneous demand (PSD) in AS/NZS 3500.1:2021 and fire flow rate based on AS 2419.1:2021 have also been calculated and run in EPANET model to confirm that pressures and pipe flow velocities are acceptable.

The minimum required supply pressures and flow rates are achieved at the proposed dwellings and hydrants.



Rachel Horner

Civil / Environmental Engineer

RESPONSE TO TASWATER RAI

This report is prepared in response to the request for additional information from TasWater dated 18 July 2022. The following points are addressed:

1. *To allow TasWater to determine potential hydraulic service capacity limitations, please provide the following for both existing and proposed development:*
   a. *The required Peak day flow rate in L/s and the required residual pressure (kPa) at the point of connection.*
   b. *Peak day usage in L/day*
   c. *Probable simultaneous water demand (PSD) for the existing + proposed development;*
   d. *The required fire flow rate in L/s and the required residual pressure (kPa) at the point of connection.*
      NOTE: The pressures will need to include losses through the actual connection, the associated pipework and the elevation changes.
   e. *Calculations of the number of Equivalent Tenements.*
      NOTE: The engineering design calculations must comply with AS/NZS 3500.0:2003 Plumbing and Drainage and the Sewerage and Water Codes of Australia - Melbourne Retail Water Agencies Integrated Code version(s) published by the Water Services Association of Australia, and as amended by TasWater's Supplements.

      Response:

      The total available static pressure for the site is estimated to be 100m. The property connection is at approximately 35m elevation, resulting in an available static pressure at the property connection of 100 – 35 = 65m (650kPa).

      The existing site has base demand of 74.2 residential equivalent tenements (ETs) (from 32 three bedroom units x 0.8 ETs and 81 two bedroom units x 0.6 ETs).

      The ETs for the existing commercial buildings, including gym/pool complex, community hall, men's shed, and craft shed, are approximated from fixture unit loadings in AS/NZS 3500.1. Based on equivalent fixture unit loadings, the commercial buildings are conservatively each approximated as equivalent to a single dwelling. Thus, they are modelled as 4 commercial ETs in total for the existing site.

      The proposed development includes 43.2 additional residential ETs for the site, based on 0.8 ETs per 3 bedroom unit x 54 units.

      The peak day usage from the existing and proposed development is calculated in EPANET based on the number of equivalent tenements, the 24 hour residential & commercial demand patterns, and the base demand of 0.017836L/ET/s. The peak day usage from the existing development is 2.76L/s, the additional peak day usage from the proposed additional dwellings is 1.54L/s, and the total peak day usage from the post-development site is 4.30L/s.

      The PSD based on the AS/NZS 3500.1 calculation is 9.38L/s existing and 4.96L/s additional (14.34L/s total).

      Additional hydrants are proposed for the site, and are required to flow at 10L/s. There is no additional loading on the existing connection from the inclusion of additional hydrants. The most disadvantaged new hydrant is modelled with 10L/s flow rate to verify supply pressures can be achieved. The peak day usage with fire hydrant flowing is calculated in EPANET to be 12.84L/s,

based on the total number of equivalent tenements, the 24 hour residential, commercial & fire demand patterns, and the base demand of 0.017836L/ET/s.

Losses through the existing property connection are accounted for by including a loss coefficient for the pipes connected to the node representing the meter assembly in the model. Roughness coefficient is applied to all pipes in accordance with TasWater Supplement.

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PROJECT DESCRIPTION

Existing Conditions

The existing site (2 Piper Road) is an existing residential retirement village, featuring 113 existing dwellings (32 three bedroom units and 81 two bedroom units), along with community facilities including gym complex, community hall, men's shed, and craft shed. The property is serviced by an existing DN150 connection, with DN100 master meter and DN100 fire assembly. Refer to Figure 1 for existing site conditions.



Figure 1: Existing site conditions at 647 East Derwent Highway and 2 Piper Road [1]



Figure 2: Existing water meter assembly

Proposed Development

The proposed development includes construction of 54 multiple dwellings, along with associated driveway and hydraulic services. For the purposes of the water supply calculation, all new multiple dwellings are assumed to be three bedroom, although they are likely to be a mix of two and three bedroom units as at the existing site. The water supply network to service the additional units is proposed to be connected to the existing private supply line through the site and be serviced by the existing master meter and property connection. Additional private fire hydrants internal to the development are proposed, to achieve required fire hydrant coverage in accordance with AS 2419.1:2021.

A new DN63 ID50 supply loop is proposed, connected off the existing private DN100 water supply loop, to service the new dwellings. The separate DN100 line for the hydrants will be continued through to the new part of the development to service the additional hydrants. There are no proposed changes to the existing meter assembly.

The demand loadings for the multiple dwellings are calculated in accordance with Appendix A and B of the TasWater Supplement to Water Supply Code of Australia WSA 03 – 2011-3.1 MRWA Edition V2.0 (TasWater Supplement) and modelled in EPANET. The demand is also modelled in accordance with the method in AS/NZS 3500.1:2021, and modelled in EPANET given that the size of the project is outside of the values provided in the tables in AS/NZS 3500.1:2021 Appendix C. A description of the EPANET model is provided in this report.

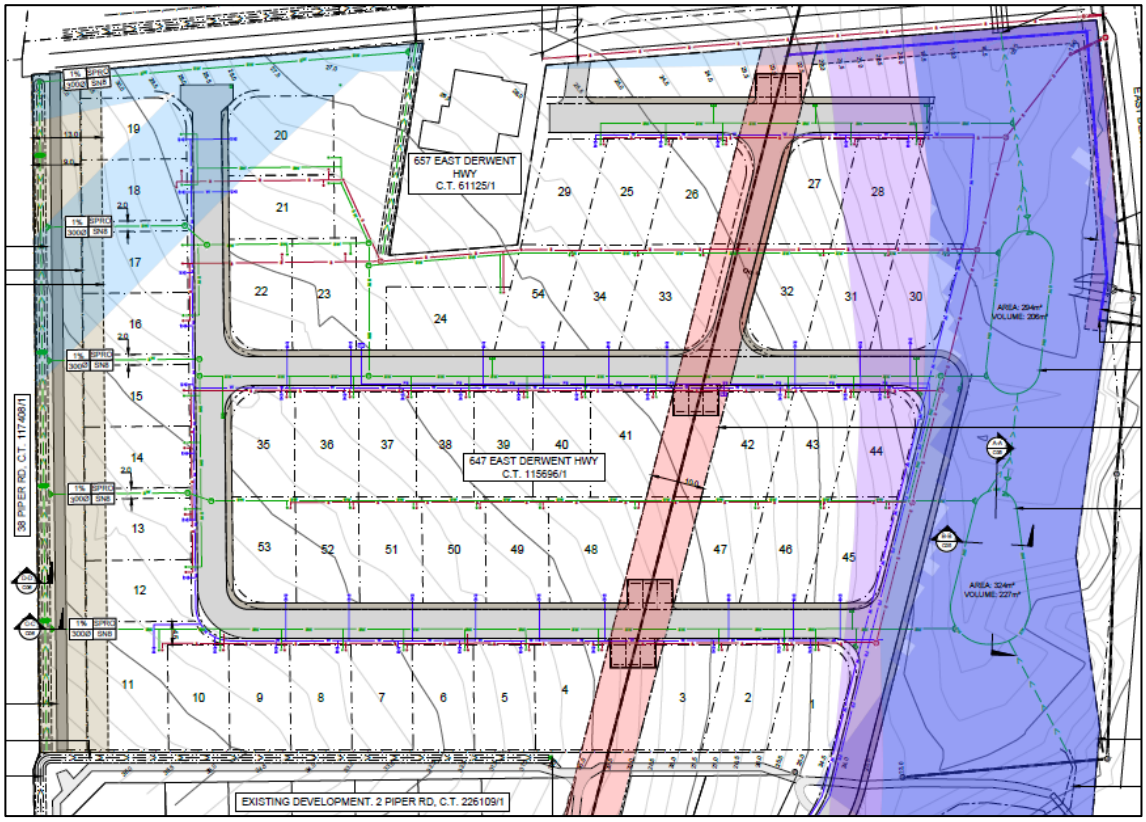


Figure 3: Proposed development at 647 East Derwent Highway

EPANET MODEL

Model Scenarios

The private water supply network for the proposed additional 54 units at 647 East Derwent Highway has been modelled using EPANET. Two flow condition scenarios have been modelled:

1. 43.2 additional equivalent tenements (ETs) for the site, based on 0.8ET per 3 bedroom unit x 54 units, in accordance with Appendix A of the TasWater Supplement, and 10L/s flow rate for a period of 4 hours in accordance with Table 3.1.5 at the most disadvantaged proposed private hydrant (adjacent to unit 23), modelled as a 72 hour period in accordance with Appendix B. The existing load from the existing site is modelled as 74.2ETs residential and 4ETs commercial.
2. Probable simultaneous demand (PSD) of 4.96L/s, based on 54 dwellings in accordance with AS/NZS 3500.1:2021 Table 3.2.3, and 10L/s flow rate in accordance with AS2419.1:2021 Table 2.2.6(A), at the most disadvantaged private fire hydrant (adjacent to unit 23), modelled as a single period. The existing load from the existing site is modelled as PSD of 9.38L/s.

Design Parameters

The supply pipe sizes have been determined to ensure:

1. Minimum head at any node of 50kPa (5m) as per AS/NZS 3500.1:2021 Clause 3.3.2,
2. Maximum flow velocity of 3m/s as per AS/NZS 3500.1:2021 Clause 3.4, and
3. Minimum pressure at private fire hydrant of 200kPa (20m) flowing at 10L/s as per AS 2419.1:2021 Table 2.2.6(A).

Minimum pressures given in the TW Supplement (minimum head at connection of 220kPa (22m) and minimum head at hydrant of 250kPa (25m) flowing at 10L/s) are required only for property connections & TasWater hydrants, but are used as a point of comparison in the model.

Inputs and Assumptions

Model Setup

The additional 54 units are proposed to be serviced by a DN63 ID50 supply loop connected to the existing DN100 supply in the existing site, with two smaller offtakes for Units 15-21 & 25-29, along with extension of the existing separate DN100 line to supply the private fire hydrants. Refer to Figure 2 and JSA drawing C02.

Demand for each proposed unit and hydrant is modelled via individual nodes along the supply loop. Refer to Figure 4 for node locations.

The demand for the existing site is modelled via two nodes at the modelled offtake point to the existing DN100 line, one for the units and one for the commercial buildings such that they can have different demand patterns applied.

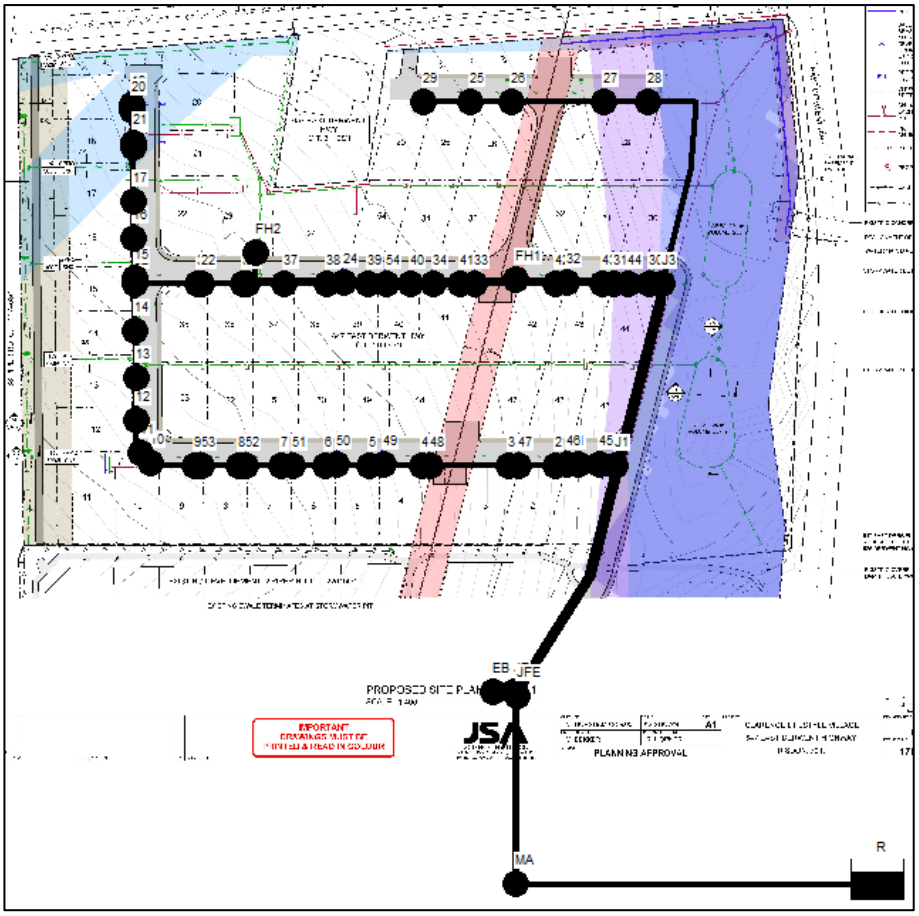


Figure 4: EPANET model layout

Pipe Parameters

Pipe friction was modelled utilising Hazen Williams Coefficient, C, determined according to Table 3.1.6.3 of the TasWater Supplement, C = 130.

All new pipes are modelled according to their actual lengths as scaled from the site plan C02 by JSA. Existing pipe lengths are estimated from LISTmap as the distance from the reservoir to the master meter (480m) and the distance from the master meter through the private system to the point of connection for the new branch line to service the new units (280m). The lines representing the existing pipes are not drawn to scale in the model, the lengths are adjusted manually.

The existing property connection is DN150 with two DN100 supply lines through the site (one for water use and one for hydrant supply). The existing pipe from the reservoir to the master meter varies in size according to LISTmap data, but is conservatively modelled as the smallest diameter (DN150) for the entire 480m length. Two DN100 lines are modelled from the master meter through to the point of connection for the new branch lines to service the new units, to represent the existing private water supply and fire hydrant supply in the existing site.

Fittings losses in the property connection and meter assembly are accounted for by applying loss coefficients to the sections of pipe connected to the node representing the meter assembly. The loss coefficients are estimated to be k = 0.88 for the fire assembly and k = 3.86 for the master meter assembly [2].

Proposed pipes are modelled as an ID50 supply loop for the new units, with two ID32 offtakes to service the smaller branches. The continuation of the separate supply line for the fire hydrants is DN100.

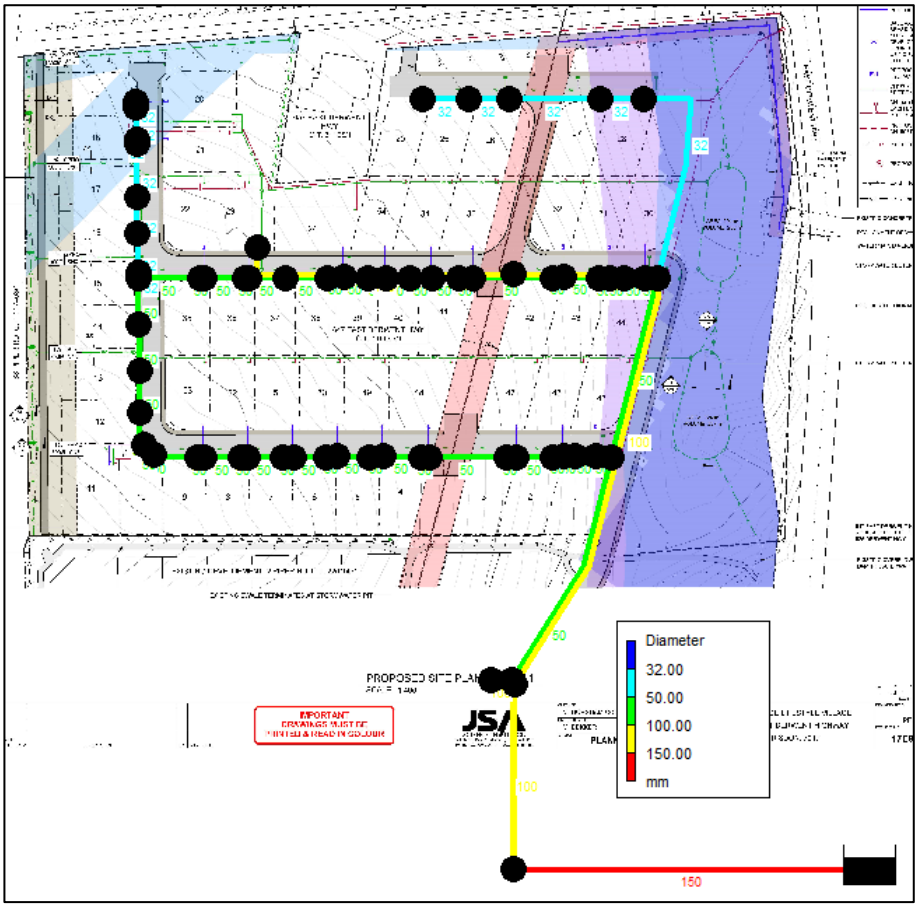


Figure 5: Pipe diameter in EPANET model

Node Parameters

Each of the new units is represented by a node, with base demand of 0.8ETs (for a 3 bedroom unit per TW Supplement Appendix A). The floor levels of the proposed units are not known; the elevation of each node is conservatively estimated as the highest natural surface level on each unit lot with 2m added, to account for potential FFL and height of fixtures inside the unit.

The existing site demand is represented by two nodes, located at the point of connection for the new ID50 branch to the existing DN100 line. The residential node has base demand of 74.2ETs (calculated from 32 three bedroom units x 0.8 ET and 81 two bedroom units x 0.6 ET). The demand pattern for this node is based on the TasWater Residential Demand Pattern of 24 hours duration repeated over 3 days (per Appendix B).

A second node is applied for the commercial buildings, with the ETs approximated from fixture unit loadings in AS/NZS 3500.1, including gym/pool complex (22 loading units), community hall (17 loading units), men's shed (6 loading units), and craft shed (6 loading units). Based on equivalent fixture unit loadings, the commercial buildings are conservatively each approximated as equivalent to a single dwelling (approximately equivalent to 31 loading units). Thus, they are modelled as 4 commercial ETs in total for the existing site, with the TasWater Commercial Demand Pattern of 24 hours repeated over 3 days (per Appendix B) applied to this node.

For the model of the flow over a 72hour period, the base demand number of ET's is multiplied by the demand multiplier of 0.017836L/s to provide the requisite load in L/s per node, in accordance with Appendix A and B of the TasWater Supplement.

The demand pattern for the hydrants is based on the TasWater Fire Demand Pattern of 24 hours duration repeated over 3 days. The most disadvantaged new hydrant (adjacent to Unit 23) is applied an ET demand of 561 ETs in accordance with TW Supplement Appendix B, such that the demand is 10L/s for 4 hours.

The AS/NZS 3500.1:2021 calculation is modelled as a single period. The probable simultaneous demand (PSD) for 54 dwellings is 4.96L/s, as per AS/NZS 3500.1:2021 Table 3.2.3. Therefore, demand multiplier in the EPANET model is 4.96 / 54 = 0.092L/s, with each unit applied base demand of 1.

Database Checks

Standard database checks as outlined in Appendix B of TasWater Supplement were conducted to check the following elements:

- All pipes modelled to accurate length
- All pipes modelled to accurate size (internal diameter) and C = 130
- All nodes specified at correct, non-zero elevation

Model Results

The lowest pressure available is at Unit 11, with hydrant running at FH2, with pressure head of 58.06m at 9am and 58.03m at 6pm in the model based on TasWater Supplement, and 30.99m in the model based on AS/NZS 3500.1 calculation. This exceeds the required minimum head at any node of 22m (TasWater) or 5m (AS/NZS 3500.1). Refer to Figure 6 and Figure 7.

The modelled pressure for the private fire hydrant flowing at 10L/s is 58.12m in the model based on TasWater Supplement, and 53.63m in the model based on AS/NZS 3500.1 & AS 2419.1 calculation. This exceeds the minimum pressure at private fire hydrant of 200kPa (20m) flowing at 10L/s per AS 2419.1 & 250kPa (25m) flowing at 10L/s per TW Supplement.

Noting that required pressures given in the TW Supplement are required only for property connections & TasWater hydrants; they are achieved in the model although it is for a private development and not necessarily required.

The maximum pipe flow velocity is 2.53m/s, in the model based on the AS/NZS 3500.1 calculation (since flow rates & velocities are higher in this model). This does not exceed the maximum flow velocity of 3m/s. Refer to Figure 8.

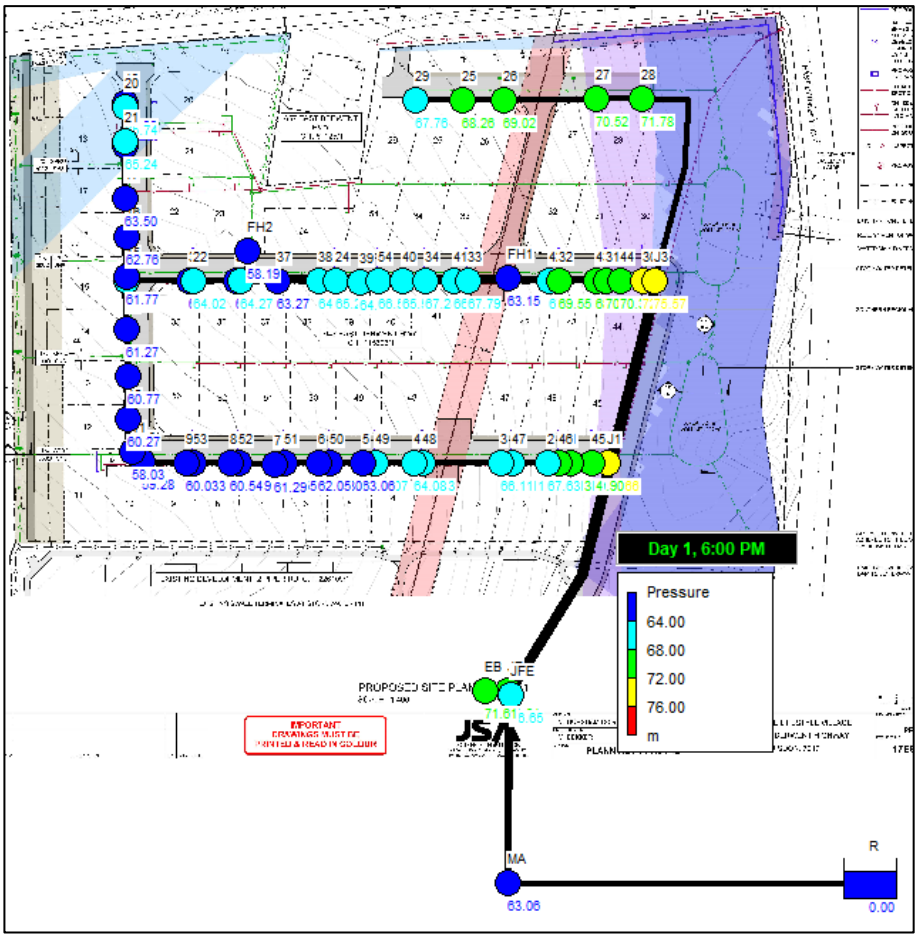


Figure 6: Pressure at nodes for demand calculation based on Appendix A and B of the TasWater Supplement & 10L/s at hydrant (at 7pm)

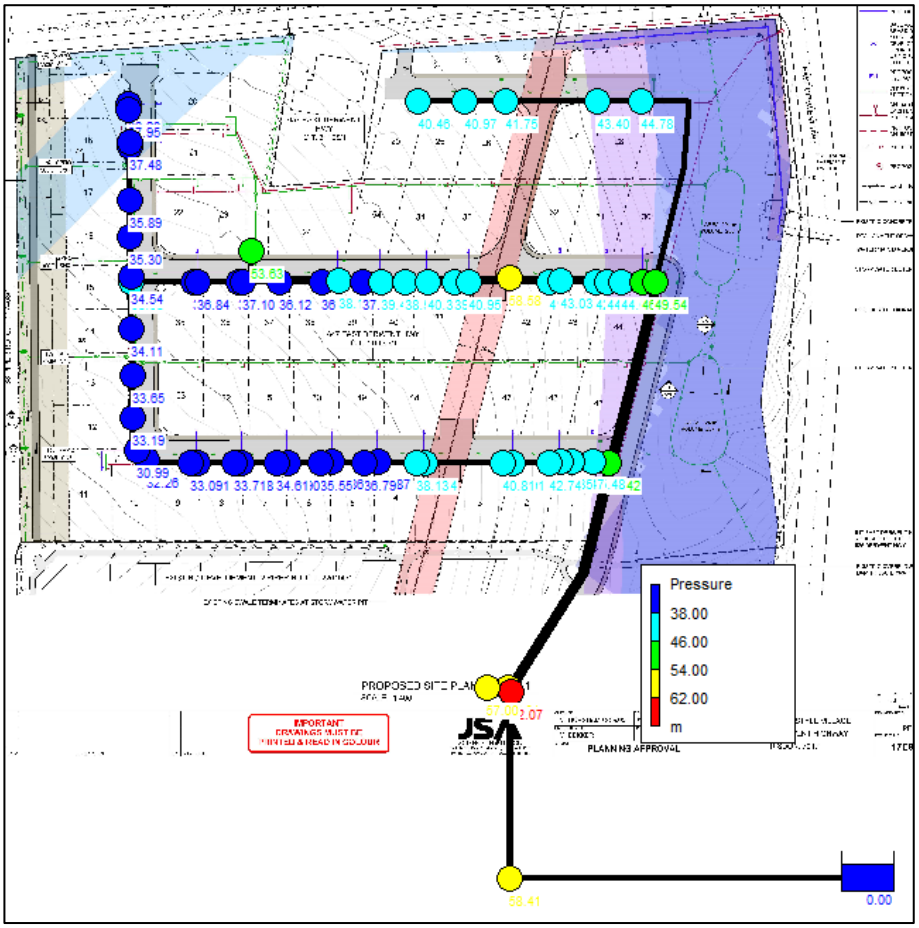


Figure 7: Pressure at nodes for demand calculation based on AS/NZS 3500.1 calculation (single period)

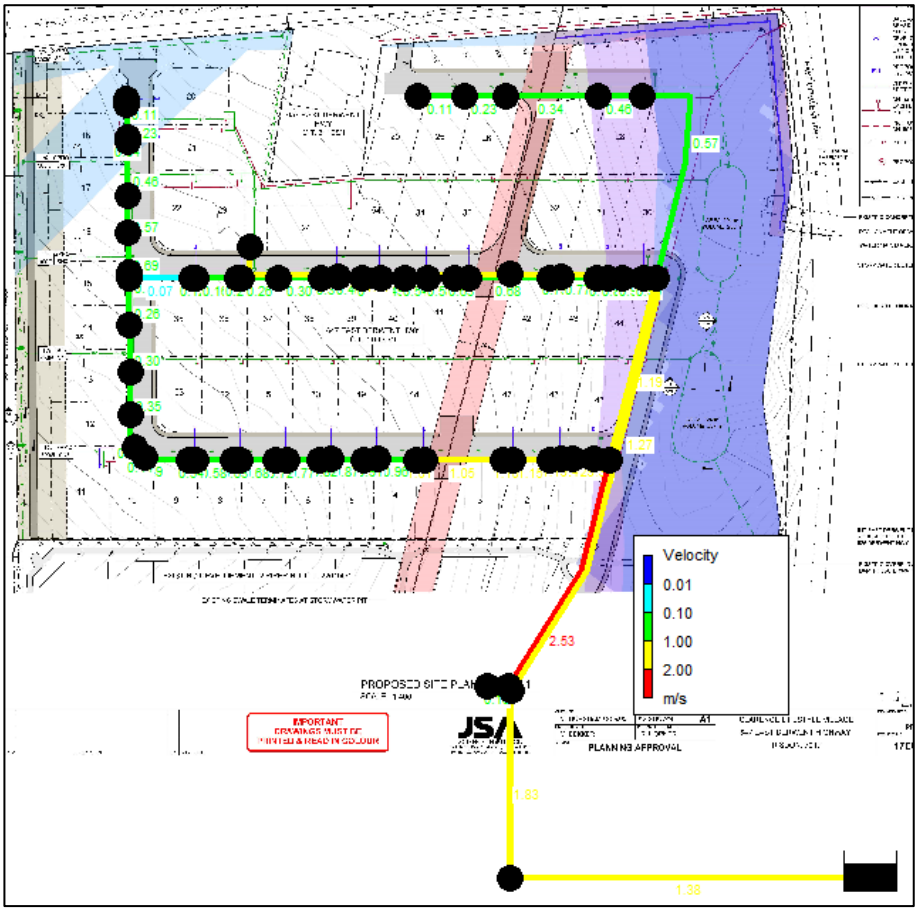


Figure 8: Pipe flow velocity for demand calculation based on AS/NZS 3500.1 calculation (single period)

CONCLUSIONS

This document has outlined the modelled performance of the proposed extension to the private water supply system at 647 East Derwent Highway & 2 Piper Road, to service the proposed additional 54 multiple dwellings at the site.

The additional development is proposed to be serviced by the existing DN100 master water meter and DN150 water connection for the site, with a new ID50 supply loop connected to the existing private DN100 line, to supply the additional 54 units. New private fire hydrants in the site are proposed to be serviced by extension of the existing separate DN100 fire service in the site.

The demands and flow rates have been calculated in accordance with TasWater Supplement, AS/NZS 3500.1, and AS 2419.1, with minimum pressures and maximum velocity requirements achieved.

REFERENCES

[1] Land Tasmania, “LISTmap,” 2018. [Online]. Available: http://maps.thelist.tas.gov.au/listmap/app/list/map. [Accessed May 2024].

[2] Australian Pipe Friction Handbook Fourth Edition, Pump Industry Australia Incorporated, 2013.

[3] TasWater, *TasWater Supplement to Water Supply Code of Australia WSA 03-2011-3.1 MRWA Edition V2.0 Issue Number: Public 04,* TasWater, 2015.

[4] Water Services Association of Australia, *Water Supply Code of Australia WSA 03-2011-3.1 Melbourne Retail Water Agencies Edition Version 2.0,* Water Services Association of Australia, 2012.

[5] Joint Technical Committee WS-014, Plumbing and Drainage, *AS/NZS 3500.1:2021 Australian/New Zealand Standard Plumbing and drainage Part 1: Water services,* Standards Australia Limited, 2021.

[6] Committee FP-009, Fire Hydrant Installations, *AS 2419.1:2021 Australian Standard Fire hydrant installations Part 1: System design, installation and commissioning,* Standards Australia Limited, 2021.

APPENDIX A: LIST OF ACRONYMS

AS 2419.1:2021	Australian Standard Fire hydrant installations Part 1: System design installation and commissioning
AS/NZS 3500.1:2021	Australian/New Zealand Standard Plumbing and drainage Part 1: Water services
C	Hazen Williams Coefficient
DN	Nominal Diameter
ET	Equivalent Tenements
ID	Internal Diameter
PSD	Probable Simultaneous Demand
TasWater Supplement	TasWater Supplement to Water Supply Code of Australia WSA 03-2011-3.1 MRWA Edition V2.0
TW	TasWater