MWH

BUILDING A BETTER WORLD

FINAL REPORT

Impact Assessment of Potable Water Supply and Sewerage Infrastructure for "The Bellvista 2" Development

Prepared for Sunshine Coast Water - FNMWS11207

May 2010

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REVISION SCHEDULE

REV. NO.	DATE	DESCRIPTION	PREPARED BY	REVIEWED BY	APPROVED BY
1.0	05/01/2010	Draft Report for SCW	H Lin	K Grimley	K Grimley
2.0	07/01/2010	Final Report for Issue to Brown Consulting and SCRC (Shaun Matthews)	H Lin	K Grimley	K Grimley
3.0	16/04/2010	Revised Report to SCW to reflect change in key inputs (demands and recycled water)	J Beck	K Grimley	K Grimley
4.0	19/5/2010	Final Report - Minor Amendments	K Grimley	K Grimley	K Grimley

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1 Introduction

MWH was commissioned by Sunshine Coast Water (SCW) to undertake the impact assessment on potable and recycled water supply and sewerage infrastructure for the proposed Bellvista Stage 2 development. The proposed development currently sits outside the existing Caloundra City Plan's urban development footprint. It was within the future Greenfield area of Caloundra South however the decleared Master Planned area did not include this site. The site is adjacent to an existing development.

As part of a bring forward activity, SCW requires an assessment to ascertain that the current and future capacity of the existing water supply and sewerage schemes will service the proposed development. The assessment is considering the impact of a series of residential and non-residential demands. These demands are derived from landuse and dwelling stock information provided by the developer and the applicable multiplies from the current SCW Desired Standards of Service (DSoS). The landuse and dwelling stock numbers provide by the developer are provided in Appendix D.

Figure 1-1 shows that the proposed development is located at Lot 22 SP190373 in Caloundra West of Sunshine Coast Regional Council (SCRC). This area is bounded by Bellvista Boulevard on the north, Caloundra Aerodrome on the east and Lamerough Creek on the west and south.

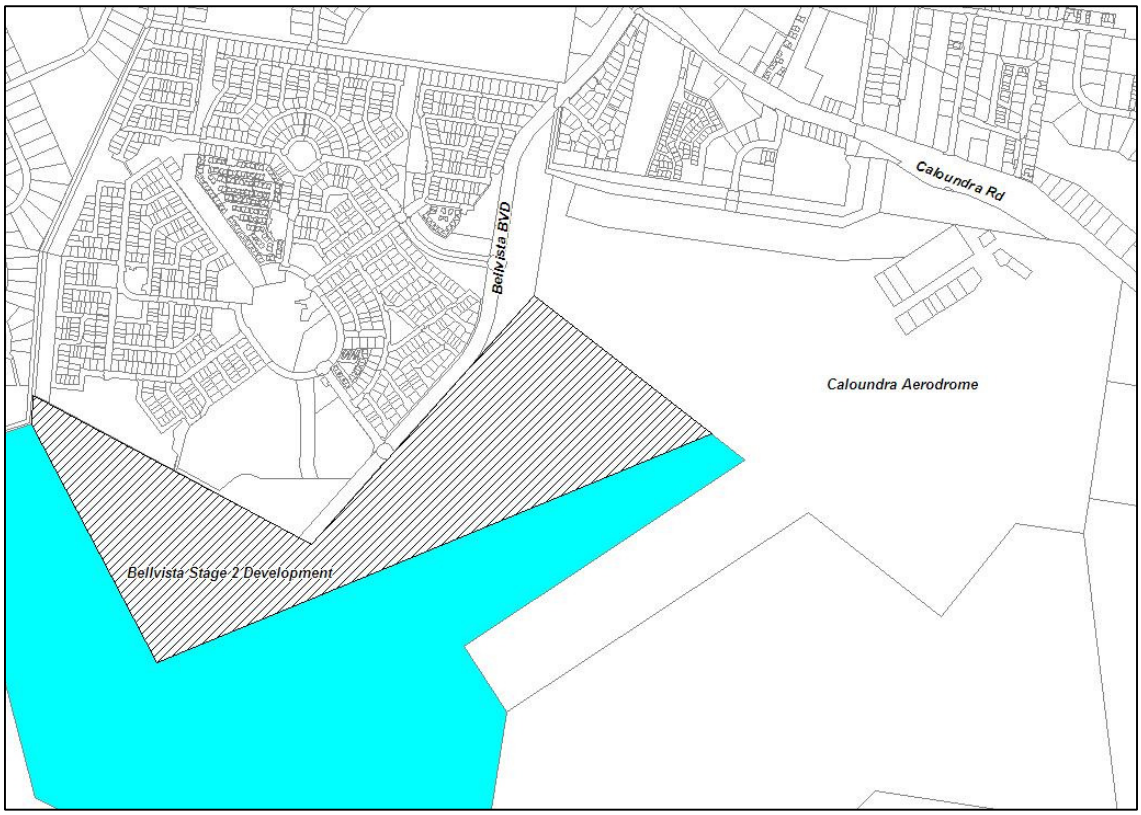


Figure 1-1: Bellvista Stage 2 Development Locality Plan

It is noted that this report should not be interpreted as an acceptance by SCRC of the proposed development or level of demand. Its sole purpose is to determine the impacts of such a demand on the water supply and sewerage infrastructure.

2 Scope of Work

The scope of this impact assessment is as follows:

- Calculation of demands of the site based on landuse data supplied by Brown Consulting (type, quantity and timing e.g. dwellings or GFA).
- Assessment of the impact of the proposed development upon the water supply system and sewerage system (up to the inlet of PS L1) compared to the desired standard of service. Impact assessment would be undertaken for the existing and future scenarios.
- Development of proposed solutions and timing. That is, points of connection and augmentations required to the existing network to service the proposed development.
- Report detailing the above and identifying acceptable solutions. The report will include appropriate figures.

3 Population Assessment

3.1 Proposed Development Details

The developer has indicated a staged development program from 2012 to 2015 and as given in Table 3-1. A copy of the email from the developer representative advising landuse and dwelling stock numbers is provided in Appendix D.

Table 3-1: Summary of Bellvista Stage 2 Development

Development Type	Phase 1 (2012)	Phase 2 (2013)	Phase 3 (2014)	Phase 4 (2015)	Total
Detached Residential (Lots)	182	252	166	-	600
Attached Residential (Lots)	-	60	-	90	150
Total (Lots)	**182**	**312**	**166**	**90**	**750**
Commercial (Area (m^2))	600	600	**-**	-	1200
Total (m^2)	**600**	**600**	**-**	-	**1200**

3.2 Equivalent Tenant Calculation

The number of equivalent tenant (ET) was derived based on the provided summary in Table 3-1 and the conversion rates used in '*Caloundra City Priority Infrastructure Plan*'. The conversion rates are extracted as below:

1. For Water ET:
    a. 1 'Residential – detached' = 1 ET;
    b. 1 'Residential – attached' = 0.69 ET; and
    c. 100 m^2 of Retail GFA = 1.11 ET.
2. For Sewer ET:
    a. 1 'Residential – detached' = 1 ET;
    b. 1 'Residential – attached' = 0.84 ET; and
    c. 100 m^2 of Retail GFA = 1.41 ET.

To align with the SCW DSoS, the type of 'Residential – detached' is regarded as Single Family Residential (SFR), 'Residential – attached' as Multiple Family Residential (MFR) and 'Retail' as the commercial (COM) sector. The summarised ET of each phase of the proposed development is provided in Table 3-2 for Water and Table 3-3 for Sewer.

Table 3-2: Summery of ET of Development Phase - Water

Number of ET	Phase 1 (2011)	Phase 2 (2012)	Phase 3 (2014)	Phase 4 (2015)
SFR	182.0	252.0	166.0	0.0
MFR	0.0	41.4	0.0	62.1
COM	6.7	6.7	0.0	0.0
Total	*188.7*	*300.1*	*166.0*	*62.1*
Grand Total	**716.9**			

Table 3-3: Summery of ET of Development Phase - Sewer

Number of ET	Phase 1 (2011)	Phase 2 (2012)	Phase 3 (2014)	Phase 4 (2015)
SFR	182.0	252.0	166.0	0.0
MFR	0.0	50.4	0.0	75.6
COM	8.5	8.5	0.0	0.0
Total	*190.5*	*310.9*	*166.0*	*75.6*
Grand Total	**742.9**			

4 Water Supply System Impact Assessment

4.1 Design Criteria

In accordance with the SCW DSoS, the system performance should be assessed for three mean day maximum month (MDMM) days then followed by three maximum days (MD).

The minimum service pressure at the property boundary for urban property is 22m. The reservoir head should be positive at the end of 3 maximum day demand.

For the fire flow provision, the minimum residual pressure at the hydrant for fire service is 12m with 30 L/s fire flow for 4 hour duration for the commercial/industrial properties and multiple level residential building with 4 storeys or more. The 15 L/s fire flow for 2 hours duration are required at the other residential properties. The minimum pressure in the mains and all other areas of the water supply zone is 6m. A positive pressure should be available in the mains at the peak hour time of the water supply zone. The background demand for fire flow is at the 2/3 peak hour demand of the water supply zone.

Appendix C shows the DSoS of SCW water supply system.

4.2 Water Supply Network Model

A H2O Map model of the whole of the Sunshine Coast water supply network, developed by MWH for Sunshine Coast Water as part of a regional water supply planning study was utilised for this assessment. This model contains the updated infrastructure data and existing and future demand. The only modification required to the supplied model was the configuration of supply to the subject site. That is, the development site (which was originally considered part of Caloundra South) was to ultimately be served via new trunk infrastructure from the south from circa 2016. This may no longer be the case. The key settings of model are described in the following sections.

4.2.1 Unit Demands and Patterns

The provided model includes unit demands, peaking factors and patterns for three supply scenarios defined in the SCW DSoS. In deriving the demands, it has been assumed that the growth component of the demand identified in future planning horizons is subject to Queensland Development Code (QDC) regulations. Therefore, Case 2 unit consumption and Case 2 diurnal peaking factors according to the SCW DSS have been applied to all growth demand. Case 2 Supply Scenario refers to the scenario without a recycled water network, but utilising a rainwater tank.

4.2.2 Modelling Scenarios

The Phases 1 to 4 of the proposed Bellvista Stage 2 development are scheduled from 2012 to 2015. This study assumes that the first phase is included in the 2011 planning horizon and Phases 2 to 4 in the 2016 planning horizon.

When assessing the impact of the proposed Bellvista Stage 2 development, the proposed augmentations to the network as recommended in the *Draft SCW Regional Water Infrastructure Strategic Growth Planning Study* (MWH, 2010) for the four planning horizons were taken into consideration.

The demand from the proposed Bellvista Stage 2 development was placed on the Bellvista DMA.

The scenarios listed in Table 4-1 were analysed for the purposes of this study:

Table 4-1: Modelled Water Network Scenarios

Scenario	Infrastructure Set	Background Demand Set	Bellvista Stage 2 Demand	Purpose
1	Existing	2011 without Greenfield	None	Business as usual (BAU) case
1a	Existing	2011 without Greenfield	Phase 1 only	Assess the impact to existing network
2	Existing and recommended augmentations as per regional water supply planning study for 2016	2016 without Greenfield	None	Business as usual (BAU) case
2a	Existing plus pipes to Bellvista Stage 2 and recommended augmentations as per regional water supply planning study for 2016	2016 without Greenfield	Full	Assess the impact to future network
3	Existing and recommended augmentations as per regional water supply planning study for 2021	2016 without Greenfield	None	Business as usual (BAU) case
3a	Existing plus pipes to Bellvista Stage 2 and recommended augmentations as per regional water supply planning study for 2021	2021 without Greenfield	Full	Assess the impact to future network
4	Existing and recommended augmentations as per regional water supply planning study for 2038	2038 without Greenfield	None	Business as usual (BAU) case
4a	Existing plus pipes to Bellvista Stage 2 and recommended augmentations as per regional water supply planning study for 2038	2038 without Greenfield	Full	Assess the impact to future network

4.3 Impacts to Water Supply Network

As the timing of the planned Greenfield infrastructure for the Caloundra South area was unknown at the time of writing this report, this area was not activated in any of the scenarios. Therefore the impact of the Bellvista Stage 2 development has been assessed based on supply from the north only. The Draft 2010 Master Plan on the other hand does assume that the Caloundra South infrastructure will be available by 2016 and as such some results presented here may differ to what is presented in the Draft 2010 Master Plan.

4.3.1 Scenario 1 – 2011 Business as Usual Case

None of Bellvista Stage 2 demand was included in this scenario. The existing water supply network, including the proposed augmentations up to 2011 as identified in 2010 Master Plan, can sufficiently serve the existing serviced lots based on the simulated results provided in Figure AP- 1 of Appendix A. The minimum water pressure of most nodes is above 22m in the Bellvista DMA, Caloundra West DMA and Little Mountain high level zone (HLZ). Several nodes in the Little Mountain HZL (as identified in Figure AP- 1) have minimum pressures less than 22m, but at these were already flagged in the Draft 2010 Master Plan. This issue persists through all planning horizons.

4.3.2 Scenario 1a – 2011 Phase 1 Bellvista Stage 2 Demand

Based on Scenario 1, the 188.7 ET from Phase 1 of the proposed development and the 375mm diameter trunk main from the proposed development to the connecting point (node CS00026) on Bellvista Boulevard were inserted into the model as show in Figure 4-1. The simulated result is provided in Figure AP- 2 of Appendix A. The minimum pressure at one location (C_C11981 and C_RC0139) on the edge of the Bellvista DMA is less than 22m. However, these are not located on a service main and as such have not demands allocated to them therefore there is no breach of the DSoS.

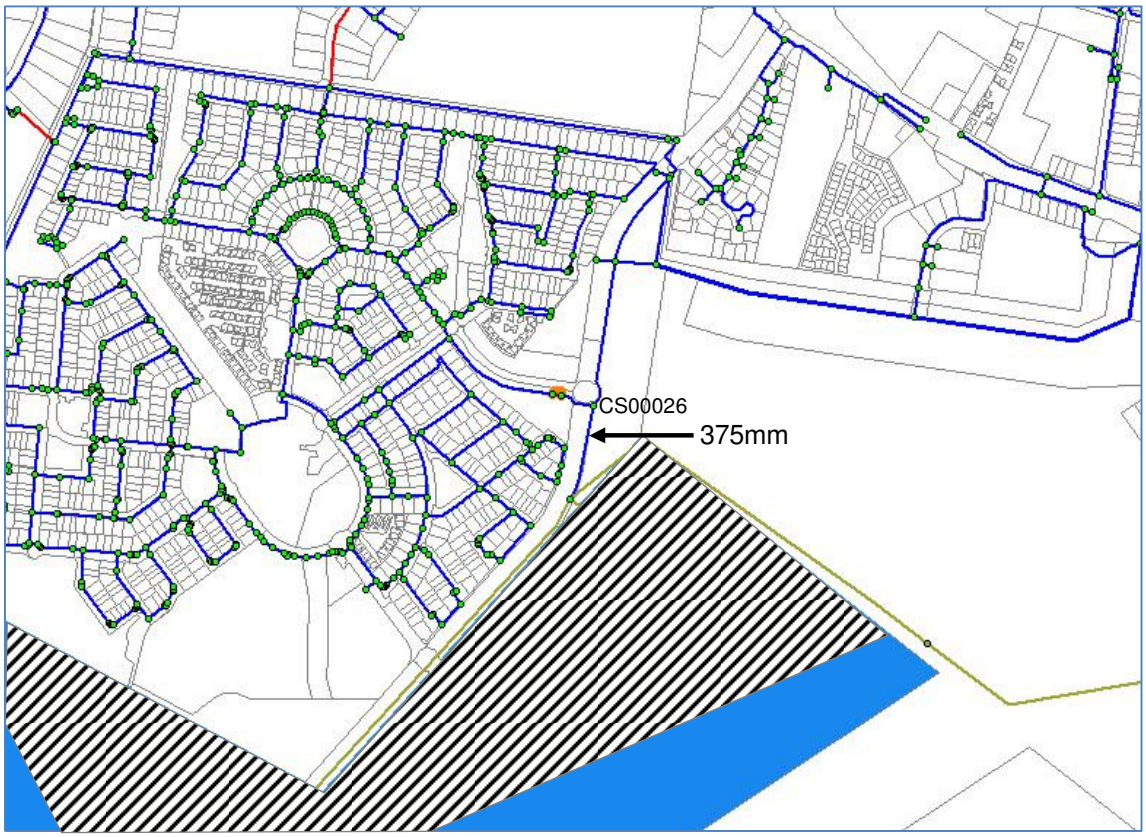


Figure 4-1: Bellvista Stage 2 Connection to Existing Model

4.3.3 Scenario 2 – 2016 Business as Usual Case

None of Bellvista Stage 2 demand was included in this scenario. The existing water supply network, including the proposed augmentations up to 2016 as identified in 2010 Master Plan, can sufficiently serve the existing serviced lots based on the simulated results provided in Figure AP- 3 of Appendix A. The minimum water pressure of most nodes is above 22m in the Bellvista DMA, Caloundra West DMA and Little Mountain high level zone (HLZ), with the exception of nodes C_C11981 and C_RC0139 at the edge of the Bellvista DMA. However, these are not located on a service main and do not trigger any DSoS issues.

4.3.4 Scenario 2a – 2016 Full Bellvista Stage 2 Demand

Based on Scenario 2, the full 716.9 ET from the Bellvista Stage 2 development were inserted into the model. The simulated result is provided in Figure AP- 4 of Appendix A. The minimum pressure at several nodes on the edge of the Bellvista DMA along Bellvista Rd is less than 22m. However, all but one of those are not located on a service main and do not trigger any DSoS issues.

One critical node is located on a service main is C_5334. This node has an unexpectedly high ET allocation (36+7 ET). The demand model shows one lot in that area (1569SP204748) with an allocated ET of 35 for all planning horizons, even though this lot has an area of less than 1000m^2 and is classified as “detached residential”. Without that demand the minimum pressure at node C_5334 will be above 22m.

Another critical node was identified between the Bellvista DMA and Little Mountain HLZ (C_C11779). The residual pressure at this node was just under 18m. The losses in the reticulation network through Bellvista are generally acceptable. However, when tracing the flow back upstream toward the reservoir the head loss in the 300mm diameter main in Quarry Rd and the 300 mm diameter main to the reservoir has increased sufficiently enough to trigger the deficiency in node C_C11779. This deficiency can be resolved by augmenting these mains with a 375mm parallel main approximately 935m in length (see Figure 4-2).

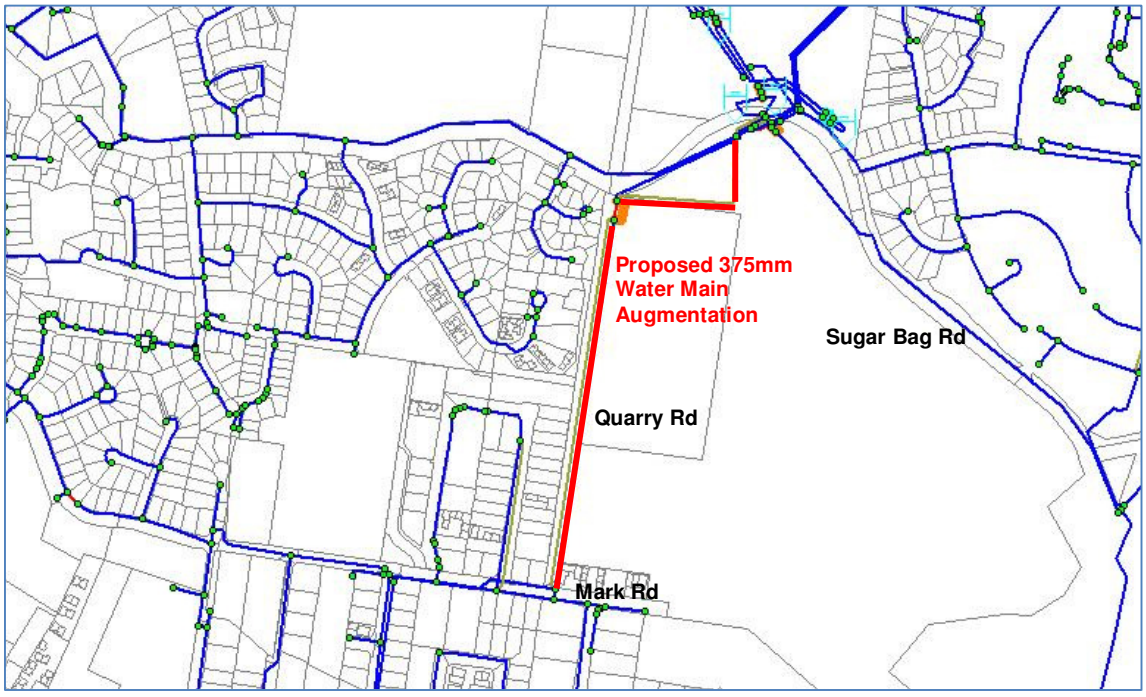


Figure 4-2: Location of Proposed Augmentation

4.3.5 Scenario 3– 2021 Business as Usual Case

None of Bellvista Stage 2 demand was included in this scenario. The existing water supply network, including the proposed augmentations up to 2021 as identified in 2010 Master Plan, can sufficiently serve the existing serviced lots based on the simulated results provided in Figure AP- 5 of Appendix A. The minimum water pressure of all nodes is above 22m in the Bellvista DMA, Caloundra West DMA and Little Mountain high level zone (HLZ), with the exception of nodes C_C11981 and C_RC0139 at the edge of the Bellvista DMA. However, these are not located on a service main and as such have not demands allocated to them.

4.3.6 Scenario 3a – 2021 Full Bellvista Stage 2 Demand

Based on Scenario 3, the full 716.9 ET from the Bellvista Stage 2 development were inserted into the model. The simulated result is provided in Figure AP- 6 of Appendix A. The situation at the 2021 planning horizon is very similar to that at the 2016 planning horizon with several nodes the edge of the Bellvista DMA along Bellvista Rd having minimum pressures less than 22m. Most of those nodes, however, are not located on service mains, except for node C_5334 which has already been discussed in Section 4.3.4.

Also two node failures occur in the rural area on the boundary between the Bellvista DMA and Little Mountain HLZ (C_C11779 and C_C11795). This can be resolved by 375mm water main augmentation as discussed in Section 4.3.4.

4.3.7 Scenario 4 – Ultimate Business as Usual Case

None of Bellvista Stage 2 demand was included in the model. The existing water supply network, including the proposed augmentations up to 2038 (Ultimate) as identified in 2010 Master Plan, can sufficiently serve the existing serviced lots based on the simulated results provided in Figure AP- 7 of Appendix A. The minimum water pressure of all nodes is above 22m in the Bellvista DMA, Caloundra West DMA and Little Mountain high level zone (HLZ), with the exception of nodes C_C11981, C_RC0139 and C_C12003 at the edge of the Bellvista DMA. However, these are not located on a service main and as such have not demands allocated to them.

4.3.8 Scenario 4a – Ultimate Full Bellvista Stage 2 Demand

Based on Scenario 4, the full 716.9 ET from the Bellvista Stage 2 development were inserted into the model. The simulated result is provided in Figure AP- 6 of Appendix A. The situation at the Ultimate planning horizon is very similar to that at the 2021 planning horizon and as such the same observations as have been made for Scenario 3a apply here.

4.3.9 Refinement of Infrastructure Trigger

The staged demands, provide in Table 3-2, were tested with the 2011 BAU demands (similar to Scenario 1a) in order to identify a measurable trigger for the required augmentation.

The critical node was confirmed as (C_C11779). The residual pressure at this node was 20.2 m at maximum hour with a demand at Bellvista 2 of 489 ET (sum of Phase 1 and Phase 2 demands). The residual pressure at this node with no demand from Bellvista 2 is 23 m. It would therefore be reasonable to suggest that the trigger for the required augmentation is soon after the complete of the Phase 1 demand of 189 ET and well before the completion of the Phase 2 demand (being an additional 300 ET).

It is therefore suggested that no more than 250 ET should be approved with out the required augmentations in place.

4.4 Impacts to Bulk Water Supply Infrastructure

The performance of the existing and augmented (as per Draft 2010 Master Plan) bulk water supply infrastructure was checked to assess the impact of the proposed Bellvista Stage 2 development on said infrastructure. Over the four planning horizons the bulk infrastructure has sufficient capacity for the Bellvista Stage 2 development as defined in Table 3-2 and Table 3-3. The increased demand on the bulk system will however have a bring forward impact on the timing of the additional reservoir storage at Sugarbag Road.

5 Sewerage System Impact Assessment

5.1 Design Criteria

In accordance with the SCW DSoS, the sewerage design criteria for this assessment are listed in Table 5-1.

Table 5-1: SCW Sewerage Design Criteria

Item	Design Parameter	Comment
Average Dry Weather Flow (ADWF).	600 L/ET/day	
Peak Wet Weather Flow (PWWF) for conventional gravity sewers.	5 x ADWF	For existing network
Peak Wet Weather Flow (PWWF) for reduced infiltration gravity sewers.	4 x ADWF	For Greenfield development
Peak Dry Weather Flow (PDWF).	C_2 X ADWF	$C_2 = 4.7 \times (2.7 \times ET)^{-0.105}$
Maximum depth of flow at PWWF (existing pipes)	Pipe full and surcharge of manholes to a maximum of 1 m below manhole lid	

Source: "Regional Strategy Project Unit, Technical Memorandum No. 7 Desired Standards of Service" (SCRC, 2009)

5.2 Sewerage Network Model

A simplified trunk mains model comprising SPS BV1, SPS LM2 and the sewers (dual 225/375/525/750 mm) to the wet well of L1 was constructed in H20 Map SWMM for this assessment. The modelled network is shown in Figure 5-1.

Pipe configuration, pumping station details and loading delineations were extracted from the provided Mike Urban model. The actual loadings (i.e. ETs) were updated based on the latest demand figures obtained from the SCW Infrastructure Demand Model. Has agreed with SCW it has been assumed that SPS L1 has the sufficient capacity to transfer the sewage from its catchment, including Bellvista Stage 2 development. Hence a free fall outlet was inserted at SPS L1 wet well in the model. The unit loadings and peaking factors were adopted from the SCW DSoS (listed in Table 5-1). The 2011, 2016 and Ultimate background loadings were assessed in this study.

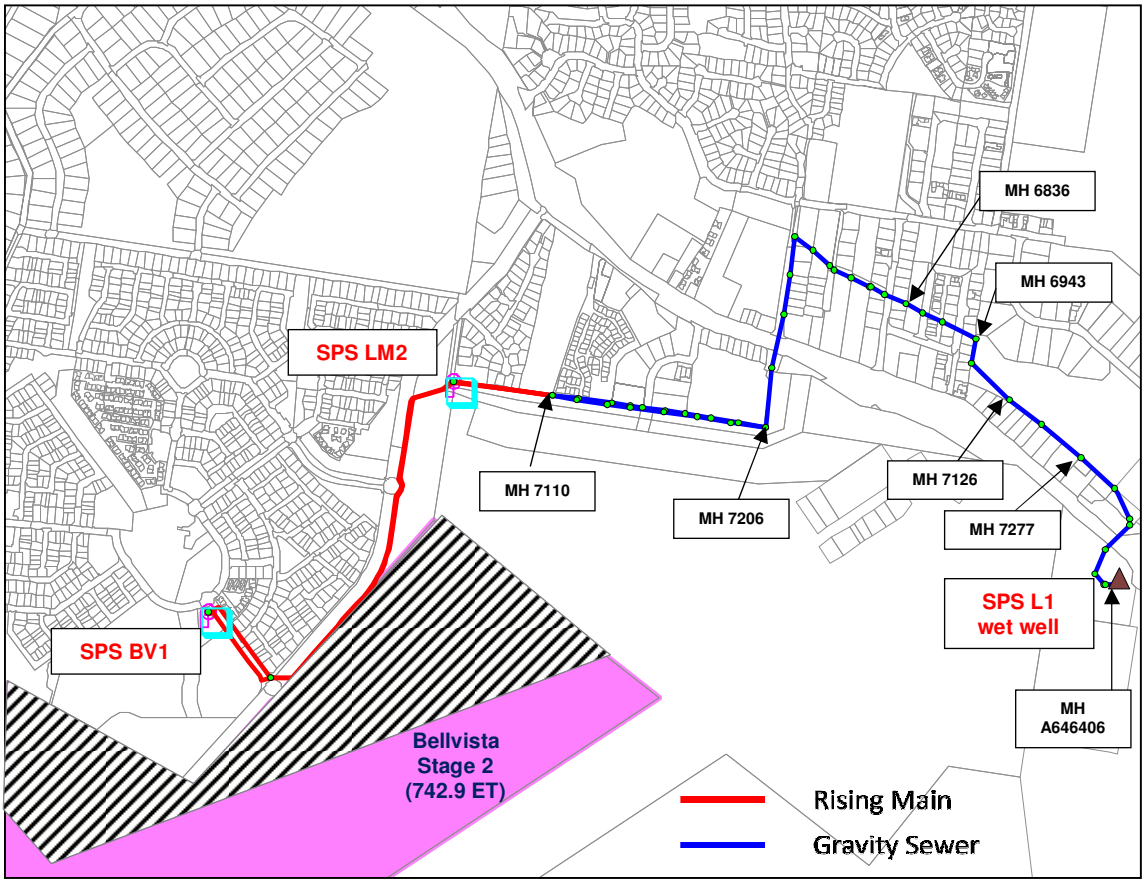


Figure 5-1: Modelled Sewerage Network

5.3 Impacts to Sewerage Network

Previously it was assumed (based on the Caloundra South Structure Plan) that the demands from the portion of the site now describe as Bellvista Stage 2 may be temporarily pumped to the SPS L1 catchment until a new Caloundra South sewerage treatment plant (STP) is constructed. However, at the time of drafting this report, the masterplanning for the Caloundra South Structure Plan was still being undertaken, and as such the timing of finished major infrastructure was unknown. It was assumed that the Bellvista Stage 2 development will have to be permanently serviced by the Caloundra Coastal system, i.e. the demands from that site will be permanently pumped to the SPS L1 catchment. In accordance with the provided GIS contours, the sewage generated by proposed development will be collected via local gravity sewers to the lowest point within the boundary then transfered by a new pumping station via pressure and gravity mains to the SPS L1 catchment.

Based on the model results, the 2011, 2016, 2021 and Ultimate “business as usual” longitudinal section from SPS BV1 and LM2 discharging point, manhole ‘7110’, to manhole ‘A646406’ is provided in Figure AP- 9 to Figure AP- 12 of Appendix B respectively. It shows that the dual 225mm diameter sewers (receiving sewers of SPS BV1 and LM2) are at capacity without Bellvista Stage 2 loadings from circa 2011. Under ultimate conditions flooding is predicted to occur at manholes ‘6836’ and ‘6943’. However, it should be noted that these two manholes have got limited cover to begin with, with manhole ‘6943’ having less than 0.5m pipe cover according to the asset data provided. Hence the loadings from the proposed development must be discharged downstream the dual 225mm diameter sewers on the northern side of Caloundra Road in the short-term and downstream of manhole “6943’ in the long-term. Alternately a dedicated pressure/gravity system could convey flow directly to SPS L1.

Theoretically if the loading from phase 1 (189 ET) of Bellvista Stage 2 development was discharged into manhole '7206', just downstream of the dual 225mm diameter sewers (see Figure AP- 13 of Appendix B) the impact to performance of the down stream system would be minimal.

For the 2016 and 2021 planning horizons, however, the loading from the four phases of the Bellvista Stage 2 development needs to be diverted to manhole '7126' without causing any overflows (see Figure AP- 14 and Figure AP- 15 of Appendix B). However, the maximum hydraulic gradient line (HGL) at several manholes is less than 1m below the manhole lid (such as manhole '6943' with 0.13m below the manhole lid), which does not comply with the SCW DSoS. Given the surrounding levels it is possible that these manhole lid levels are inaccurate. Regardless, the sewer is at capacity and cannot accept further load. It is recommended to move the discharging point to manhole '7277' to minimise the height of HGL at manhole '6943' and others (see Figure AP- 14 of Appendix B). Given that manhole '7277' is so close to SPS L1 and would require the cross of Caloundra Road, it might be more efficient to connect directly to one of the manhole just upstream of SPS L1 on the south side of Caloundra Road.

For the Ultimate planning horizon, as flooding is already predicted to occur along the 375mm trunk main, the loadings from Bellvista Stage 2 would need to be transferred to manhole '7277' or directly to SPS L1, so as not to overload the trunk main even further.

The lowest point of the site is close to the south-eastern corner of the property boundary. Based on the assumption that there would be no access to construct infrastructure across the aerodrome site any augmentation would need to generally follow the existing infrastructure until at least the end of the dual diameter 225mm mains. From this point two alternatives are available (see Figure 5-2):

- Follow the existing infrastructure alignment (up to 2.1 km pressure main plus 2.4 km gravity main); or
- Continue the alignment on the south side of Caloundra Road (up to 2.1 km pressure main plus 1.9 km gravity main);.

Constructing along the existing alignment will require crossing Caloundra Road, which is a designated State controlled road requiring more rigorous construction processes. There may also be other constraints due to the existing infrastructures. The alternate route (south side of Caloundra Road) may also have constraints such as land tenure issue and constructability.

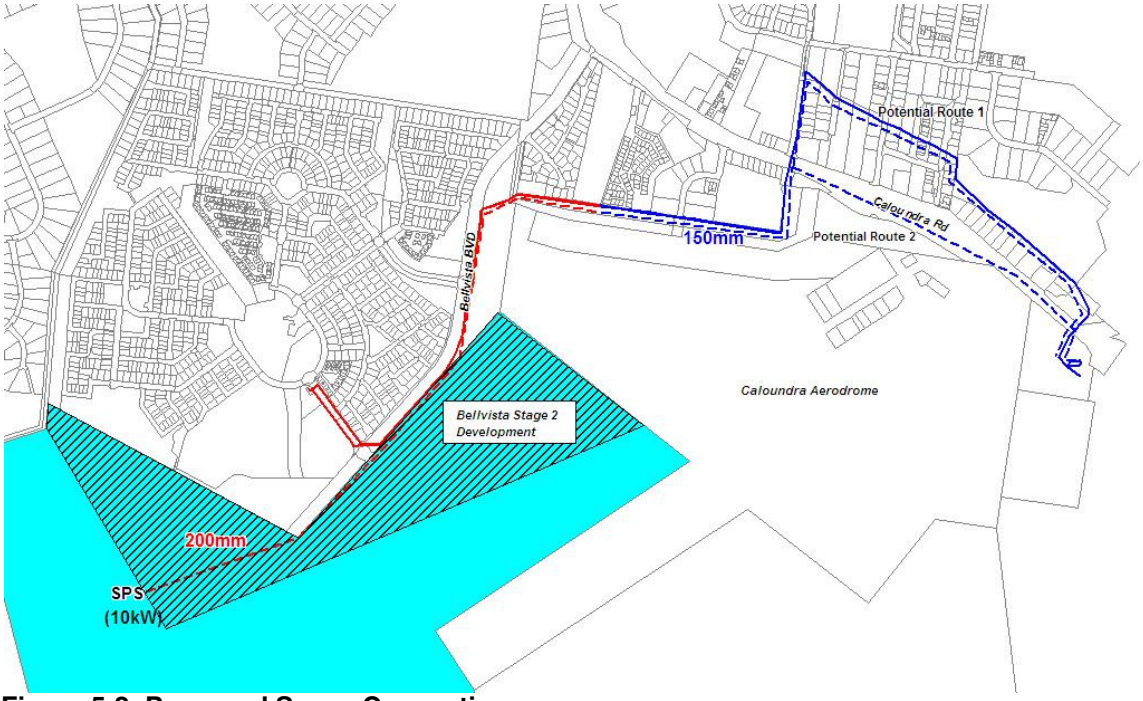


Figure 5-2: Proposed Sewer Connections

6 Conclusions and Recommendations

The following conclusions can be drawn from this study:

- The existing water supply and sewerage systems have not been planned to cater for demands from the Bellvista Stage 2 site;
- The *Draft SCW Regional Water Infrastructure Strategic Growth Planning Study 2010* identifies strategies which take the Bellvista Stage 2 development into consideration. These include major trunk infrastructure from the south;
- A change in the designation of the development site has triggered a reconsideration of these strategies;
- The population of proposed development was derived as 716.9 Water ET or 742.9 Sewer ET in accordance with the conversion rates used in '*Caloundra City Priority Infrastructure Plan*' and SCW DSoS;
- Without the bulk Greenfield water supply infrastructure in place in Caloundra South:
    - The existing water network can provide sufficient service to Phase 1 (188.7 ET) of the proposed development in 2011;
    - The existing water network can, without augmentation, provide sufficient service to supply Phase 1 (188.7 ET) but not all of Phase 2 (additional 300 ET);
    - The existing water network and the proposed augmentations for the 2016 planning horizon can provide sufficient service for the full demand of the proposed development in 2016 with the construction of a 375mm diameter main from the Sugarbag Road facility to the intersection of Quarry and Mark Roads;
    - The existing water network and the proposed augmentations for the 2021 planning horizon can provide sufficient service for the full demand of the proposed development in 2021 with the 375 mm diameter augmentation in place;
    - The existing water network and the proposed augmentations for the Ultimate planning horizon can provide sufficient service for the full demand of the proposed development at Ultimate with the 375 mm diameter augmentation in place; and
    - The additional storage at Sugarbag Road will have a theoretical bring forward requirement;
- In the short-term the sewerage generated from Phase 1 of the proposed development can be delivered to manhole '7206', just downstream of the dual 225mm diameter sewers. However, from phase 2, sewage generated by the proposed development needs to be pumped to manhole '7277' or alternatively directly to SPS L1 without causing any overflows in the SPS L1 catchment under the Ultimate planning horizons when a free fall condition at the wet wells of SPS L1 is available.

The following recommendations can be drawn from this study:

- That no more than 250 ET (water) from this site be approved for development without the 375 mm diameter augmentation in place.
- The pipe cover at sewerage manholes '6776' and '6943' is less than 0.5 m and at '7206', '6836' and '6741' it is less than 1m, based on the provided model. A detailed manhole survey is recommended at these locations.

- A route selection study be undertaken for the 375mm diameter water supply trunk main.
- Land tenure, regulated approvals and constructability assessment investigation be undertaken for the proposed sewerage infrastructure.

Appendix A Water Network Model Result

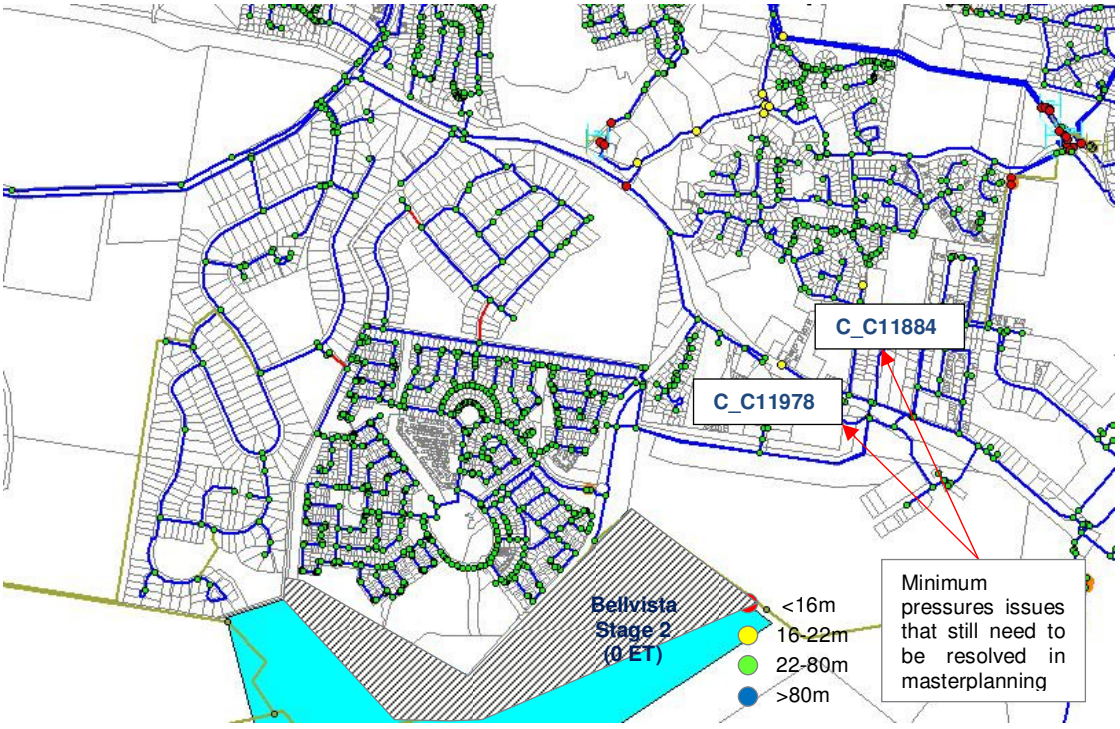


Figure AP- 1: Scenario 1 (2011 BAU) Minimum Pressure Thematic Map

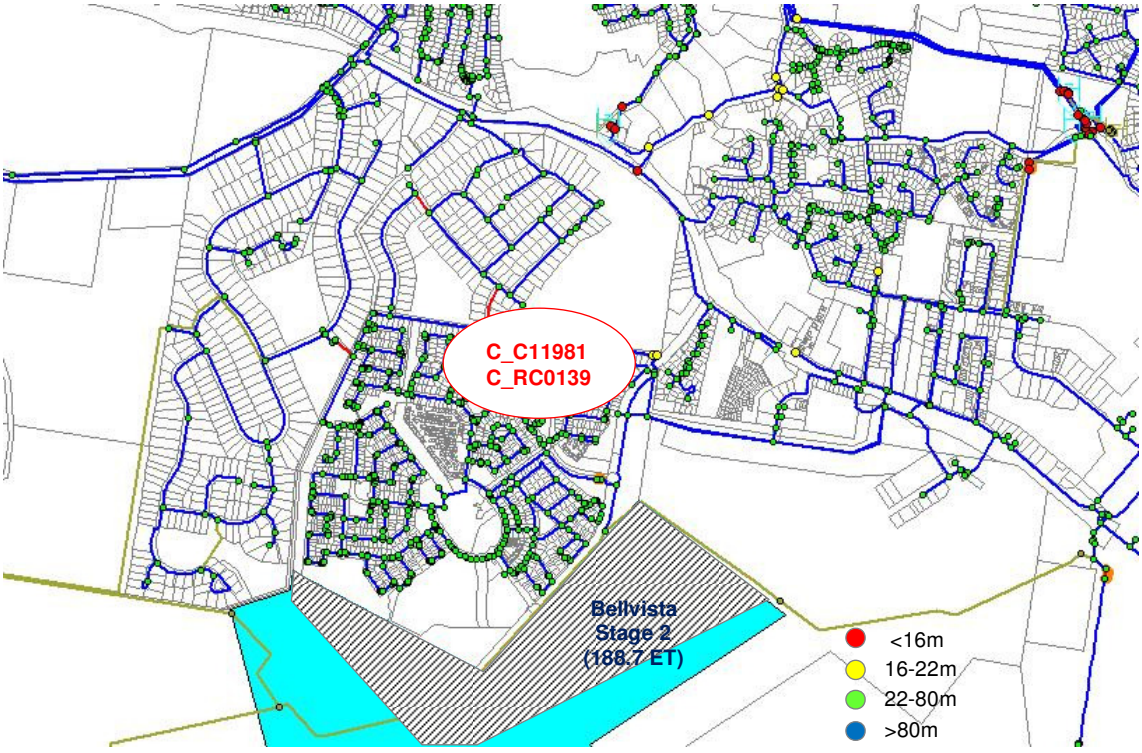


Figure AP- 2: Scenario 1a (2011 Phase 1 Bellvista Stage 2 Demand) Minimum Pressure Thematic Map

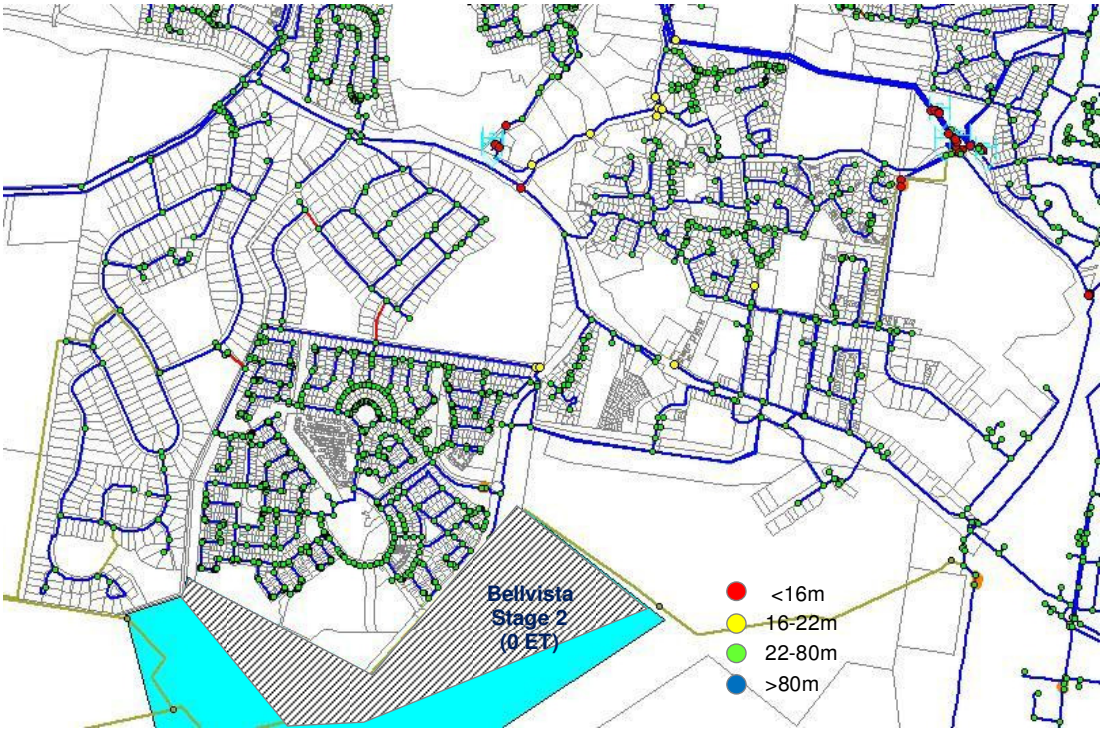


Figure AP- 3: Scenario 2 (2016 BAU) Minimum Pressure Thematic Map

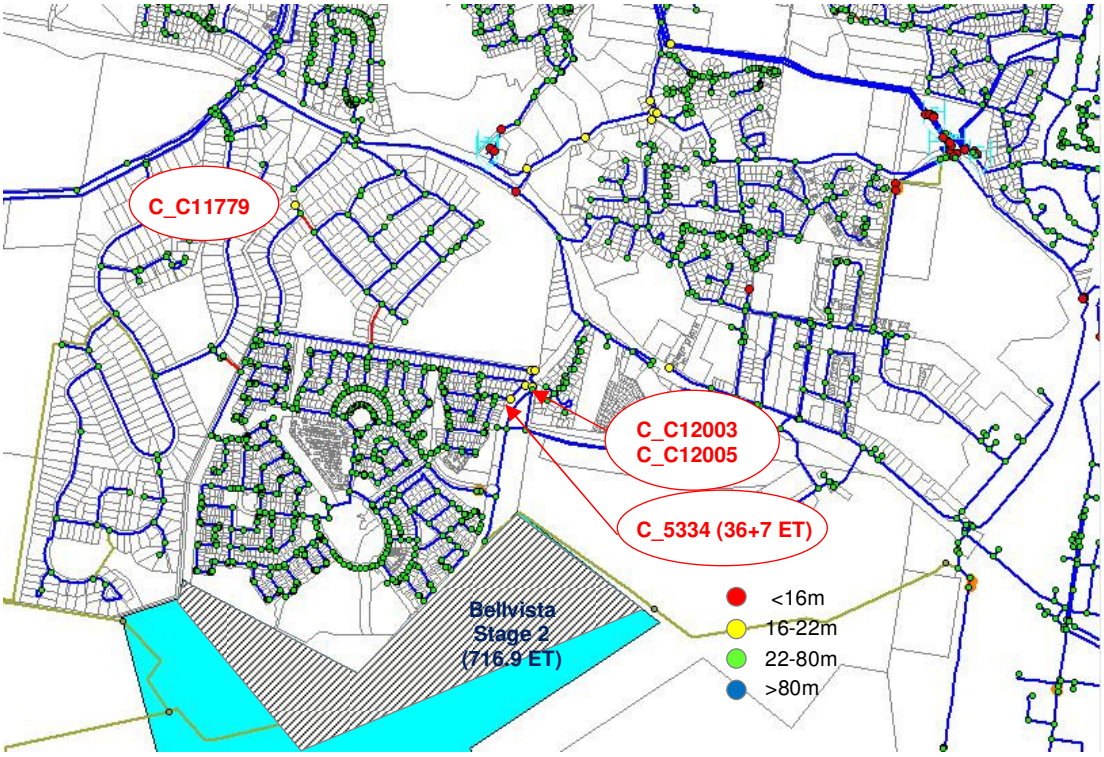


Figure AP- 4: Scenario 2a (2016 Full Bellvista Stage 2 Demand) Minimum Pressure Thematic Map

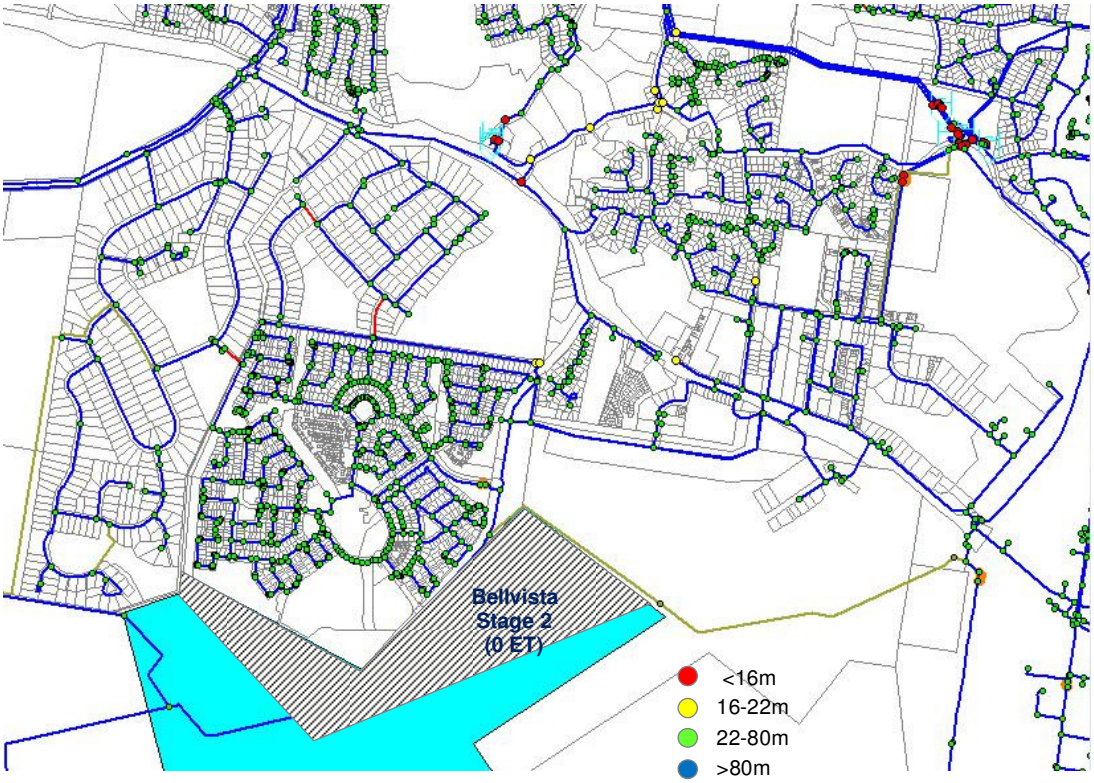


Figure AP- 5: Scenario 3 (2021 BAU) Minimum Pressure Thematic Map

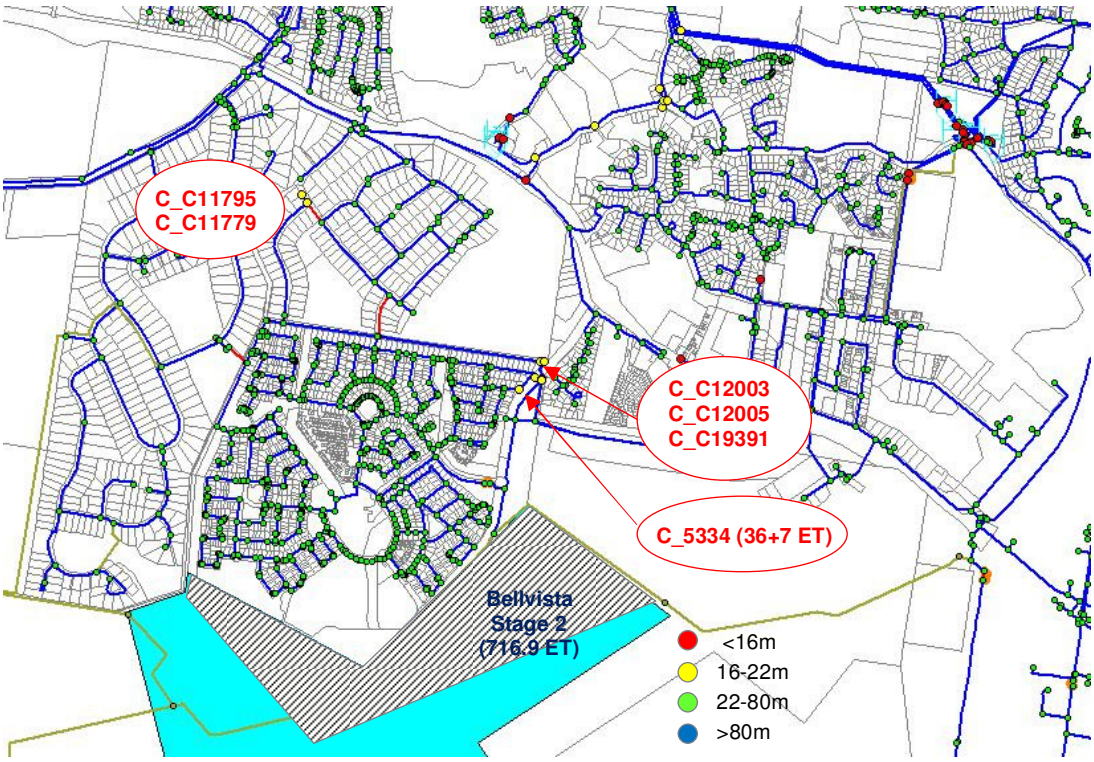


Figure AP- 6: Scenario 3a (2021 Full Bellvista Stage 2 Demand) Minimum Pressure Thematic Map

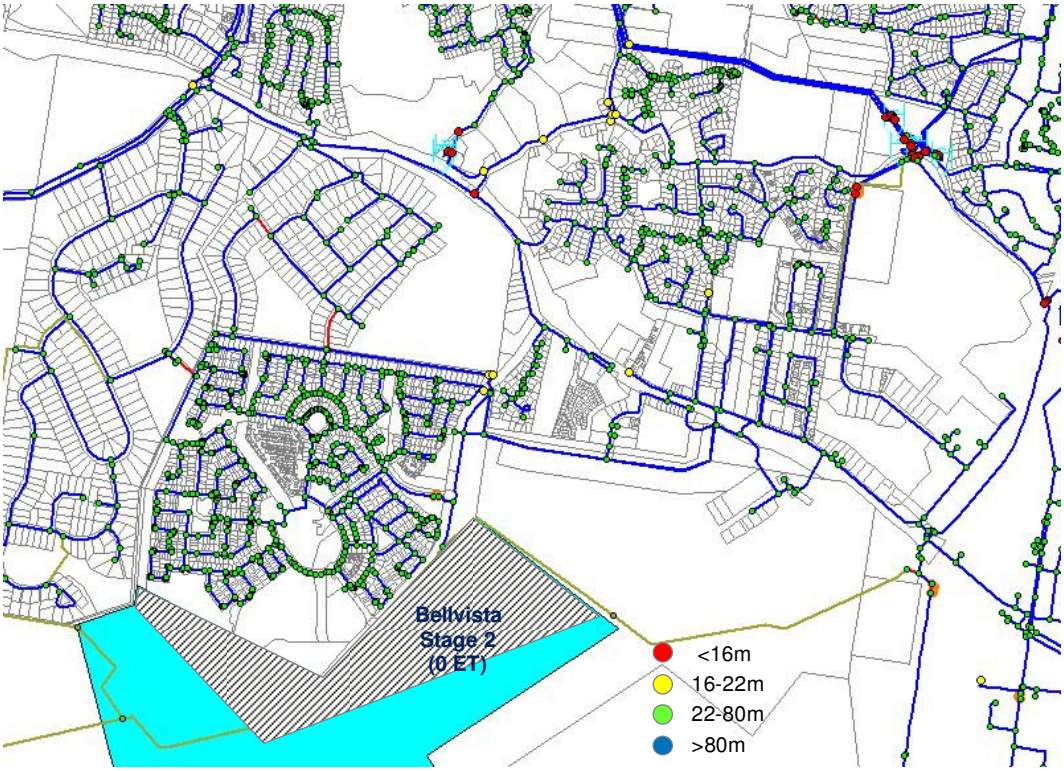


Figure AP- 7: Scenario 4 (Ultimate BAU) Minimum Pressure Thematic Map

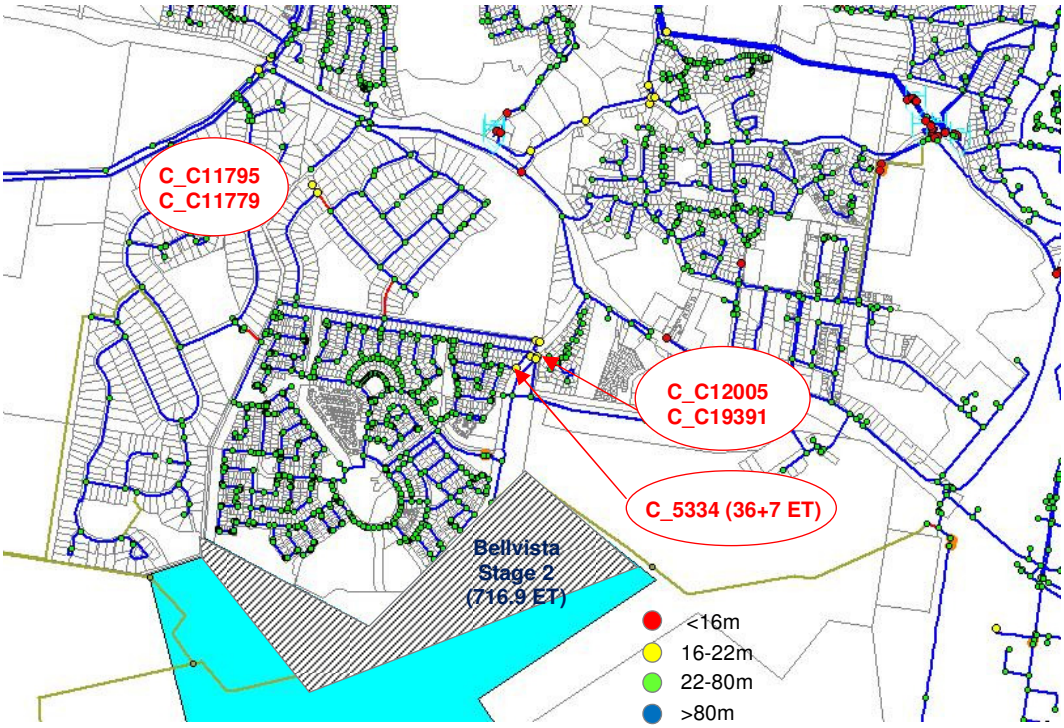


Figure AP- 8: Scenario 4a (Ultimate Full Bellvista Stage 2 Demand) Minimum Pressure Thematic Map

Appendix B Sewerage Network Model Result

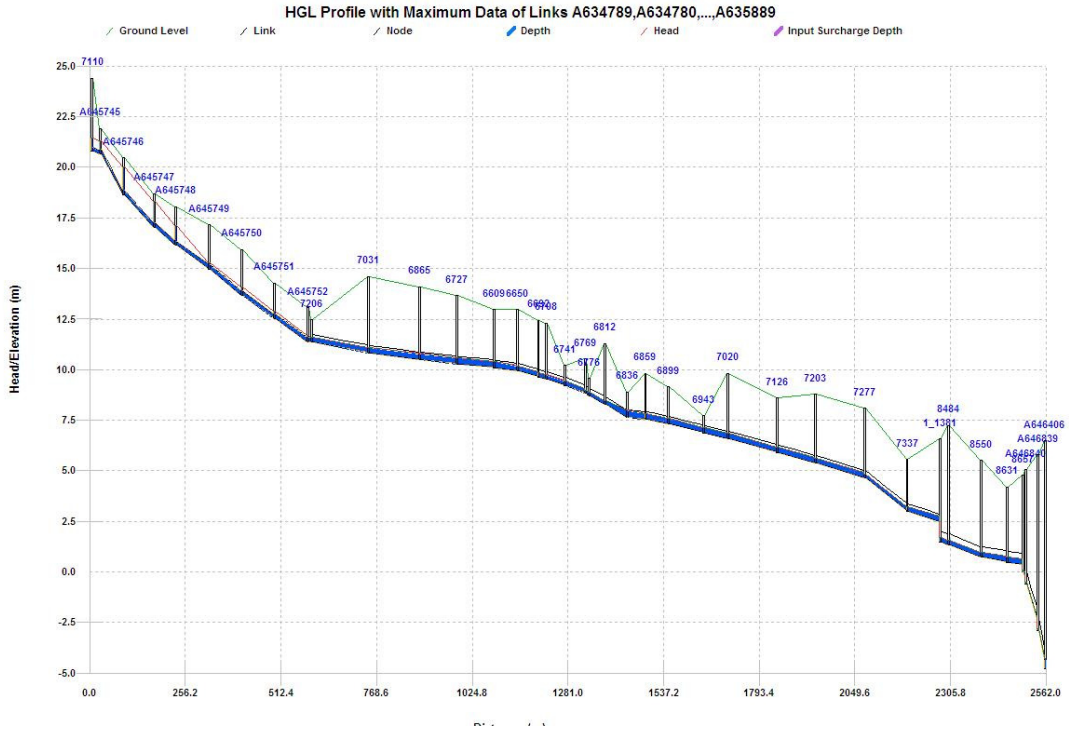


Figure AP- 9: 2011 BAU Longitudinal Section (0 ET from Bellvista Stage 2 development)

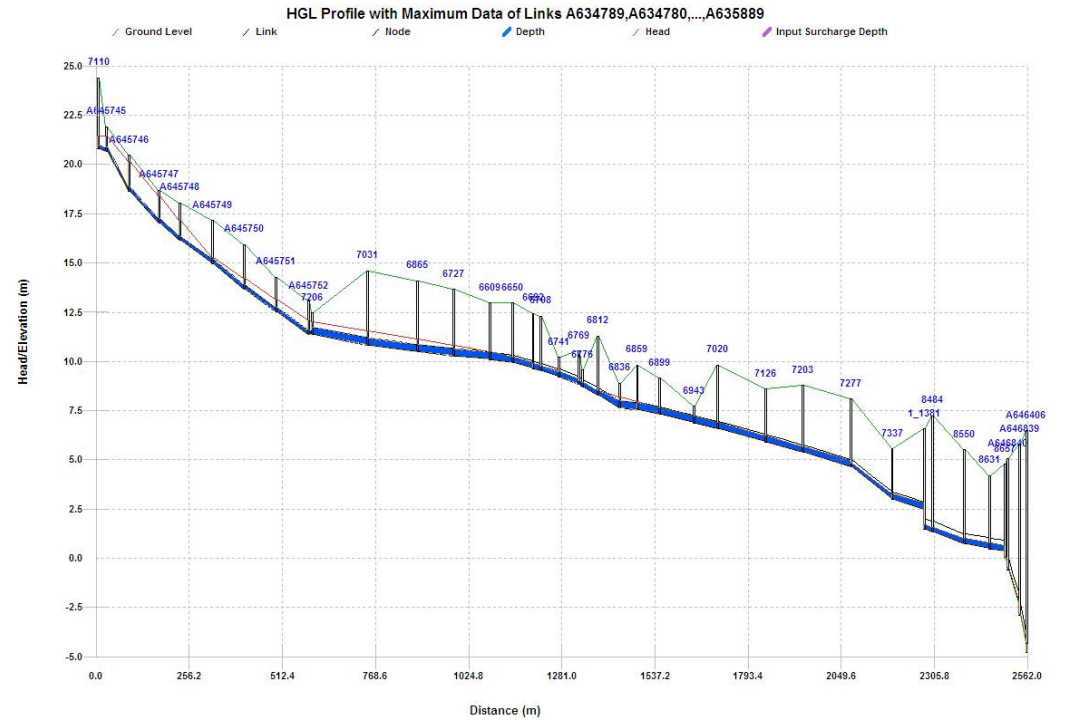


Figure AP- 10: 2016 BAU Longitudinal Section (0 ET from Bellvista Stage 2 development)

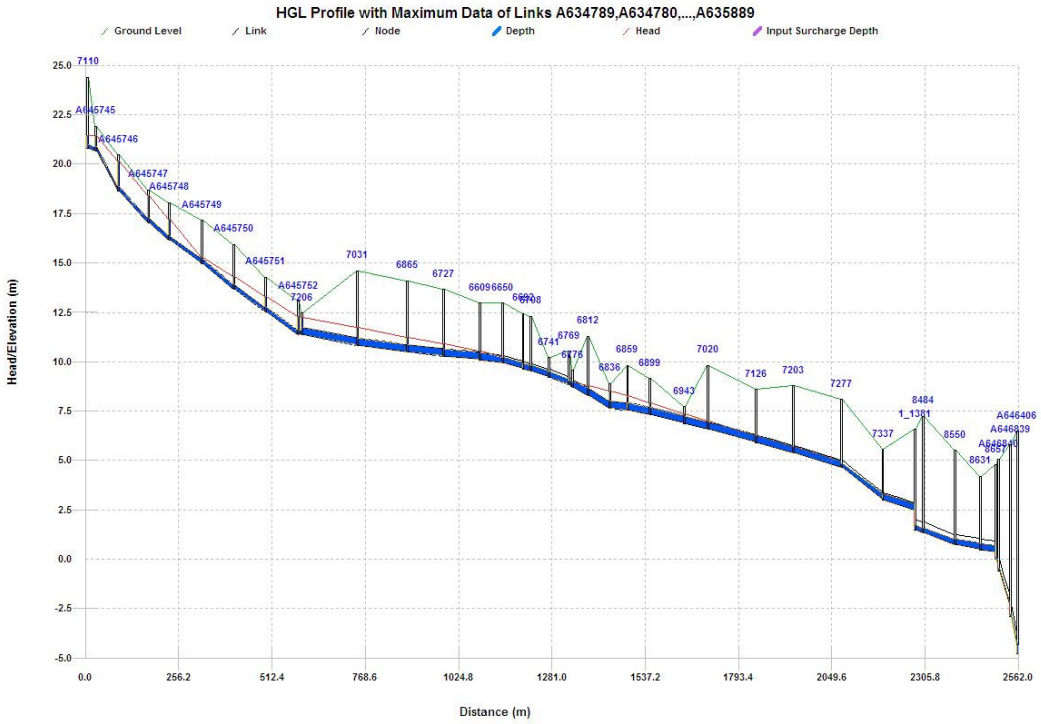


Figure AP- 11: 2021 BAU Longitudinal Section (0 ET from Bellvista Stage 2 development)

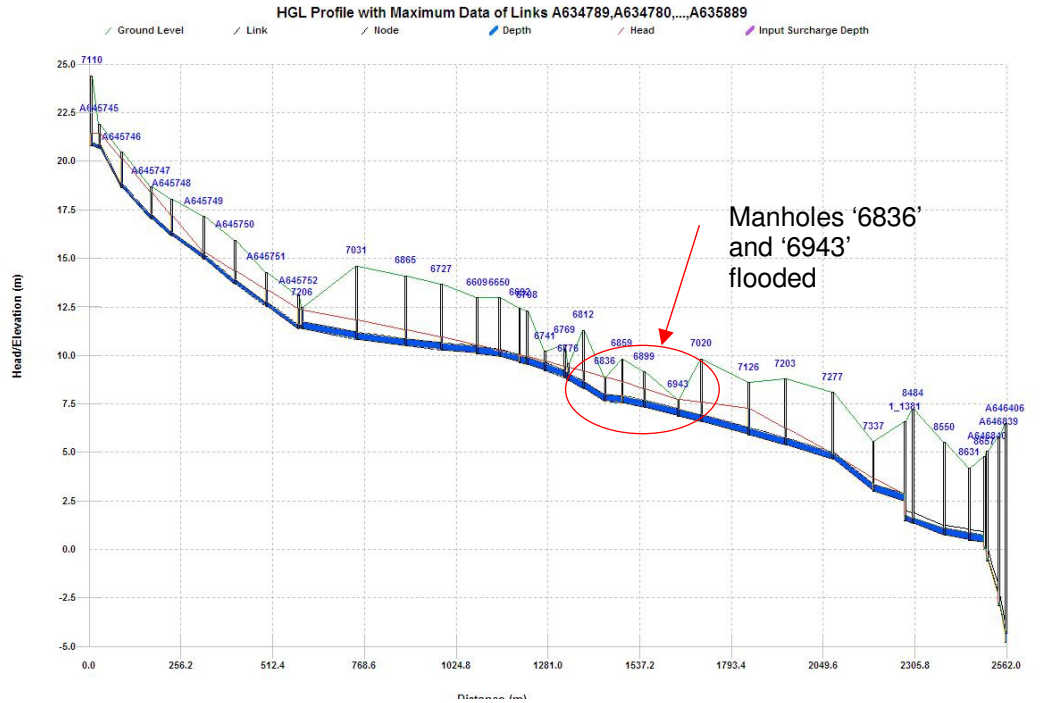


Figure AP- 12: Ultimate BAU Longitudinal Section (0 ET from Bellvista Stage 2 development)

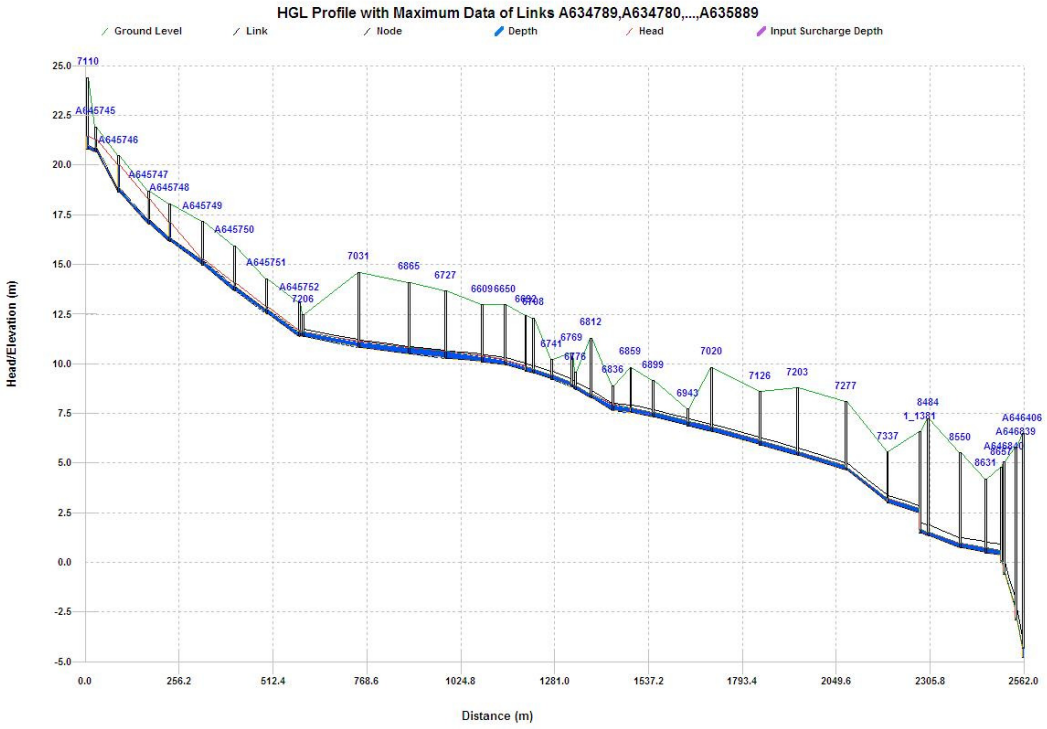


Figure AP- 13: 2011 Full Bellvista Stage 2 Development Longitudinal Section (Pumped to Manhole 7206)

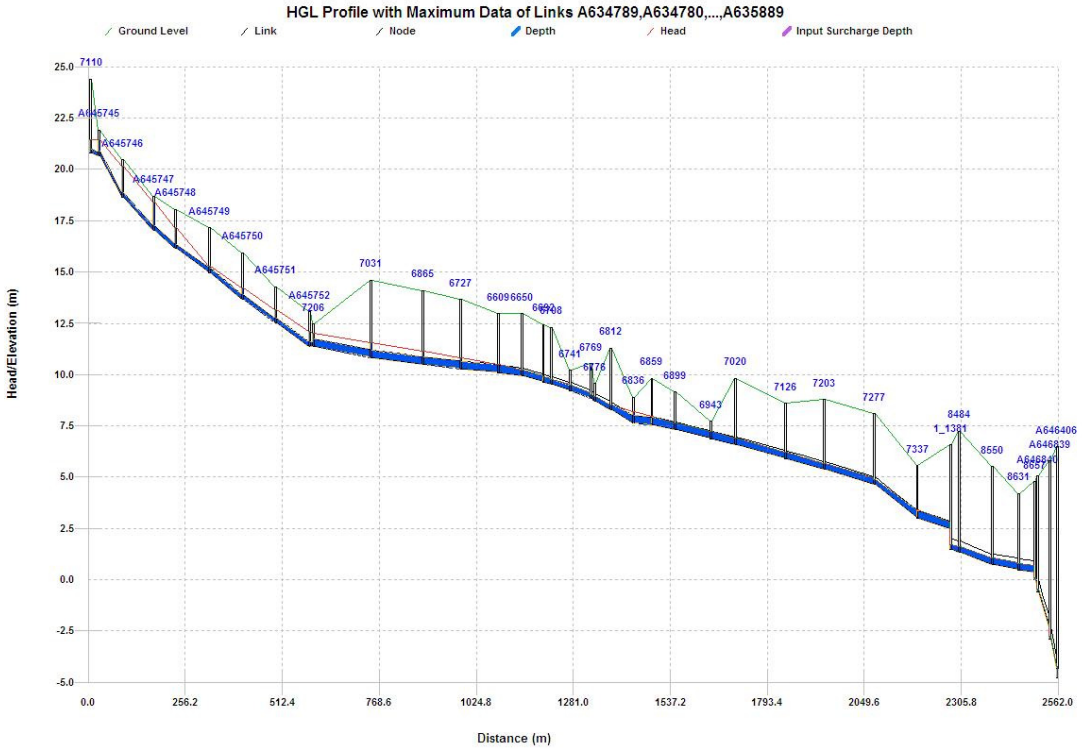


Figure AP- 14: 2016 Full Bellvista Stage 2 Development Longitudinal Section (Pumped to Manhole 7277)

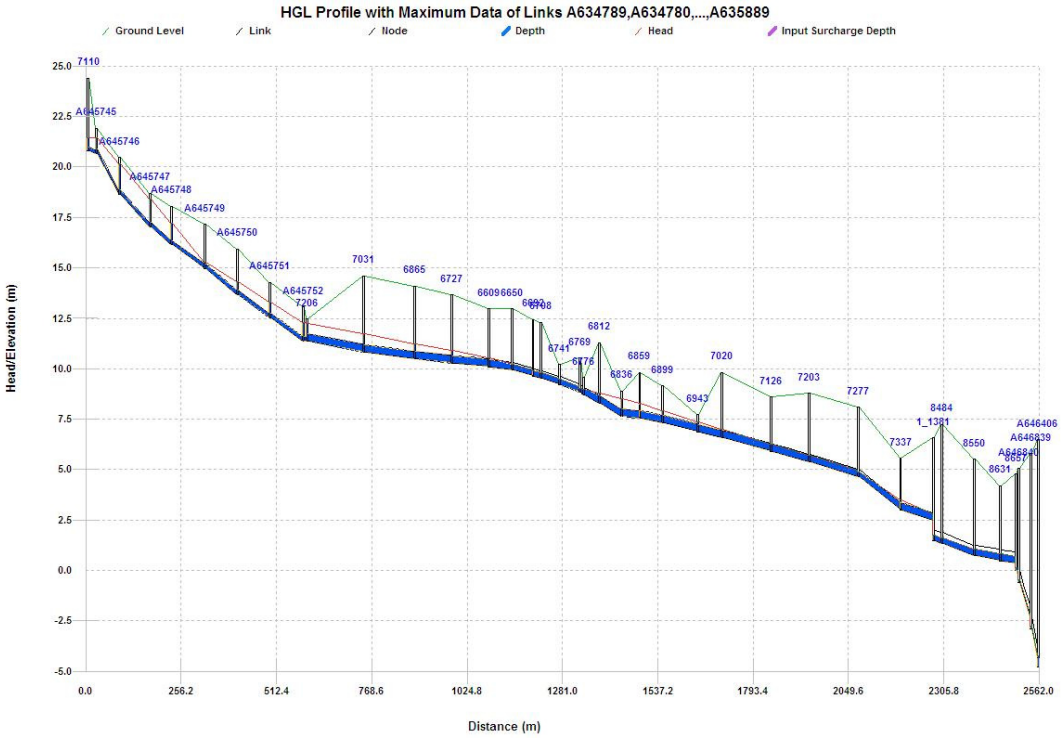


Figure AP- 15: 2021 Full Bellvista Stage 2 Development Longitudinal Section (Pumped to Manhole 7277)

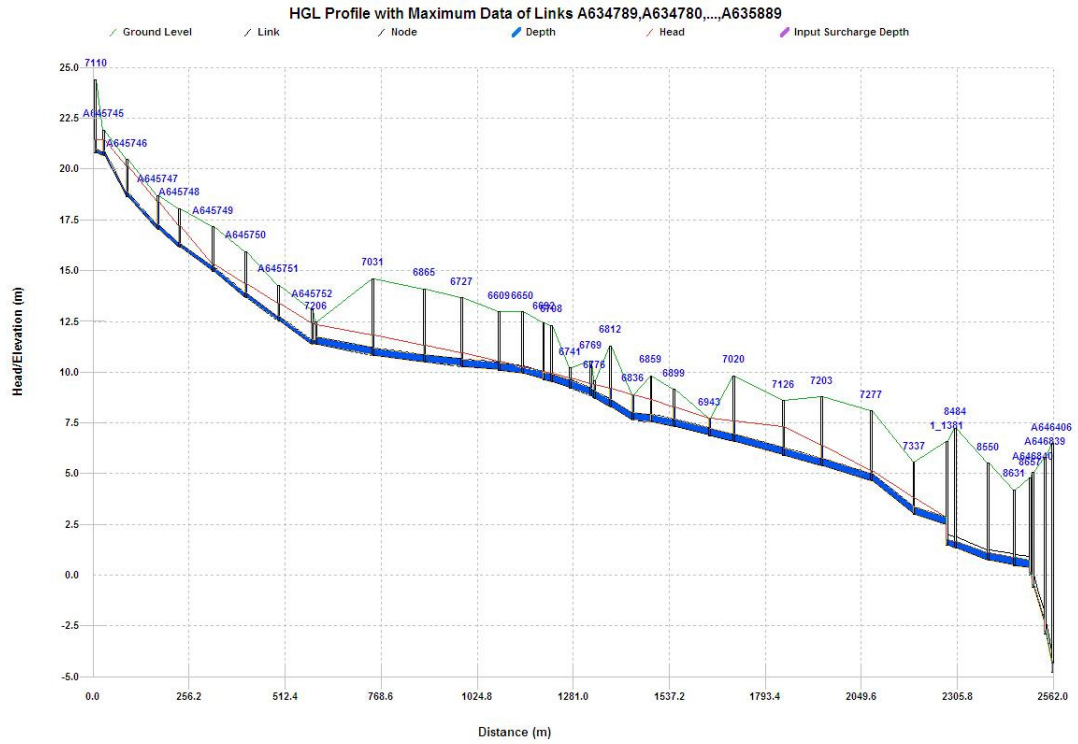


Figure AP- 16: Ultimate Full Bellvista Stage 2 Development Longitudinal Section (Pumped to Manhole 7277)

Appendix C Sunshine Coast Water Desired Standards of Service

Level of Impact Assessment Specification – Supporting Document 1. Regional Strategy Project Unit Technical Memorandum No. 7. Desired Standards of Service

Demand Based Standards

Table 1: SCW Potable Water Demand Based Desired Standards of Service

<table>
<tr><th>Standard</th><th>Reference Number</th><th>Criteria</th></tr>
<tr><td>Demand Unit</td><td>P01</td><td>2.7 EP / 1 ET</td></tr>
<tr><td>Average Day Potable Water Demands per Equivalent Tenement

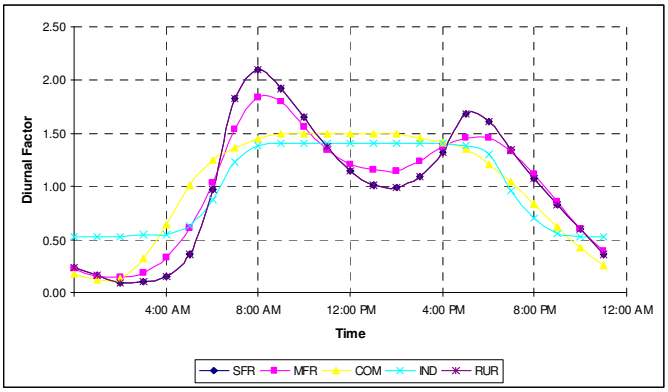
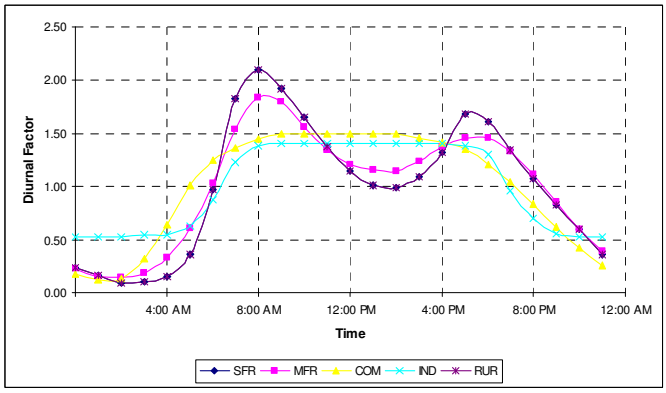
(L/ET/day)</td><td>P02-1

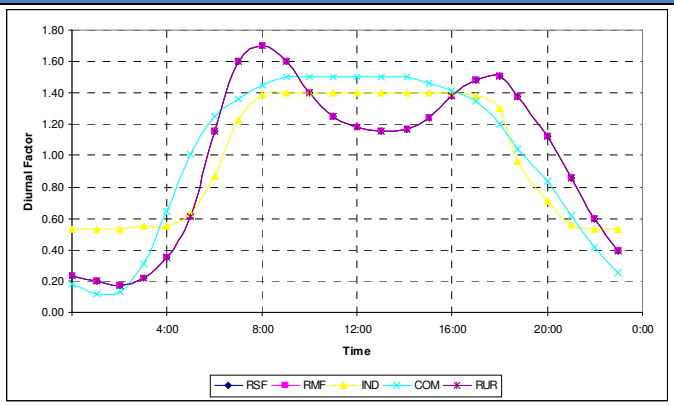
P02-2

P02-3</td><td>
CASE 1 Dwellings L/ET/day
<table>
<tr><th>Land Use Group*</th><th>Existing</th><th>2011</th><th>2016</th><th>2021</th><th>2031</th><th>Ultimate</th></tr>
<tr><td>Single Family Residential (SFR)</td><td>804</td><td>774</td><td>733</td><td>705</td><td>669</td><td>653</td></tr>
<tr><td>Multiple Family Residential (MFR)</td><td>683</td><td>654</td><td>618</td><td>593</td><td>562</td><td>548</td></tr>
<tr><td>Rural Residential (RUR)</td><td>804</td><td>774</td><td>733</td><td>705</td><td>669</td><td>653</td></tr>
<tr><td>Commercial (COM)</td><td>804</td><td>785</td><td>767</td><td>758</td><td>754</td><td>750</td></tr>
<tr><td>Industrial (IND)</td><td>804</td><td>785</td><td>767</td><td>758</td><td>754</td><td>750</td></tr>
</table>
CASE 2 Dwellings L/ET/day
<table>
<tr><th>Land Use Group*</th><th>Existing</th><th>2011</th><th>2016</th><th>2021</th><th>2031</th><th>Ultimate</th></tr>
<tr><td>Single Family Residential (SFR)</td><td>405</td><td>390</td><td>366</td><td>353</td><td>340</td><td>336</td></tr>
<tr><td>Multiple Family Residential (MFR)</td><td>493</td><td>476</td><td>451</td><td>436</td><td>425</td><td>421</td></tr>
<tr><td>Rural Residential (RUR)</td><td>405</td><td>390</td><td>366</td><td>353</td><td>340</td><td>336</td></tr>
<tr><td>Commercial (COM)</td><td>804</td><td>785</td><td>767</td><td>758</td><td>754</td><td>750</td></tr>
<tr><td>Industrial (IND)</td><td>804</td><td>785</td><td>767</td><td>758</td><td>754</td><td>750</td></tr>
</table>
CASE 3 Dwellings L/ET/day
<table>
<tr><th>Land Use Group*</th><th>Existing</th><th>2011</th><th>2016</th><th>2021</th><th>2031</th><th>Ultimate</th></tr>
<tr><td>Single Family Residential (SFR)</td><td>367</td><td>353</td><td>331</td><td>318</td><td>306</td><td>303</td></tr>
<tr><td>Multiple Family Residential (MFR)*</td><td>377</td><td>364</td><td>343</td><td>332</td><td>325</td><td>322</td></tr>
<tr><td>Rural Residential (RUR)</td><td>367</td><td>353</td><td>331</td><td>318</td><td>306</td><td>303</td></tr>
<tr><td>Commercial (COM)</td><td>603</td><td>589</td><td>575</td><td>569</td><td>566</td><td>563</td></tr>
<tr><td>Industrial (IND)</td><td>603</td><td>589</td><td>575</td><td>569</td><td>566</td><td>563</td></tr>
</table>
*Land Use Group – As defined in issued population model or equivalent
</td></tr>
<tr><td>Potable water peaking factors

(x AD)</td><td>P03-1

P03-2</td><td>
Case 1 Dwellings
<table>
<tr><th>Land Use Group</th><th>MDMM</th><th>MD</th><th>MH</th></tr>
<tr><td>Single Family Residential (SFR)</td><td>1.5</td><td>1.9</td><td>4</td></tr>
<tr><td>Multiple Family Residential (MFR)</td><td>1.5</td><td>1.9</td><td>3.5</td></tr>
<tr><td>Rural Residential (RUR)</td><td>1.5</td><td>1.9</td><td>4</td></tr>
<tr><td>Commercial (COM)</td><td>1.5</td><td>1.9</td><td>2.85</td></tr>
<tr><td>Industrial (IND)</td><td>1.5</td><td>1.9</td><td>2.66</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Standard</th><th>Reference Number</th><th>Criteria</th></tr>
<tr><td></td><td>P03-3</td><td>
Case 2 Dwellings
<table>
<tr><th>Land Use Group</th><th>MDMM</th><th>MD</th><th>MH</th></tr>
<tr><td>Single Family Residential (SFR)</td><td>2.6</td><td>3.7</td><td>7.8</td></tr>
<tr><td>Multiple Family Residential (MFR)</td><td>1.8</td><td>2.5</td><td>4.6</td></tr>
<tr><td>Rural Residential (RUR)</td><td>2.6</td><td>3.7</td><td>7.8</td></tr>
<tr><td>Commercial (COM)</td><td>1.5</td><td>1.9</td><td>2.85</td></tr>
<tr><td>Industrial (IND)</td><td>1.5</td><td>1.9</td><td>2.66</td></tr>
</table>
Case 3 Dwellings
<table>
<tr><th>Land Use Group</th><th>MDMM</th><th>MD</th><th>MH</th></tr>
<tr><td>Single Family Residential (SFR)</td><td>2.0</td><td>2.5</td><td>4.2</td></tr>
<tr><td>Multiple Family Residential (MFR)</td><td>1.9</td><td>2.4</td><td>4.1</td></tr>
<tr><td>Rural Residential (RUR)</td><td>2.0</td><td>2.5</td><td>4.2</td></tr>
<tr><td>Commercial (COM)</td><td>1.5</td><td>1.8</td><td>2.7</td></tr>
<tr><td>Industrial (IND)</td><td>1.5</td><td>1.8</td><td>2.5</td></tr>
</table>
</td></tr>
<tr><td>Case 1 Properties – AD Diurnal Profiles</td><td>P04-1a</td><td> 
</td></tr>
<tr><td>Case 2 Properties – AD Diurnal Profiles</td><td>P04-2a</td><td> 
</td></tr>
</table>

Standard	Reference Number	Criteria
Case 3 Properties – AD Diurnal Profiles	P04-3a	

Performance Based Standards

Table 2: SCW Potable Water Performance Based Desired Standards of Service

<table>
<tr><th>Standard</th><th>Reference Number</th><th>Criteria</th></tr>
<tr><td>Pressure Performance Criteria</td><td>P06
P07
P08</td><td>
<table>
<tr><th>Criteria</th><th>Performance Specification (m)</th><th>Details</th></tr>
<tr><td>Minimum Pressure</td><td>22</td><td>Minimum pressure of 22 m in the reticulation main is to be maintained at all times (20m at property boundary plus 2m losses in smaller fittings and house connections). Compliance should be demonstrated under maximum hour demand conditions with zonal reservoirs at their minimum operating level.</td></tr>
<tr><td>Minimum pressure for serviced areas outside PIP boundaries</td><td>16</td><td>Any use of this relaxed minimum service pressure criteria must first be agreed upon with Sunshine Coast Water.</td></tr>
<tr><td>Maximum Pressure</td><td>80</td><td>Compliance should be demonstrated during minimum demand periods with reservoirs at their maximum operating level.</td></tr>
</table>
^The 16 m rule was adopted in the previous Caloundra City Council standards of service (DDPSP) and was generally in place due to areas originally serviced prior to the adoption of priority infrastructure areas or regulated planning.
</td></tr>
<tr><td>Water Pipeline Sizing Criteria</td><td>P09
P10
P11
P12</td><td>
<table>
<tr><th>Criteria</th><th>Performance Specification</th></tr>
<tr><td>Bulk supply pipeline operating under gravity</td><td>Capacity to transport MDMM demand over 24 hours</td></tr>
<tr><td>Bulk supply pipeline operating under pumped supply</td><td>Capacity to transport MDMM demand over 20 hours per day</td></tr>
<tr><td>Zonal and reticulation water supply mains</td><td>Sized for the maintenance of pressure meeting both maximum hour and fire flow performance criteria</td></tr>
<tr><td>Maximum Velocity in all mains</td><td>2.5 m/s</td></tr>
</table>
</td></tr>
<tr><td>Potable Reservoir Sizing Criteria</td><td></td><td>
<table>
<tr><th>Criteria</th><th>Performance Specification</th></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Standard</th><th>Reference Number</th><th>Criteria</th></tr>
<tr><td></td><td>P13a

P13b

P14

P15</td><td>
<table>
<tr><td>Potable ground level reservoirs in traditional network (New Reservoir)</td><td>1 x MD + 30 % contingency storage</td></tr>
<tr><td>Potable ground level reservoirs in traditional network (Existing Reservoir)</td><td>1 x MD

When the existing reservoir cannot sustain the planned growth the infrastructure shall be sized as per P13a.</td></tr>
<tr><td>Potable ground level reservoirs in dual reticulation network.</td><td>1.8 x MD</td></tr>
<tr><td>Elevated reservoirs</td><td>6 x (MH – 1/12 MDMM) + 150 kL fire storage (statistical analysis);

Or

Maintenance of storage to a minimum of 30% full is demonstrated at existing elevated reservoirs through dynamic modelling where the operation of the supply pumping station is acceptable and the pumping station contains adequate security against power failure. Performance is to be tested using dynamic modelling.</td></tr>
</table>
</td></tr>
<tr><td>Potable Water Pumping Station Sizing Criteria</td><td>P16

P17

P18</td><td>
<table>
<tr><th>Criteria</th><th>Duty Pump Specification</th><th>Standby Pump Specification</th><th>Other</th></tr>
<tr><td>Pumping stations servicing ground level reservoirs</td><td>MDMM demand over 20 hours per day</td><td>Equivalent to largest duty pump</td><td></td></tr>
<tr><td>Pumping stations servicing elevated reservoirs</td><td>((6 x MH – operating volume) / (6 x 3600)) (L/s unit)</td><td>Equivalent to largest duty pump</td><td></td></tr>
<tr><td>Booster pumping stations – direct supply to customers</td><td>MH demand</td><td>Equivalent to largest duty pump</td><td>FF pump set required if duty pumps cannot provide fire flow.</td></tr>
</table>
</td></tr>
<tr><td>Fire Flow Demand and Supply Requirements</td><td>P19

P20a
P20b
P20c
P20d</td><td>Fire Flow Assessment Background Demand = 2/3 MH

<table>
<tr><th>Property Type</th><th>Total FF Demand (L/s)</th><th>Flow sourced from number of adjacent hydrants</th><th>Duration (hours)</th></tr>
<tr><td>Detached residential</td><td>15</td><td>2 hydrants (7.5 l/s each)</td><td>2</td></tr>
<tr><td>Multiple Level residential < 4 storeys</td><td>15</td><td>2 hydrants (7.5 l/s each)</td><td>2</td></tr>
<tr><td>Multiple level residential => 4 storeys</td><td>30</td><td>3 hydrants (10 L/s each)</td><td>4</td></tr>
<tr><td>Commercial / Industrial</td><td>30</td><td>3 hydrants (10 L/s each)</td><td>4</td></tr>
</table>
</td></tr>
<tr><td>Fire Flow Performance Pressure Requirements</td><td>P21a
P21b</td><td>
<table>
<tr><th>Location</th><th>Minimum Pressure Requirement (m)</th></tr>
<tr><td>At hydrants in use</td><td>12 m</td></tr>
<tr><td>To all of network other than hydrants in use</td><td>6 m</td></tr>
</table>
</td></tr>
</table>

Appendix D Demand Advice Email

Subject: FW: Bellvista Stage 2 - 2010/61-00001,- Request for Information
Attachments: atteb575.1

From: Troy Schultz[SMTP:TROY.SCHULTZ@BROWNCONSULTING.COM.AU]
Sent: Tuesday, March 23, 2010 11:36:22 AM
To: Kevin Grimley; David Creevey; Andrew Matthews
Cc: Brent Thomas; Mark Stephens
Subject: RE: Bellvista Stage 2 - 2010/61-00001,- Request for Information
Auto forwarded by a Rule

Guys,

The following is revised projections for the above, differing to previous advise.

2012	Detached Residential	182 lots
2012	Commercial	600 m2 GFA
2013	Detached Residential	252 lots
2013	Commercial	600 m2 GFA
2013	Attached Residential	60 du
2014	Detached Residential	166 lots
2015	Attached Residential	90 du

Total = 600 detached, 150 attached, 1200m2 commercial GFA (retail)

Trust this will be adopted into the modelling as required.

Regards,

Troy Schultz | Engineer - Urban Development
Brown Consulting (Qld) Pty Ltd
15 Nicklin Way, Buddina, Queensland, 4575
PO Box 997, Buddina, Queensland, 4575
P 07 5470 9260 **F** 07 5470 9262
E Troy.Schultz@brownconsulting.com.au
W www.brownconsulting.com.au

APPENDIX F

Sunshine Coast Regional Council Screen Plot

Emergency Access

Sunshine Coast
Regional Council

SCREEN PLOT

Date: 24 Jun 10 Time: 14.01.03

Requested By:

Major Roads
Railway Line
Road and Water Reserves
WATER
ROAD
Major Dams - SCRC
Council Boundary
2008 DERM Ortho
2008 SCRC Ortho

LOCALITY DIAGRAM