From: "Ben Collings - BNC Planning" <bnc@bncplanning.com.au>
Sent: Thu, 6 Nov 2025 15:29:44 +1000
To: "Development Assessment" <developmentassessment@townsville.qld.gov.au>
Cc: "Kate Wilkes" <Kate.Wilkes@townsville.qld.gov.au>
Subject: RE: LODGEMENT OF A DEVELOPMENT APPLICATION UNDER CHAPTER 3, PART 2 OF THE PLANNING ACT 2016
Attachments: Engineering Report Rev B.pdf

Further to the email below, please find attached an updated copy of the supporting Engineering Report which has had a number of minor errors corrected. Please use the attached version for the assessment.

Kind regards,

Benjamin Collings
Director

Office 7 / Ground Floor / 41 Denham Street TOWNSVILLE CITY QLD 4810
PO BOX 5493 TOWNSVILLE QLD 4810 **T.** (07) 4724 1763 **M.** 0438 789 612 **E.** bnc@bncplanning.com.au

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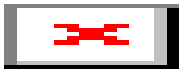
From: BNC Planning
Sent: Sunday, 2 November 2025 2:56 PM
To: Development Assessment <developmentassessment@townsville.qld.gov.au>
Subject: FW: LODGEMENT OF A DEVELOPMENT APPLICATION UNDER CHAPTER 3, PART 2 OF THE PLANNING ACT 2016

BNC Planning, acting on behalf of the applicant, herby lodge the attached development application in accordance with the provisions of Chapter 3, Part 2 of the *Planning Act 2016* seeking a preliminary approval for a variation request. The subject premises is addressed as **11 Black Hawk Boulevard, Thuringowa Central.**

This development application is being made to the Townsville City Council as the relevant assessment manager under the *Planning Regulation 2017* and has been made in the *approved form* as required under s51 of the *Planning Act 2016*.

The relevant assessment manager application fee will be paid by or on behalf of the applicant following confirmation of receipt of this email by council. We trust this information is sufficient for acceptance of this development application as *properly made* subject to payment of the application fee. Please contact the office should there be any issues or if you require any further information.

Kind regards,



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Premise

PART OF THE Amey GROUP

STATELAND PTY LTD

11 Black Hawk Boulevard

ENGINEERING REPORT

Report No: P004113/R02
Rev: B
31 October 2025

Document reference: P004113/R02

DOCUMENT AUTHORISATION					
Revision	**Revision Date**	**Report Details**			
DRAFT	14/10/25	FOR Approval			
A	31/10/25	FOR Approval			
B	03/11/25	FOR Approval			
Prepared By		**Reviewed By**		**Authorised By**	
Fabricio Ramos		Chris Marston		Chris Marston	

CONTENTS

APPENDICES

1. INTRODUCTION

This report assesses the Civil Engineering aspects of 11 Black Hawk Boulevard, a vacant lot in the municipality of Townsville City Council.

The proposed development is located at 11 Black Hawk Boulevard bounded by Black Hawk Boulevard to its northwest and by Regiment Street and Gregory Street to its East and South respectively.

This report has been commissioned by the developer, Stateland Pty Ltd, and forms part of a variation request to consider new code assessable uses. This report examines the engineering aspects of the site in respect of the proposed variation request.

2. PROPOSED DEVELOPMENT

As shown in the Figure below, development site is currently in split zoning under the Townsville City Plan and is located on vacant, undeveloped land with a total area of 4.419 ha. The developer is seeking approval to develop the site as an integrated development comprising one or more of the proposed uses.

The tenancies within the development site is currently not finalised. Therefore, a hypothetical site layout is adopted in this TIA by selecting a mix of proposed code assessable land uses.

- The total land area is 44,190m^2, of which two-thirds is allocated for commercial use and the remaining one third for residential use.
- 14,730m^2 of land allocated for residential use will consist of 50 multiple dwellings.
- 50% of commercial use site coverage is estimated to account for setbacks, car parking, access facilities, utilities, easements and landscaping. The remaining 14,800m^2 will consist of the following land uses and gross leasable floor areas (GLFA).
    - Childcare centre with a GLFA of 800m^2
    - Medical centre with a GLFA of 1,000m^2
    - Showroom with a GLFA of 5,000m^2 and warehouse with a GLFA of 4,000m^2
    - Low impact industry with a GLFA of 4,000m^2

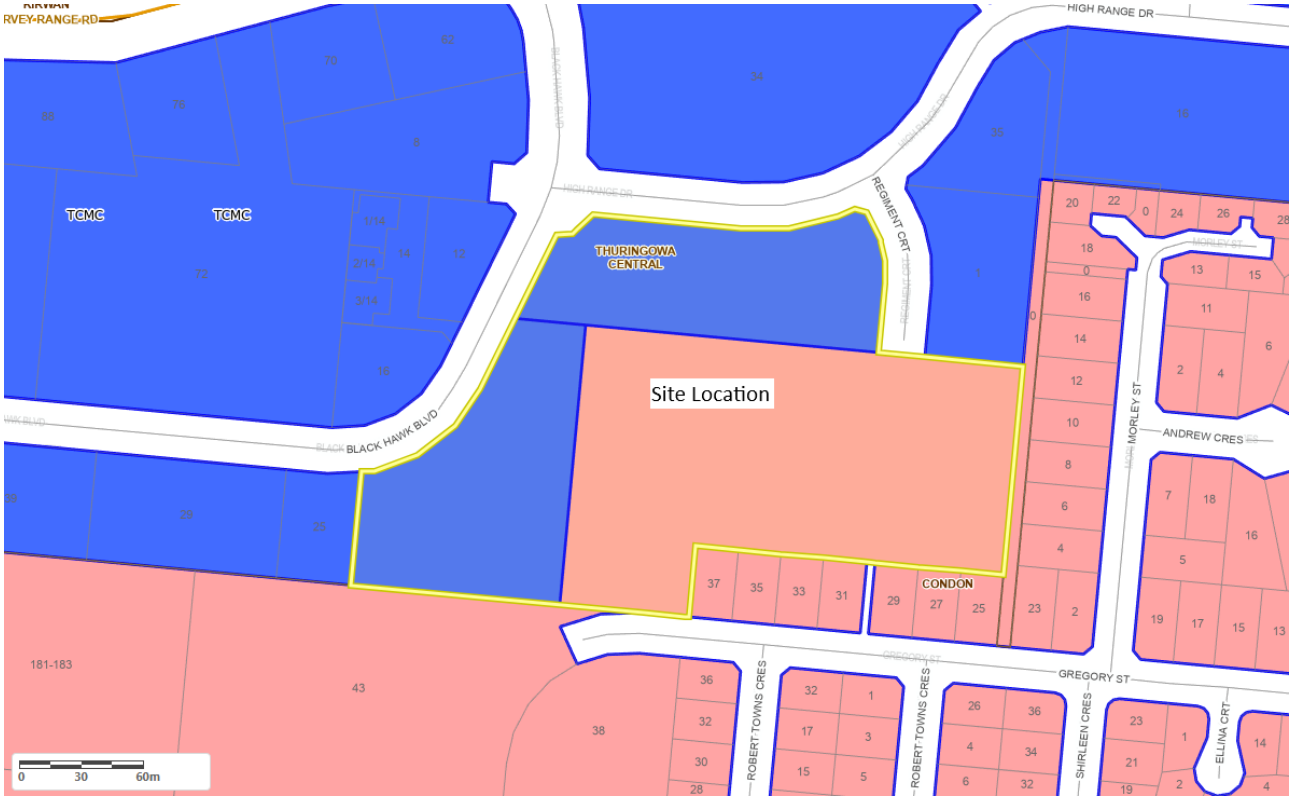

Figure 1: Townsville City council zoning map

3. TRAFFIC AND ROADWAYS

3.1 General

Access to the 11 Black Hawk Boulevard from trunk transport infrastructure is proposed to be from Black Hawk Boulevard or High Range Drive, with any internal roads and access to be designed and approved as part of the development approval process. Black Hawk Boulevard is an existing Industrial access road with a road reserve width of 22.5m. It is assumed that council will not allow industrial crossover and access to site via Gregory Street.

4. FLOODING AND EARTHWORKS

Earthworks and Flood impact will need to be addressed as part of the development approval for the proposed development which will be subject to a subsequent MCU application. Based on the council flood maps shown below it is apparent that some earthworks will be required to address the Q100 flood zone impacting the site at High Range drive.

At this stage of the development, we believe that the impact of the flood is minimal and occurs predominantly on the roadway and kerbing, from the map below it is evident that the little flood impacting the site is a direct result of low spot ponds throughout the site. The deepest point of the flood encountered on site as 0.2m in depth. The tenancies within the development site are currently not finalised. Therefore, a hypothetical site layout is adopted in this Engineering Report by selecting a mix of proposed code assessable land uses, as described in section 2. The total land area is 44,190m^2 of which two-thirds is allocated for commercial use and the remaining one third for residential use.

Both residential and commercial development would significantly increase the amount of impermeable area, and as such would increase the amount of water generated by the site which will need to be mitigated to avoid overcharging the current surrounding drainage infrastructure. One proposed solution to this would be to have some on site detention/ retention to reduce the peak discharge of the key storm events. A design solution will be presented to support the subsequent MCU application when the specific use is identified.

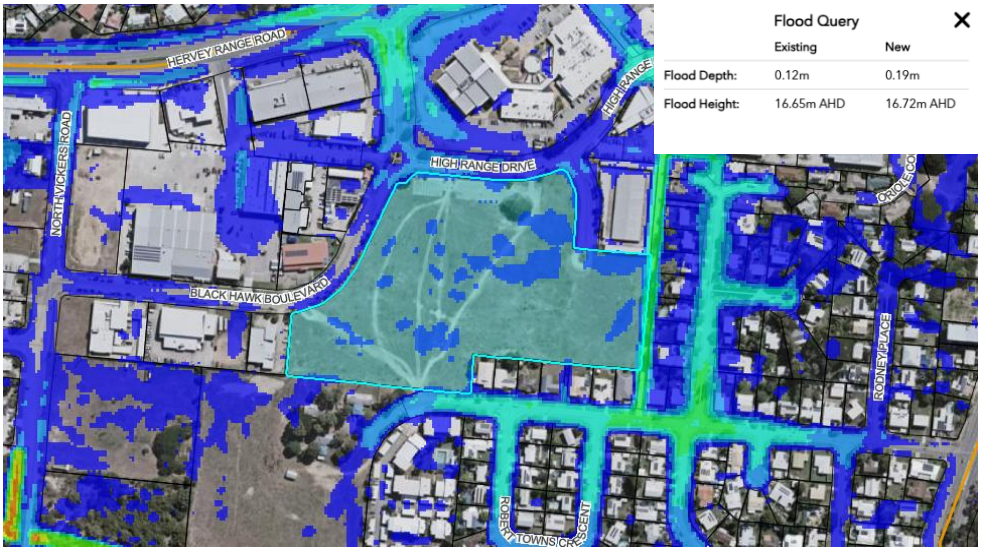

Figure 2: Townville Council flood maps with subject site highlighted blue

5. STORMWATER DRAINAGE

An analysis was carried out on existing stormwater infrastructure to measure the impact of the development at 11 Blackhawk Boulevard. The rational method was used to determine the peak discharge Q values for the surrounding catchments based on their point of discharge. A screenshot is attached showing the potential point of discharge of each catchment and the values derived from the equation are in the table below. We have compared these values primarily to determine the impact of the development in the Q values for key storms based on rainfall intensity data supplied on the bureau of meteorology website. This preliminary assessment was done to outline the increase in discharge and to prepare a strategic plan to show that the development can be completed without having worsening effect on the surrounding infrastructure. QUDM states that when developing a site from 90%+ pervious to 80%+ impervious you must ensure that the impact of the stormwater flow will be the same or less than the current maximum in the existing network. Our calculations based on the catchments show that there is an increase in the peak discharge after development of 56%. This shows that the new stormwater discharge quantity would not meet QUDM standard, and as part of the MCU application the developer must prepare a stormwater management strategy stating how they will reduce the discharge to meet the current limits. It is our opinion that a stormwater management solution can be implemented to achieve the required outcomes. Attached below is a catchment drawing showing our assumptions of the catchments and discharge points, showing changes only at discharge points A and D.

Annual Exceedance Probability AEP %

Discharge point	63.2%	50%	20%	10%	5%	2%	1%
A	**0.5818**	**0.7129**	**1.1059**	**1.4194**	**1.7097**	**2.1838**	**2.5294**
B	0.7174	0.8789	1.39	1.75	2.10	2.6927	3.1188
C	0.7782	0.9535	1.5085	1.898	2.2867	2.9209	3.3831
D	**0.4521**	**0.5539**	**0.8764**	**1.067**	**1.3285**	**1.6969**	**1.9654**
E	0.4689	0.5745	0.9089	1.1439	1.3778	1.7599	2.0384
F	0.3843	0.4707	0.7449	0.937	1.129	1.4423	1.6705

Peak stormwater discharge Q predevelopment (m^3 per second)

Annual Exceedance Probability AEP %

Discharge point	63.2%	50%	20%	10%	5%	2%	1%
A	**0.6297**	**0.7715**	**1.2206**	**1.5360**	**1.8502**	**2.3633**	**2.7373**
B	0.7174	0.8789	1.39	1.75	2.10	2.6927	3.1188
C	0.7782	0.9535	1.5085	1.898	2.2867	2.9209	3.3831
D	**0.7069**	**0.8660**	**1.3703**	**1.7244**	**2.0771**	**2.6532**	**3.0730**
E	0.4689	0.5745	0.9089	1.1439	1.3778	1.7599	2.0384
F	0.3843	0.4707	0.7449	0.937	1.129	1.4423	1.6705

Peak stormwater discharge Q post development (m^3 per second)

Assumed Catchments and Discharge points

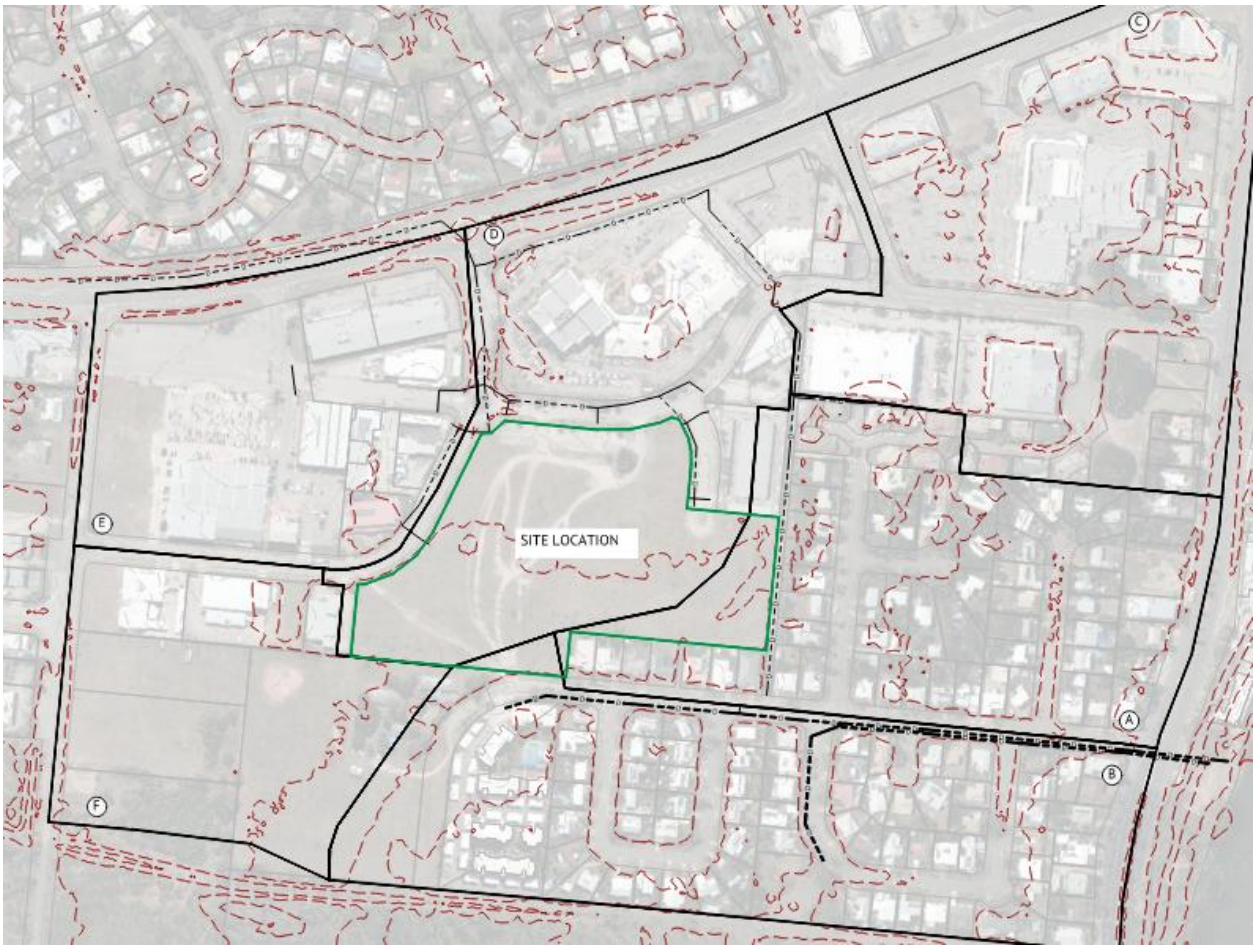

Figure 3: Pre Development stormwater catchment layout

5.1 Internal Drainage

Minor system (Q_2 – 39% AEP) stormwater flows shall be discharged from the site via overland discharge and shall be collected and transported via roadway kerb and channel, kerb inlet pits and underground stormwater drainage pipes to the major drainage system as per Council standards.

Major system (Q_{100} – 1% AEP) stormwater flows, surplus to the minor system capacity, shall be transported via the roadway systems to the main drainage paths and discharged as per normal Council requirements.

Due to the change in usage the site is now 90% impervious meaning that there will be an increase in the output of stormwater from the site. Based on our calculations the increase of the flow of water will be 3.0730 m^3 per second. This is an increase of over 50% to the existing stormwater flow. Further analysis of the stormwater drainage will be required, but at this stage one design solution could be onsite storage however, this aspect will be addressed at the time a MCU application is lodged for the specific uses that the site will be developed.

6. WATER RETICULATION

6.1 Water Infrastructure Assessment

A detailed analysis of water reticulation has been undertaken by DPM water and their report is attached (Appendix C) In summary, the proposed development can be serviced by a DN100 water main running along High Range Drive Alternatively, the site can be serviced by DN150 connection at Black Hawk Boulevard. The approximate alignment of the DN100 and DN150 water main is illustrated in the existing services Plan. Due to the water demands of commercial properties it is expected that both connections will be needed to supply enough water to the proposed development. The approximate location of the services can be seen in the illustration below.

6.2 Design Populations

The development at 11 Black Hawk Boulevard will consist of a residential area and commercial area. For design population it was decided to choose the highest demand scenario to measure the impact it would have on the surrounding infrastructure. By applying the assumed commercial population of 132.1 persons per hectare (EP) in accordance with Townsville City plan over the whole site area of 4.419 hectares, results in the EP value of 583.3 EP.

6.3 Water Demand

Water demands have been calculated in accordance with the Townsville City Plan, CTM Water Alliance Design and Construction Code (CTM Code) and Water Systems Australia Specification WSA-03 (including Townsville City Council amendments). Based on the Relevant calculations are presented below.

The maximum hour water demand per EP is 0.033 L/s/EP (based on Council's latest amendment to the planning scheme). This water demand is determined as follows:

Average Day Demand (AD)	=	583.3 EP x 600 L/day
	=	0.007 L/EP/s
Mean Day Maximum Month	=	1.5 x AD
	=	1.5 x 0.007
	=	0.0104 L/EP/s (or 900 L/EP/day)
Maximum Day (MD)	=	1.25 x MDMM
	=	1.25 x 0.0104
	=	0.013 L/EP/s (or 1,123.2 L/EP/day)
Peak Hour (PH)	=	1.50 x MD
	=	1.50 x 0.013
	=	0.0195 L/EP/s

With a full development equivalent population being 383.3 EP the peak hour demand for the site is 11.39 L/s.

In addition to the above if the site will have commercial properties a 30 l/s Fire flow water demand for commercial allotments is required as per council design standards. The standards allow for the fire flow to be provided from up to 3 hydrants.

It is expected that the initial 11 Black Hawk Boulevard development stages will be located on the western side of the property so a DN150 connection to the existing DN150 could supply water

Figure 4: External DN150 Proposed Water Main Connection

The report will be updated and refined as part of the actual development of the 11 Black Hawk Boulevard site and associated water network modelling. The preliminary reticulation water mains can be modelled on WaterGEMS but will also need to be adjusted and completed as part of the development stage of the 11 Black Hawk Boulevard site.

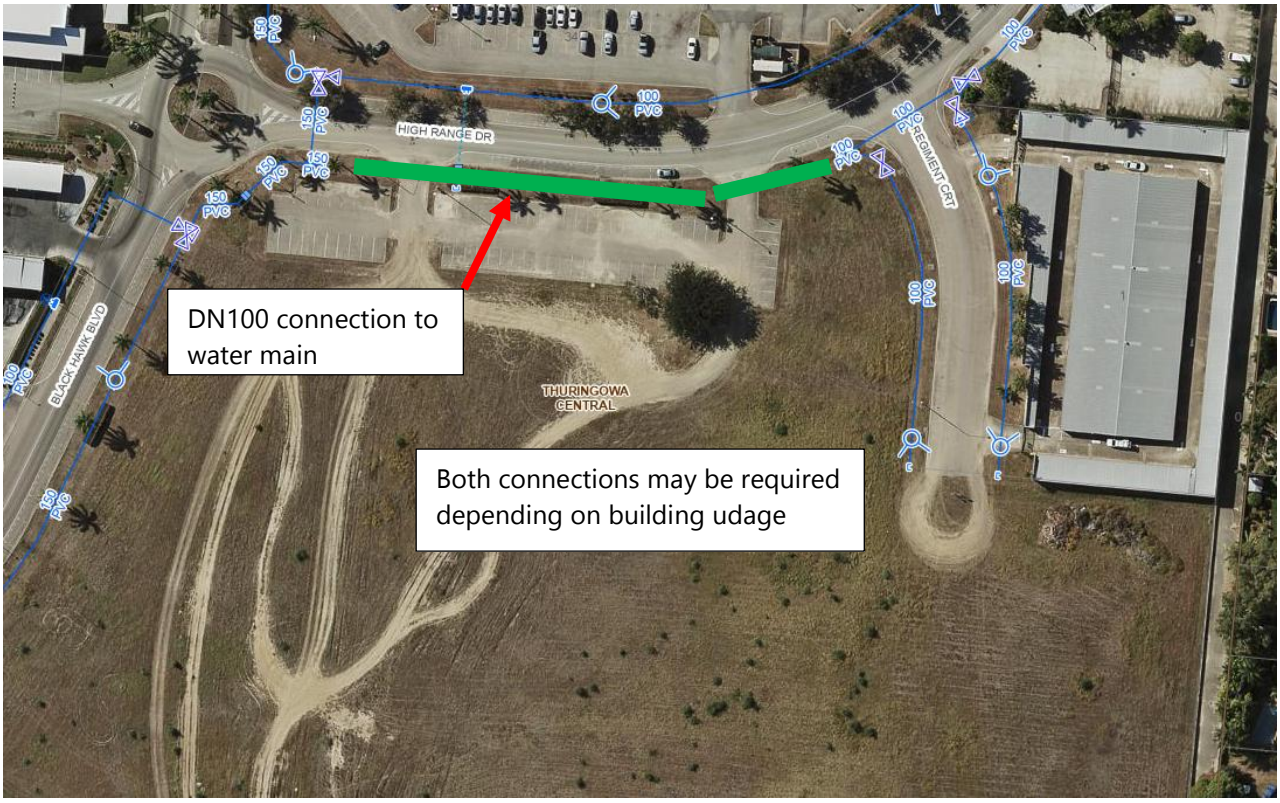

Figure 5: Proposed Water Main Connection

The full development of the 11 Black Hawk Boulevard site is therefore able to be serviced by a DN100 connection running along the frontage to High Range Drive or from the DN150 water main running along Black Hawk Boulevard (or both if there are multiple commercial developments). We have attached in the appendix, an assessment carried out by an expert, and it outlines the performance requirements of the development site (it is important to point out that this analysis was carried out for a 100% commercial development which the expert believes is a worst-case scenario).

6.4 Reticulation Mains

The development shall be serviced via water mains of DN150 PVC, DN100 PVC mains running under ground as required, and these mains will generally be on a 2.05m alignment from the property boundary as per Council standard verge profiles. When the layout of the proposed development is known all internal reticulation mains will be laid in accordance with Townsville City Council requirements.

Valves and hydrants shall be provided in accordance with normal Council requirements.

7. SEWERAGE

A detailed analysis of the sewer has been undertaken by DPM water and their report is attached. (Appendix C) In summary, 11 Black Hawk Boulevard is currently serviced by an existing PVC DN150 sewer connection.

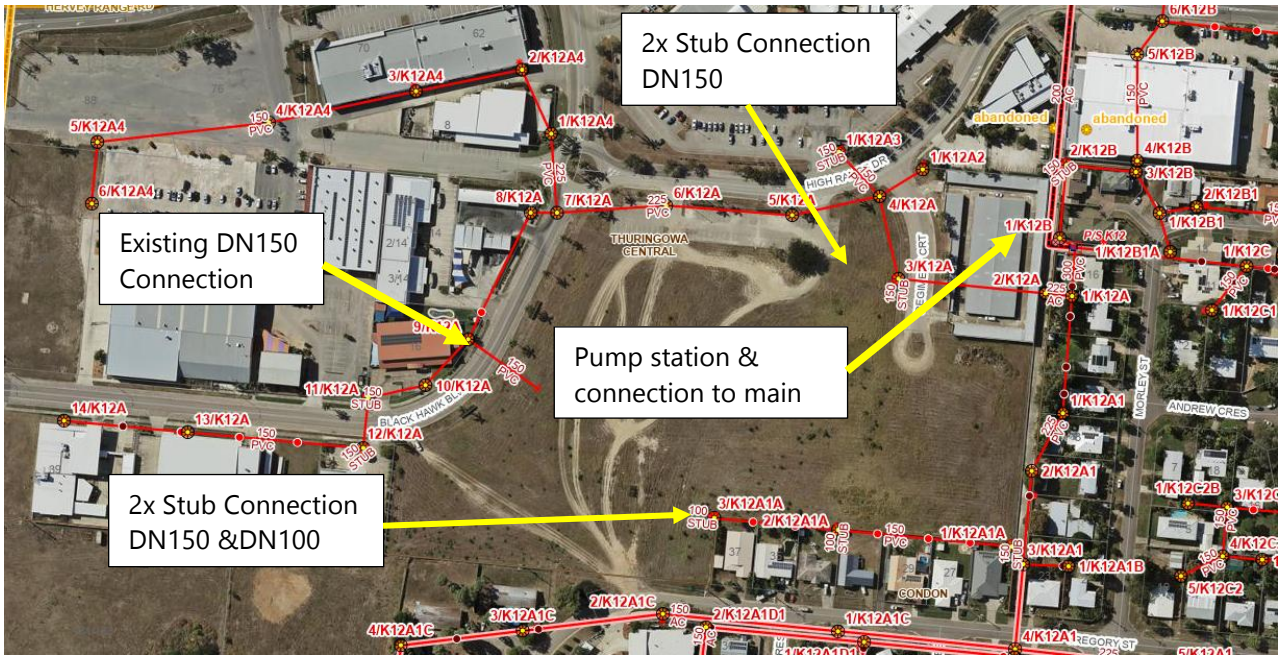

Figure 6: 11 Black Hawk Boulevard Sewer Connection Location

From a desktop assessment there are three (3) main options identified for the connection of sewer main from the 11 Black Hawk Boulevard development to the sewer main illustrated above. These three options have been analysed and reviewed to ensure main has enough capacity for the proposed site usage. Based on highest demand zoning we have selected Thuringowa Major Centre.

The existing Condon Sewer Treatment Plant (STP) is located to the southwest of the 11 Black Hawk Boulevard development site. Advice from Townsville City Council is that the existing Condon STP is at its capacity limit and is therefore not able to have sewage from the 11 Black Hawk Boulevard development directed to it. The Condon STP services the Upper Ross area (Condon, Rasmussen & Kelso) and has a licensed capacity of approximately 22,000 EP. The current connected population to the STP is nearing this population. The Council's Sewage Plans for Trunk Infrastructure illustrate future trunk sewer infrastructure works to divert sewage out of the Condon STP catchment so that it continues to meet its environmental license. This confirms the Condon STP does not have capacity for the additional 693.3 EP from 11 Black Hawk Boulevard. The proposed development can discharge sewage into the existing sewer reticulation network where it will head towards the pump station located downstream and join the pressured main.

7.1 Design commercial Populations

The development at 11 Black Hawk Boulevard will consist of a residential area and commercial area. For design population it was decided to choose the highest demand scenario to measure the impact it would have on the surrounding infrastructure. DPM water have assessed the highest demand for sewer will be from commercial activity and thus have determined sewer EP to be 693.3 EP.

7.2 Sewerage Design Criteria

The sewerage network shall be designed and constructed in accordance with the Townsville City Plan, CTM Code and Water Systems Australia Specification WSA-02.

The location and sizing of the internal sewerage infrastructure will be verified as part of the detailed design of the development planning approvals.

8. ELECTRICITY

According to Townsville council infrastructure map there is existing low voltage electrical lines running along Blackhawk Boulevard, this will be able to provide some power to this site. Due to the zoning being classified as commercial we would recommend providing underground high voltage connection to the site. This can be achieved by connecting to the existing high voltage network running across Blackhawk Boulevard just north of the proposed development site. Approximately 80m of high voltage cable and 1 crossing is required to supply the site with high voltage for commercial use. Extra details regarding connection to electricity will be supplied by an electrical engineer during MCU application.

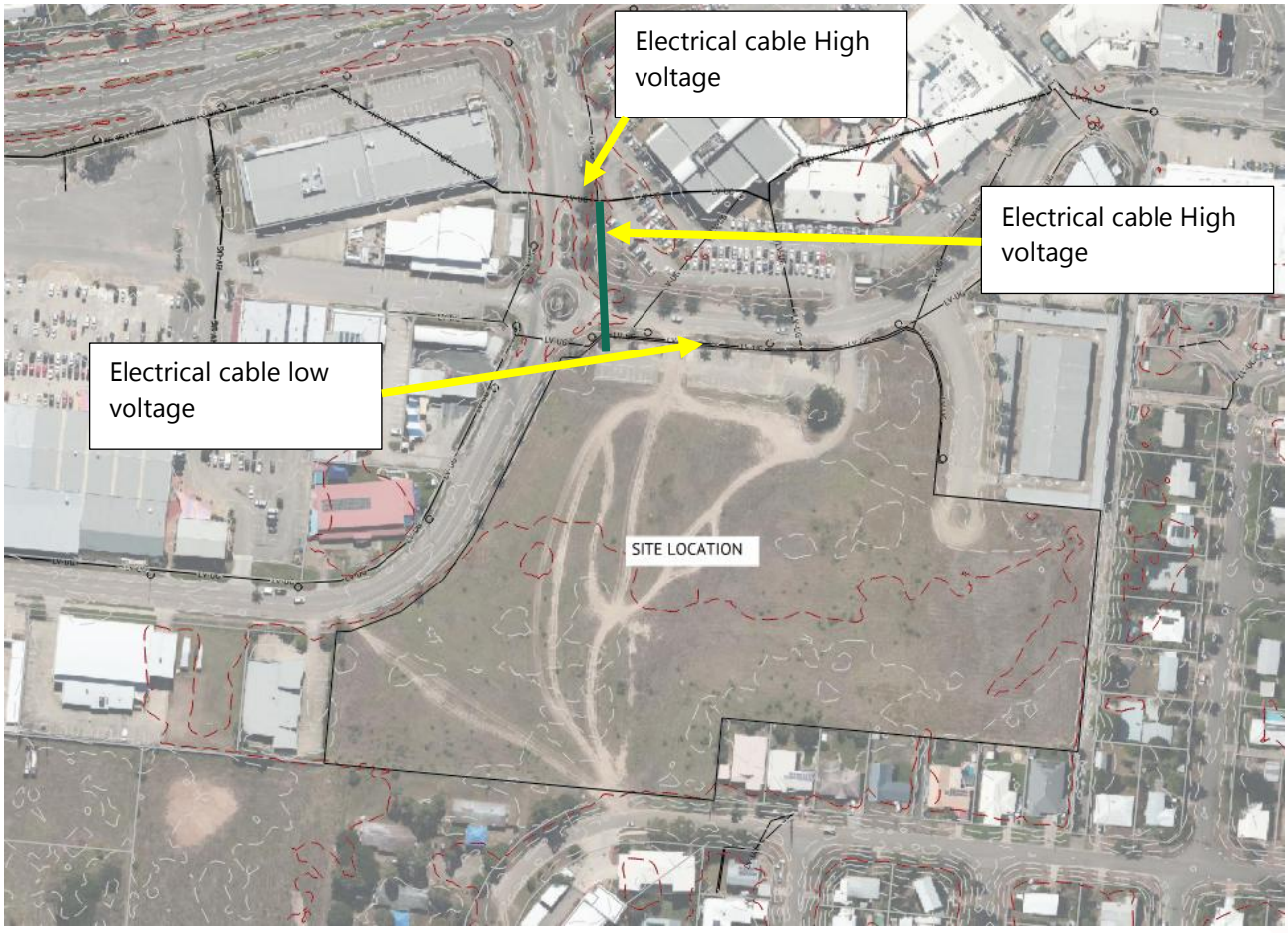

Figure 7: Proposed electrical Connection

APPENDIX A

EXISTING ELECTRICAL SERVICES

	SITE BOUNDARY
HV-UG	EXISTING HIGH VOLTAGE UNDER GROUND
LV-UG	EXISTING LOW VOLTAGE UNDER GROUND

EXISTING ELECTRICAL SERVICES LAYOUT

PRELIMINARY - NOT FOR CONSTRUCTION

DATE	REV	DESCRIPTION	REC	APP
21/10/2025	1	PRELIMINARY - NOT FOR CONSTRUCTION		

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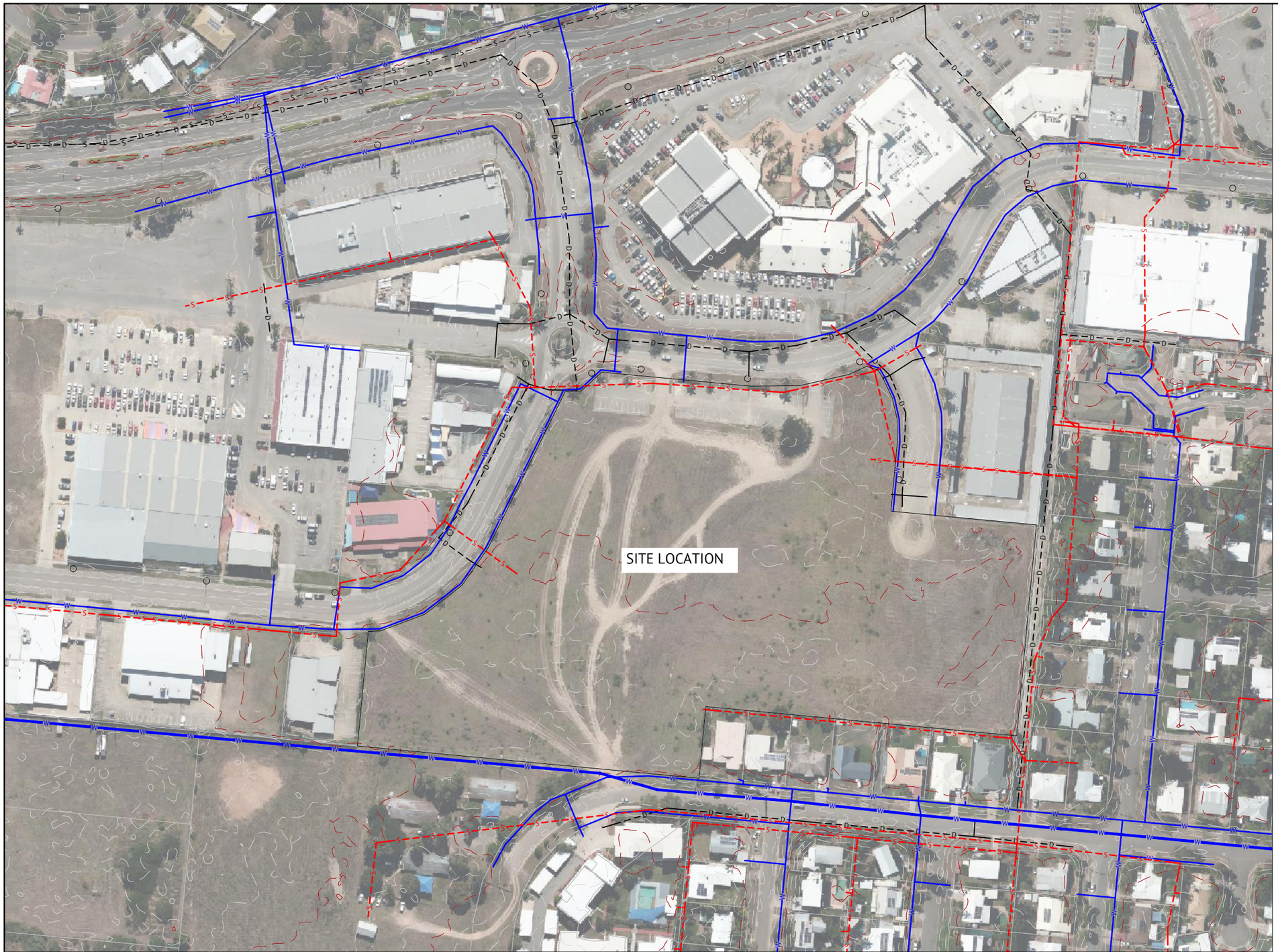
PROJECT MANAGER: CHRIS MARSTON
ENGINEERING CERTIFICATION: ENTER CERTIFIER DETAILS
SCALE
ORIGINAL SHEET SIZE A1

CLIENT: STATELAND PTY LTD
PROJECT: DUE DILIGENCE REPORTING
LOCATION: 11 BLACKHAWK BOULEVARD
SHEET TITLE: EXISTING ELECTRICAL SERVICES LAYOUT

JOB CODE: P004113
SHEET NUMBER:
REV: 1

APPENDIX B

EXISTING WATER AND DRAINAGE SERVICES



	SITE BOUNDARY
S S	EXISTING SEWER
D D	EXISTING STORMWATER DRAINAGE
W	EXISTING WATER RETICULATION
W	EXISTING WATER MAIN 1050mm
	EXISTING BOUNDARIES
	CONTOUR Minor
	CONTOUR Major

EXISTING WATER AND DRAINAGE SERVICES LAYOUT

PRELIMINARY - NOT FOR CONSTRUCTION

DATE	REV	DESCRIPTION	REC	APP
21/10/2025	1	PRELIMINARY - NOT FOR CONSTRUCTION		

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CHECKED: CHRIS MARSTON
PROJECT MANAGER: CHRIS MARSTON
ENGINEERING CERTIFICATION: ENTER CERTIFIER DETAILS
SCALE
ORIGINAL SHEET SIZE A1

CLIENT: STATELAND PTY LTD
PROJECT: DUE DILIGENCE REPORTING
LOCATION: 11 BLACKHAWK BOULEVARD
SHEET TITLE: EXISTING WATER AND DRAINAGE SERVICES LAYOUT

JOB CODE: P004113
SHEET NUMBER:
REV: 1

APPENDIX C

WATER AND SEWER CONNECTION ASSESSMENT

STATELAND PTY LTD COMMERCIAL DEVELOPMENT

11 BLACKHAWK BOULEVARD, THURINGOWA CENTRAL

WATER SUPPLY AND SEWERAGE PLANNING REPORT

Date: 29 Oct 2025 (Rev A)

TABLE OF CONTENTS

APPENDICES

REPORT AUTHORISATION				
Revision	**Revision Date**	**Details**	**Approved by**	**Signature**
A	29/10/2025	Initial Report	Desmond Moseley	

1 INTRODUCTION

This report assessed the performance of the existing water & sewer infrastructure to service the proposed re-zoning of the large land parcel that is to be located at 11 Blackhawk Blvd, Thuringowa Central. The development site is bounded by Blackhawk Blvd to the west, High Range Dr to the north, and Gregory St to the south. The existing site is currently vacant land.

The development location is illustrated on the extract below, with a larger version of the site plan provided in Appendix A. The land parcel is 4.416 ha in area.

Figure 1 – Commercial Development Site Plan

The land parcel has two zonings over it in the Townsville Planning Scheme. The proponent is looking at having the zoning changed to allow the whole site to become commercial. The assessment in this report is based on the potential re-zoning of the site to commercial. The assessment is based on applying the commercial zoning that will result in the highest water & sewer equivalent population with this being "Thuringowa Major Centre".

The site is currently serviced with a reticulated water and sewer system. The capacity of the existing infrastructure has been assessed based on the water and sewer loadings from the Thuringowa Major Centre zoning in the planning scheme. The assessment has illustrated:

- A new DN100 PVC water main will need to be constructed along the High Range Drv frontage of the development site. This water main would extend from the end of the existing DN100 water main at the intersection of High Range Drv and Regiment Ct to the west to connect to the existing DN150 PVC main at the intersection of High Range Drv and Black Hawk Blvd over a length of 120 m. This water main is required to ensure reliability of supply and ensure the flows, pressures and headloss gradients meet TCC standards.

- With the construction of the section of DN100 PVC main along the development site frontage on High Range Drv, the existing water network has sufficient capacity to service the proposed commercial re-zoning with the peak hour demands. The system also has sufficient capacity to service the development with commercial fire flows in accordance with Council standards.
- The existing DN150 and DN225 reticulation sewer that service the site to the east and to existing PS K12 (Morley St) have sufficient capacity for the commercial sewage loading.
- The modelling illustrated that the existing installed pumps in PS K12 that services the development site may not have sufficient capacity to service the peak wet weather flows from the site along with the existing Cannon Park commercial area and other residential lots that are currently serviced by PS K12. The modelling shows that slightly larger replacement pumps in PS K12 would allow the full peak wet weather flows to be pumped by PS K12. The larger replacement pumps could be installed as part of the TCC sewage pump replacement program when the existing pumps reach the end of their effective life or when the site is developed.

Further details of the water & sewer infrastructure assessment for the proposed commercial development site at 11 Blackhawk Blvd in Thuringowa Central is provided in the following report sections.

2 POPULATION ASSESSMENT

The following section provides the equivalent population assessment for the proposed re-zoning and future potential commercial development of the site at 11 Blackhawk Blvd.

The method used to assess the equivalent population of the development is to apply the broad loading rates from “Table SC3.1.6a - Planned demand generation rate for a trunk infrastructure network” from Townsville’s planning scheme. As the actual type and size of commercial development that may be constructed on the site is not certain, the worst case (highest) loading rates per ha for the potential site have been used. The extract from Table SC3.1.6a from the planning scheme is below that shows the water and sewer loading rates.

The potential commercial uses and loading rates indicate that the highest demand zoning would be the “Thuringowa Major Centre (Major Centre – TCMC)”. The water and sewer equivalent population (EP) based on the Thuringowa Major Centre zoning and loading rates is provided in Table 2.1 below.

Table 2.1 – Water Equivalent Population Assessment

	Area	Loading Rate	EP
Commercial Tenancies	4.416 ha	132.1 EP/ha	583.3 EP
Total			**583.3 EP**

Table 2.2 – Sewage Equivalent Population Assessment

	Area	Rate	EP
Commercial Tenancies	4.416 ha	157 EP/ha	693.3 EP
Total			**693.3 EP**

Table SC3.1.6a - Planned demand generation rate for a trunk infrastructure network
(Lots less than threshold)

Column 1 – Area			Column 2 (n/a)	Column 3 – Planned density			Column 4 - Demand generation rate for a trunk infrastructure network (per net developable Ha)				
Zone	Zone	Precinct		Plot ratio (Non-residential)	Plot ratio (Residential)	Dwelling density (no./Ha)	Water (EP)	Sewerage (EP)	Roads (trip ends/day)	Pathways (trip ends/day)	Parks (ERP)
CF	Community Facilities	All		-	-	-	-	-	-	-	-
CR	Character Residential	All		-	-	16.7	46.7	46.7	121.2	7.2	47.8
DC	District Centre	All		0.45	-	-	81.6	103.5	1,128.5	13.2	-
EC	Emerging Communities	MCF2		0.35	-	-	63.5	80.5	877.7	10.2	-
EC	Emerging Communities	MCNS		0.80	-	-	145.1	184.0	2,006.1	23.4	-
EC	Emerging Communities	Other		0.50	0.50	21.5	56.8	57.3	181.0	9.7	56.4
HDR	High Density Residential	PS		6.90	6.90	590.6	1,273.2	1,335.7	4,694.2	265.8	1,063.2
HDR	High Density Residential	Other		1.08	1.08	80.0	164.1	168.2	694.3	36.5	144.0
HII	High Impact Industry	All		0.65	-	-	9.5	9.7	687.0	7.0	-
LC	Local Centre	All		0.45	-	-	81.6	103.5	1,128.5	13.2	-
LDR	Low Density Residential	MCF1		0.35	-	-	63.5	80.5	877.7	10.2	-
LDR	Low Density Residential	MHF1		0.53	-	-	66.6	81.1	2,026.9	24.4	-
LDR	Low Density Residential	RRRC		0.50	0.50	20.9	57.1	57.4	165.1	9.3	57.7
LDR	Low Density Residential	ST		-	-	10.0	28.0	28.0	72.7	4.3	28.7
LDR	Low Density Residential	Other		0.50	0.50	21.0	57.0	57.2	156.6	9.2	58.0
LII	Low Impact Industry	All		0.56	-	-	35.6	44.0	871.5	9.5	-
MC	Major Centre	ACC		0.80	1.80	36.0	180.9	212.0	1,777.7	33.6	64.8
MC	Major Centre	ACF		0.50	-	-	90.7	115.0	1,253.8	14.6	-
MC	Major Centre	HPMC(MCC)		0.80	-	-	145.1	184.0	2,006.1	23.4	-
MC	Major Centre	HPMC(Other)		0.80	-	-	145.1	184.0	2,006.1	23.4	-
MC	Major Centre	MCF3		0.35	-	-	63.5	80.5	877.7	10.2	-
MC	Major Centre	TCMC(TD)		0.73	0.73	21.9	132.1	157.0	1,386.5	24.0	39.4
MC	Major Centre	TCMC(TCS)		0.73	0.73	21.9	132.1	157.0	1,386.5	24.0	39.4
MC	Major Centre	Other		0.80	1.80	18.0	163.0	198.0	1,891.9	28.5	32.4

Figure 2.1 – Extract from Council Planning Scheme – Demand Generation Rates

The above assessment has determined the upper estimate of the equivalent population for the proposed commercial development at 11 Blackhawk Blvd. The broad loading rates from the Planning Scheme has been used for the water and sewer capacity assessment.

3 WATER SUPPLY PLANNING

The proposed development site at 11 Blackhawk Blvd in Thuringowa Central is currently serviced with a potable water supply. Two of the three site frontages to road reserves have existing water mains as follows:

- DN150 PVC water main along the Blackhawk Blvd frontage of the site. This water main extends to the north and under Hervey Range Rd to connect to the existing DN300 AC trunk water main on the northern side of Hervey Ragne Rd. The existing DN300 AC trunk main on Hervey Range Rd extends to the east and connects to the DN375 AC and DN525 AC trunk water mains at the intersection of Hervey Range Rd and Thuringowa Drv.
- DN100 PVC water main along Regiment Ct that is located on the north eastern boundary of the site. This DN100 reticulation water main extends to the east along High Range Drv. This main increases in diameter to be a DN150 AC main at the intersection with Pioneer Drv and continues to the east along High Range Drv. The existing DN150 AC main connect to the existing DN375 AC trunk main on Riverway Drv.
- The existing DN375 AC trunk main on Riverway Drv and DN300 AC water main on Hervey Range Rd are supplied water from the Dougals No 2/3 reservoir site via it's trunk outlet mains.

The High Range Drv frontage of the development site does not have a water main located along it. This is the section of road from the intersection of Regiment Ct to the intersection with Black Hawk Blvd. To ensure the proposed development of the large site at 11 Black Hawk Blvd is able to be serviced with a reticulated water supply a new DN100 PVC water main is required.

A new DN100 PVC water main will need to be constructed along the High Range Drv frontage of the development site. This water main would extend from the end of the existing DN100 water main at the intersection of High Range Drv and Regiment Ct to the west to connect to the existing DN150 PVC main at the intersection of High Range Drv and Black Hawk Blvd over a length of 120 m. This new DN100 PVC main is required to ensure reliability of supply and ensure the flows, pressures and headloss gradients meet TCC standards.

Figure 3.1 below illustrates the existing water mains along with the new DN100 PVC water main that will need to be constructed along the High Range Drv frontage of the site.

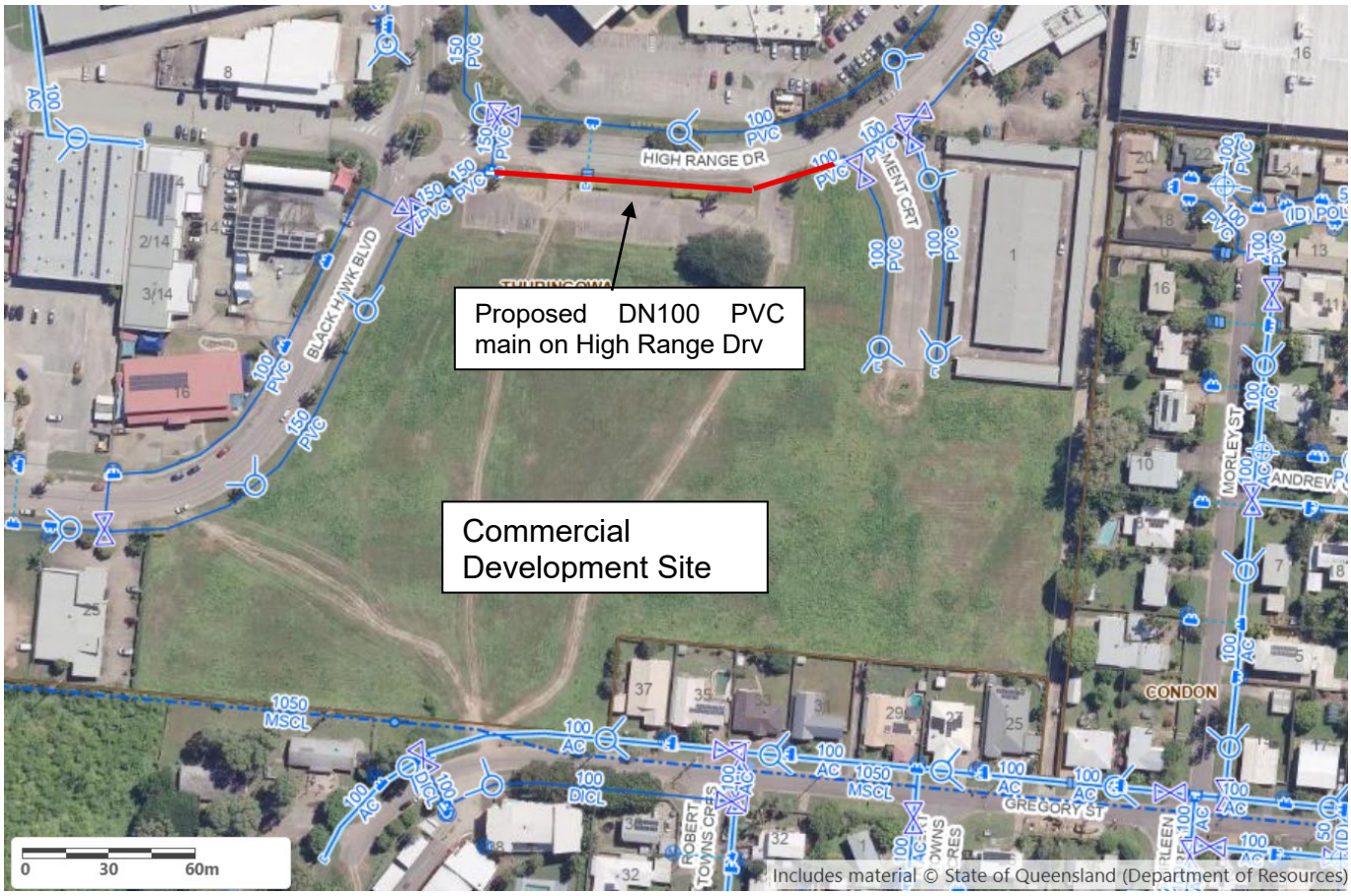


Figure 3.1 – Existing Water Mains Image

The above illustrates the development site is well serviced with a potable water system from existing reticulation and trunk water mains.

To confirm that the existing water system and the proposed DN100 PVC main along the High Range Drv frontage of the development site can adequately supply the proposed commercial development with a reticulated water supply, water network modelling has been undertaken. Details of the water network modelling is provided in the following report sections.

3.1 Water Demand

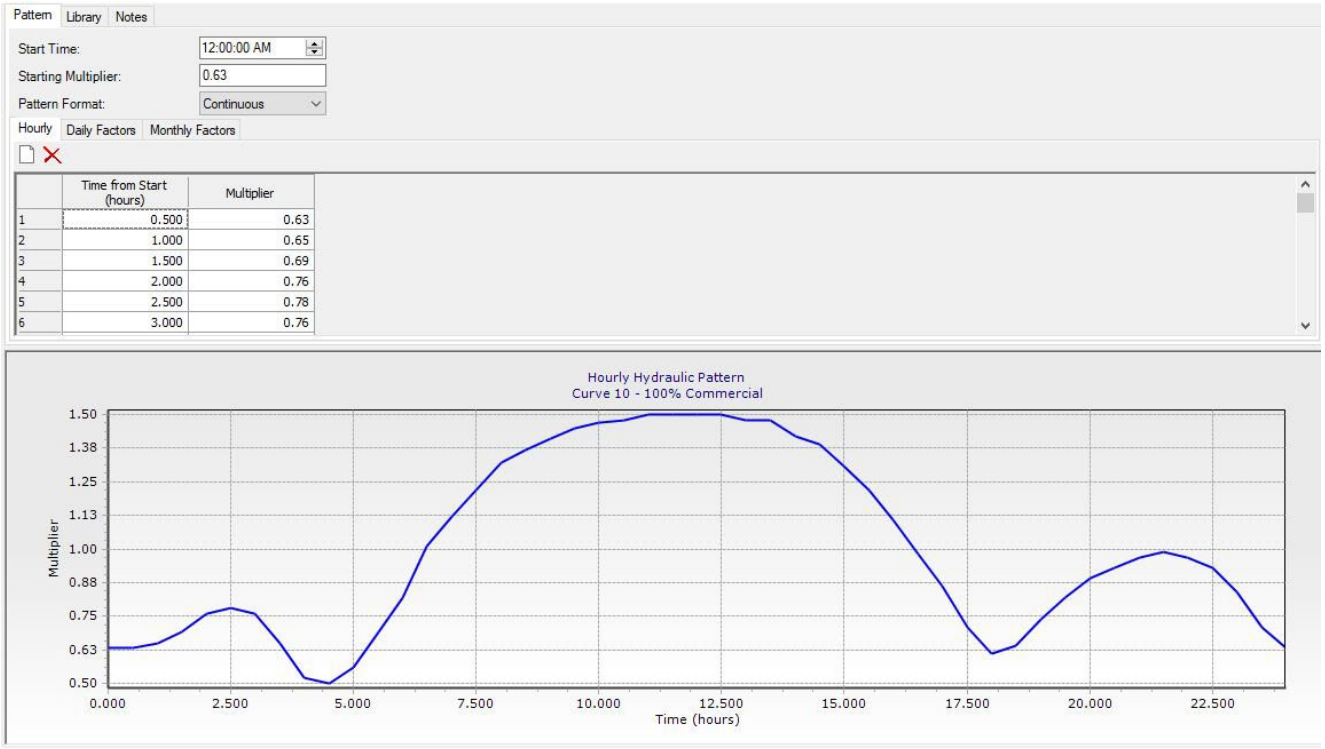
Water demands have been calculated in accordance with Townsville City Council planning scheme and its latest amendments.

The following table provides the water demand parameters for the Townsville Planning Scheme which have been used in the water infrastructure assessment for the 11 Blackhawk Blvd commercial development site.

Table SC6.4.3.21.2 Water supply unit demand parameters

Parameter	Unit Demand	Peaking Factor
Average Day (AD)	600 L/day/EP	
Mean Day Max Month (MDMM)	900 L/day/EP	1.5 AD
Peak Day (PD)	1125 L/day/EP	1.25 MDMM
Peak Hour (PH) (Residential Demands)	0.033 L/s/EP	2.56 PD

Townsville Water also have diurnal water demand patterns that are applied to the various water uses. As the proposed development will be commercial, the commercial demand diurnal pattern will be applied. The commercial demand diurnal pattern has a peaking factor of 1.5, instead of the 2.56 peaking factor provided in the above table for residential water demands. The commercial diurnal pattern is illustrated below.



Based on an equivalent population for the proposed commercial development site of 583.3 EP, the peak water demand for the development is:

= 583.3 EP x 1125 L/day/EP x 1.5 (commercial peaking factor)

= 583.3 x (1125 / (24*3600)) x 1.5

= 11.39 l/s

In addition to the above, as the development site will be commercial a 30 l/s fire flow is required in accordance with Council's design standards. The standards allow for the fire flow to be provided from up to three hydrants. The water network modelling results for the proposed Blackhawk Blvd commercial development site are provided in the following report sections.

3.2 Water Supply Assessment

The proposed commercial development at 11 Blackhawk Blvd could be serviced off the existing DN150 PVC main on the Black Hawk Blvd frontage of the site or off the proposed DN100 PVC water main along the High Range Drv frontage of the site (or both if there are multiple commercial developments undertaken).

The water network modelling has been based on the water demands being supplied off the smaller DN100 PVC water main that is proposed along the High Range Drv frontage of the development site. The performance and capacity of the existing water network to service the proposed commercial development site is as follows:

- Minimum water pressure in the reticulation network around the development site are all above 340 kPa. The water pressure is at the proposed offtake location on the DN100 PVC main on the High Range Drv frontage of the development site is 341 kPa. The lowest water pressure occurs at 6:30PM due to the high residential water demands in the adjacent Kirwan and Thuringowa Central reticulation system.
- The water pressure at 12 noon (concurrent with the peak commercial water demands) is 408 kPa. This achieves the minimum required pressure of 220 kPa.
- The velocity and headloss gradient in the existing DN150 & DN100 PVC water mains that service the development are up to 0.45 m/s and less than 0.003 m/m respectively. These both meet the required Council design standards.
- With the inclusion of the 30 l/s commercial fire flows (ie the TCC design standard for commercial facilities) concurrently with the peak water demands, the water pressure on the frontage of the development site is reduced to 305 kPa at 12 noon and to 260 kPa at 6:30PM. The lowest water pressure occurs at 6:30PM due to the high amount of residential development in the adjacent Kirwan and Thuringowa Central suburbs. Both these water pressures with the concurrent fire flows are above the minimum allowable pressure of 120 kPa.
- The velocity in the existing DN150 and DN100 PVC mains that service the development site are up to 2.96 m/s for the fire flow modelling. This is under the maximum velocity standard of 4.0 m/s for fire flows and meets Council standards.
- It is noted the above water pressures are the residual pressures within the water main and do not specifically account for pressure losses through fire hydrants, standpipes, RPZD's etc.

The assessment illustrates the proposed commercial development at 11 Blackhawk Blvd is able to be serviced with peak hour and fire flows from the existing reticulation water along with the construction of a new DN100 PVC main along the High Range Drv frontage of the development site. Further water modelling results and figures are provided in Appendix B.

It is noted that the fire flow WaterGEMS network modelling is to assess the proposed developments performance against Townsville Council planning standards. Based on the type/classification of the commercial development, the Building Code may require different fire flow and pressure standards, including a fire tank and booster pump system. This assessment has not specifically assessed the

performance against the building code requirements. Additional fire hydrant testing may be required as part of the detailed hydraulic design of the facility.

The plots below (Figure 3.2 & 3.3) from the WaterGems model illustrate the water pressures on the proposed DN100 PVC water main on the High Range Drv frontage of the site.

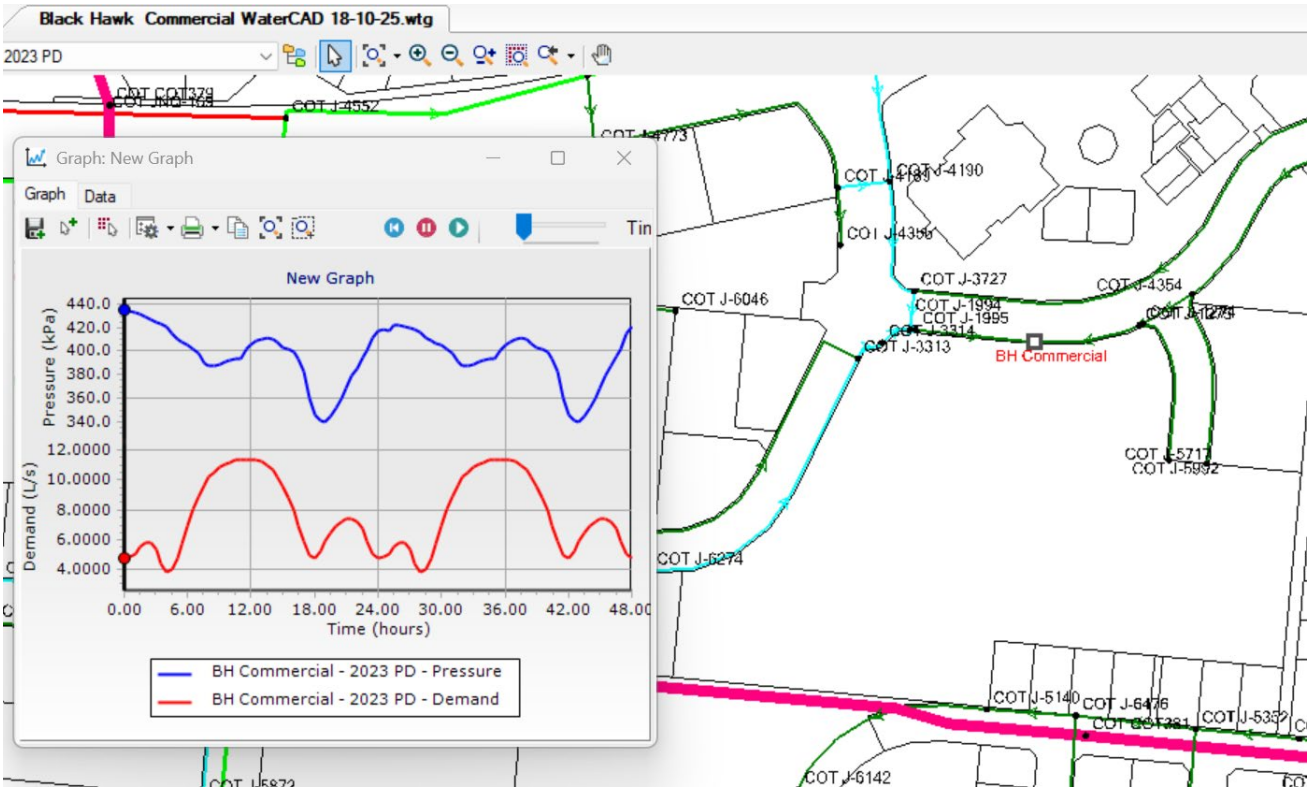


Figure 3.2 – Commercial Development Peak Hour Demands Curve

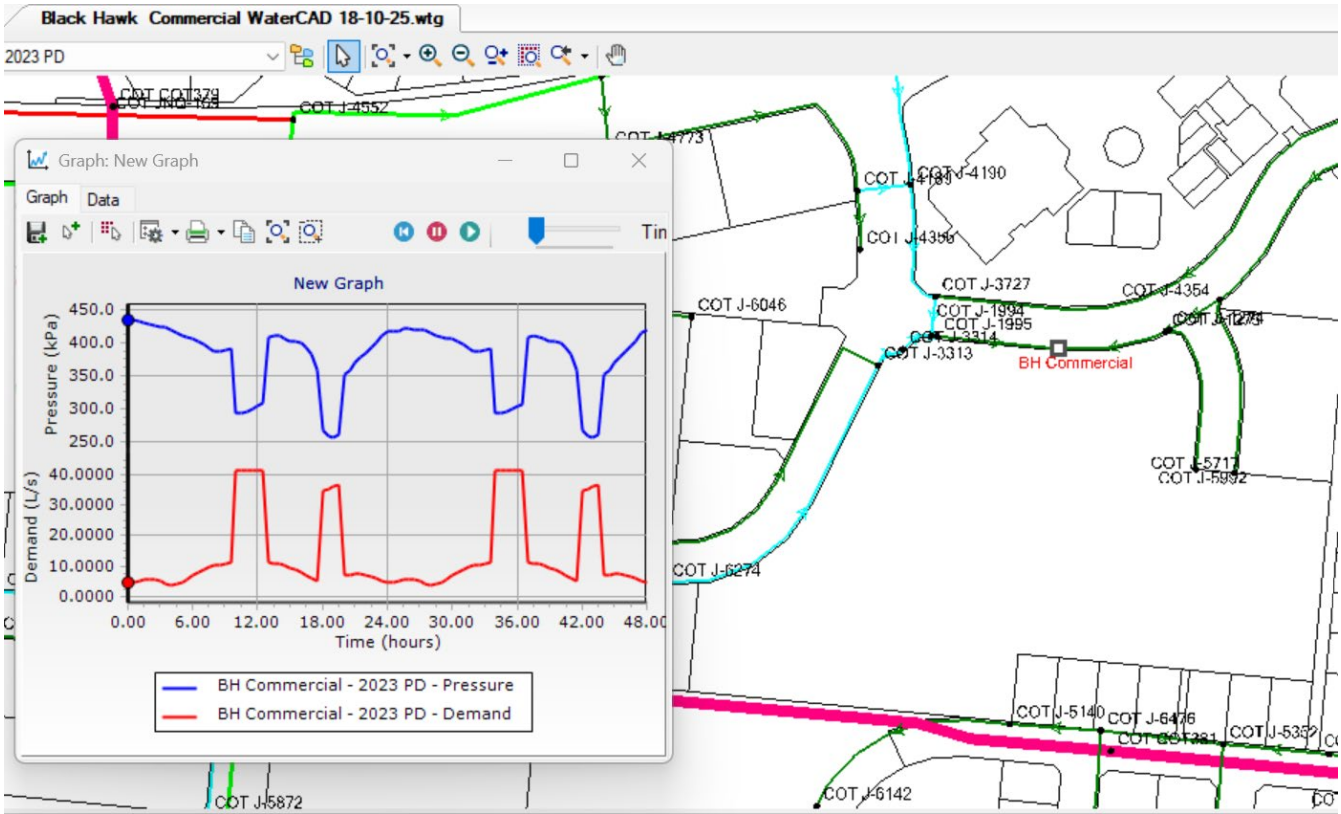


Figure 3.3 – Commercial Development Fire Flow Results Figure

4 SEWAGE SYSTEM PLANNING

The proposed commercial development site at 11 Blackhawk Blvd is currently serviced with a reticulated sewer system as follows:

- A DN150 sewer extends under Black Hawk Blvd into the development site near its western boundary. This sewer line is connected to existing MH 9/K12A.
- A DN225 sewer extends from MH 9/K12A to the north along Black Hawk Blvd to High Range Drv. The DN225 sewer then extends to the east along High Range Drv (along the frontage of the development site) through to MH 4/K12A.
- The DN225 sewer then extends to the south inside the development site and parallel to Regiment Ct and then east to MH 1/K12A that is located to the east of Morely St. A DN300 trunk sewer then extends to the north from MH 1/K12A to existing PS K12 (Morely St).
- Existing PS K12 pumps its sewage via a DN200 AC and DN200 PE sewer pressure main to discharge into existing MH 1/KT1ZQ3C that is located on Riverway Drv.

The figure below from the Council GIS illustrates the existing gravity sewer system that services the proposed commercial development site.

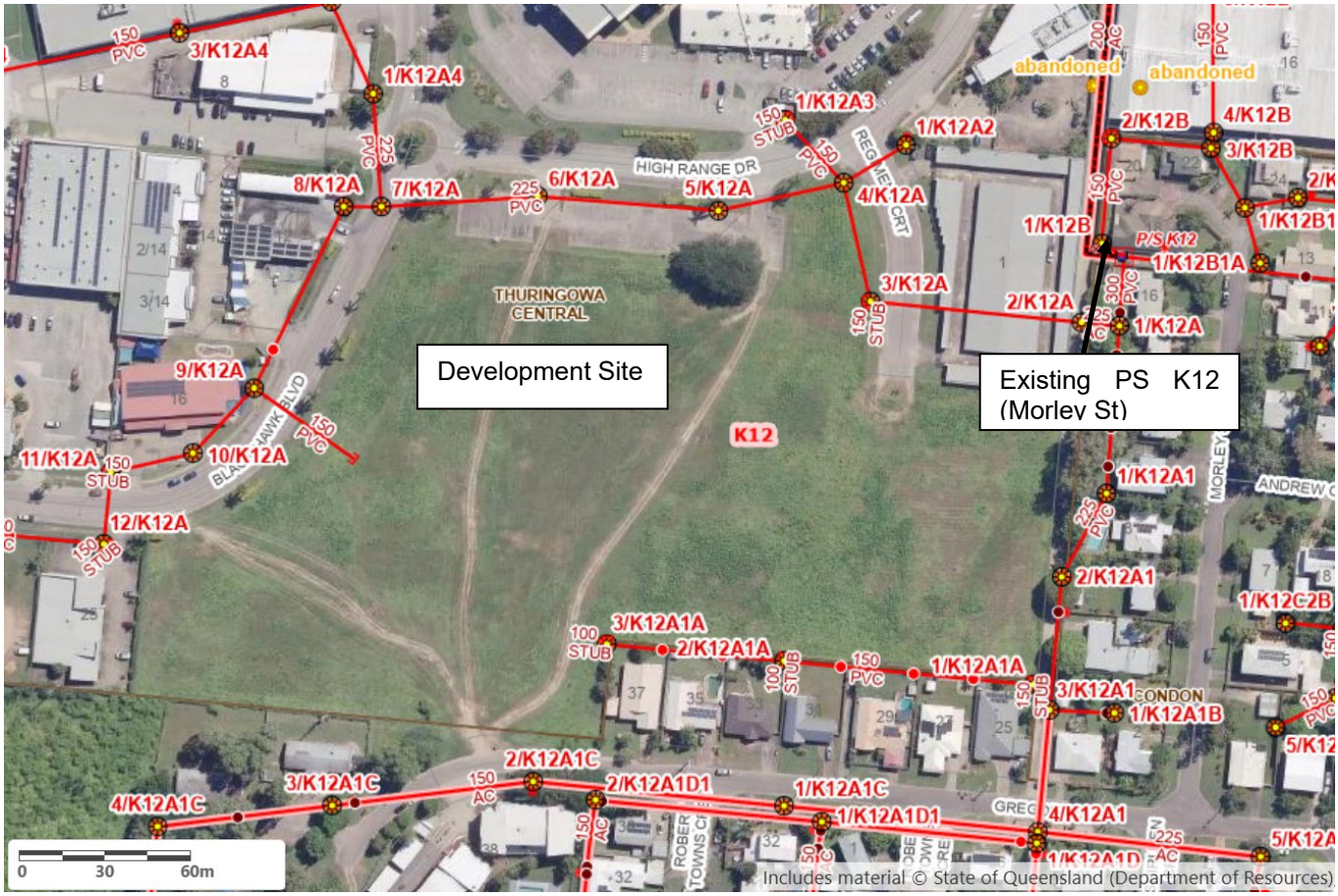


Figure 4.1 - GIS Image of Sewer System

4.1 Sewage Infrastructure Capacity

The capacity of the existing gravity sewer system to cater for the proposed commercial development site on the southern side of High Range Drv has been assessed using the SewerCAD model for Thuringowa.

Figure 4.2 below illustrates the SewerGEMS model with the additional sewage loading from the proposed commercial development added to the existing DN150 gravity sewer that crosses under Black hawk Blvd into the development site.

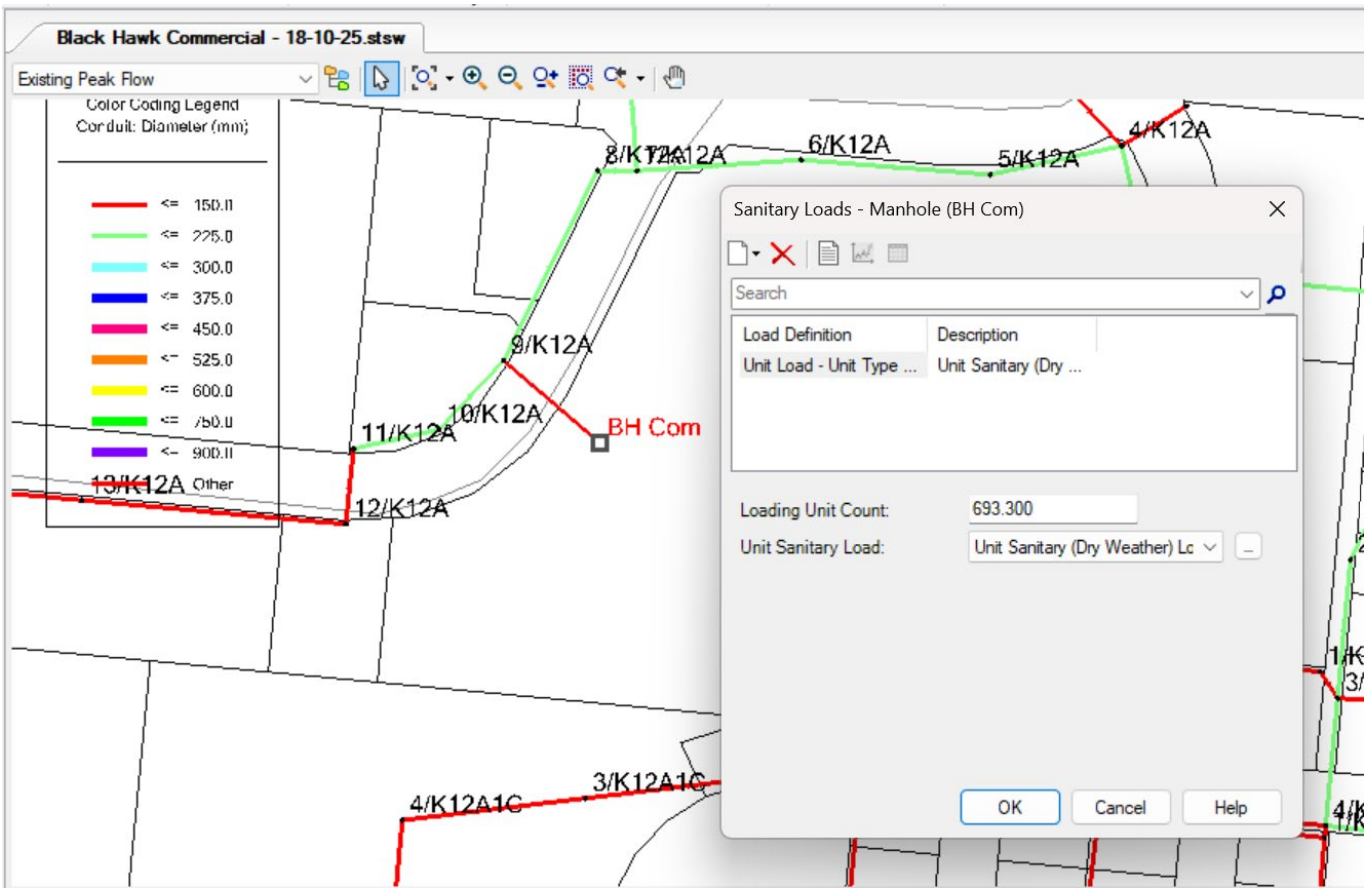


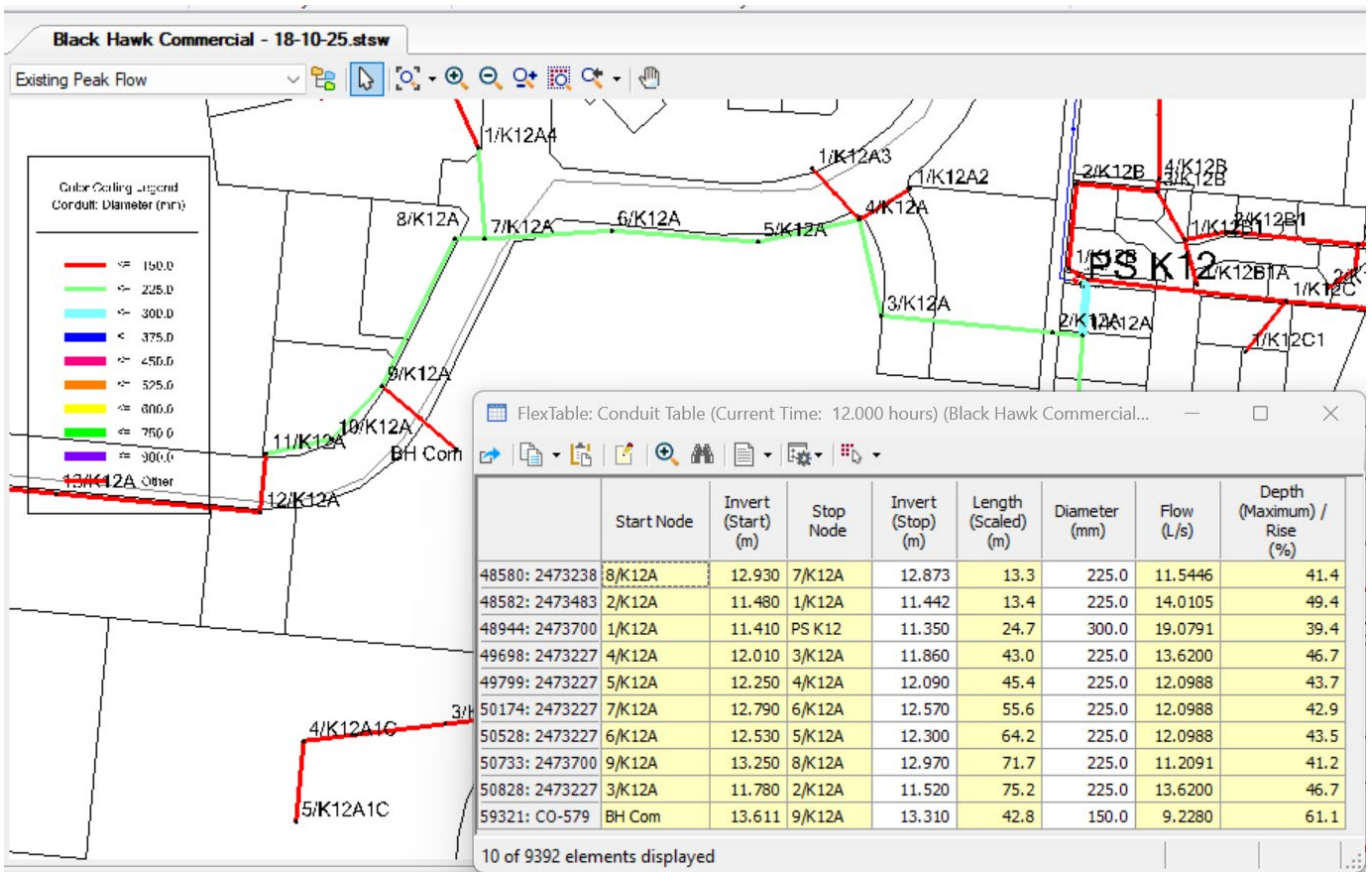
Figure 4.2 – SewerGEMS Model Figure

To assess the capacity of the existing sewer network to service the proposed commercial development, SewerGEMS network modelling has been performed. The modelling results are summarised below and illustrated on the modelling Figures 4.3. A larger version of this figure is provided in Appendix C:

- The initial sewer modelling showed that the existing pumps in PS K12 (Morley St) were not able to pump the peak wet weather flows from its existing catchment along with the increased flows from the proposed commercial development site. The existing large pump was able to discharge 25.2 l/s @ 9.8 m head which was not sufficient.
- To service the upper estimate of the sewage flows from the commercial development site, larger replacement pumps would need to be installed in PS K12. The SewerGEMS modelling has shown the revised pump duty needed to pump the peak weather flows including the flows from the commercial development site is 29.6 l/s @ 19.9 m. This is a relatively small increase in the duty of the existing large sewage pump. This replacement pump could be installed as part of Council's sewage pump replacement program when the pumps reach the end of their effective life or when the commercial development is undertaken.
- The existing DN150 sewer from the development site to MH 9/K12A flow up to 61% full. This is based on the full EP and sewage flows from the development site being directed to this sewer line. This meets the CTM Code standards of flowing less than 75% full.

- The existing DN225 gravity sewer from MH 9/K12A to MH 4/K12A flows up to 44% full. This is the DN225 gravity sewer along Black Hawk Bvd and High Range Dr that services the proposed commercial development site.
- The existing DN225 sewer from MH 4/K12A to MH 1/K12A flows up to 49% full.
- The final section of DN300 trunk sewer from MH 1/K12A to PS K12 flows up to 39% full.
- All the gravity sewers flow less than the 75% full requirement from the CTM Code and therefore have sufficient capacity for the proposed development sewer flows.

The following Figure 4.3 illustrates the depth of flow in the existing gravity sewer system that services the proposed development site at 11 Blackhawk Blvd.



	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Length (Scaled) (m)	Diameter (mm)	Flow (L/s)	Depth (Maximum) / Rise (%)
48580: 2473238	8/K12A	12.930	7/K12A	12.873	13.3	225.0	11.5446	41.4
48582: 2473483	2/K12A	11.480	1/K12A	11.442	13.4	225.0	14.0105	49.4
48944: 2473700	1/K12A	11.410	PS K12	11.350	24.7	300.0	19.0791	39.4
49698: 2473227	4/K12A	12.010	3/K12A	11.860	43.0	225.0	13.6200	46.7
49799: 2473227	5/K12A	12.250	4/K12A	12.090	45.4	225.0	12.0988	43.7
50174: 2473227	7/K12A	12.790	6/K12A	12.570	55.6	225.0	12.0988	42.9
50528: 2473227	6/K12A	12.530	5/K12A	12.300	64.2	225.0	12.0988	43.5
50733: 2473700	9/K12A	13.250	8/K12A	12.970	71.7	225.0	11.2091	41.2
50828: 2473227	3/K12A	11.780	2/K12A	11.520	75.2	225.0	13.6200	46.7
59321: CO-579	BH Com	13.611	9/K12A	13.310	42.8	150.0	9.2280	61.1

Figure 4.3 – SewerGEMS Modelling Results

The sewer system assessment therefore shows the existing gravity sewer in the catchment of PS K12 in Thuringowa Central is able to cater for the additional sewage loading from the proposed commercial development at 11 Blackhawk Blvd. The only potential upgrade works would be the replacement of the existing large pump in PS K12 (Morely St) with the dependent on the actual type and size of the commercial development that occurs at the site in the future. The installation of the larger pump in PS K12 could be undertaken by TCC as part of the future pump replacement program once the existing pump reaches the end of its effective life.

APPENDIX A
COMMERCIAL DEVELOPMENT PLANS

Location

THURINGOWA CENTRAL

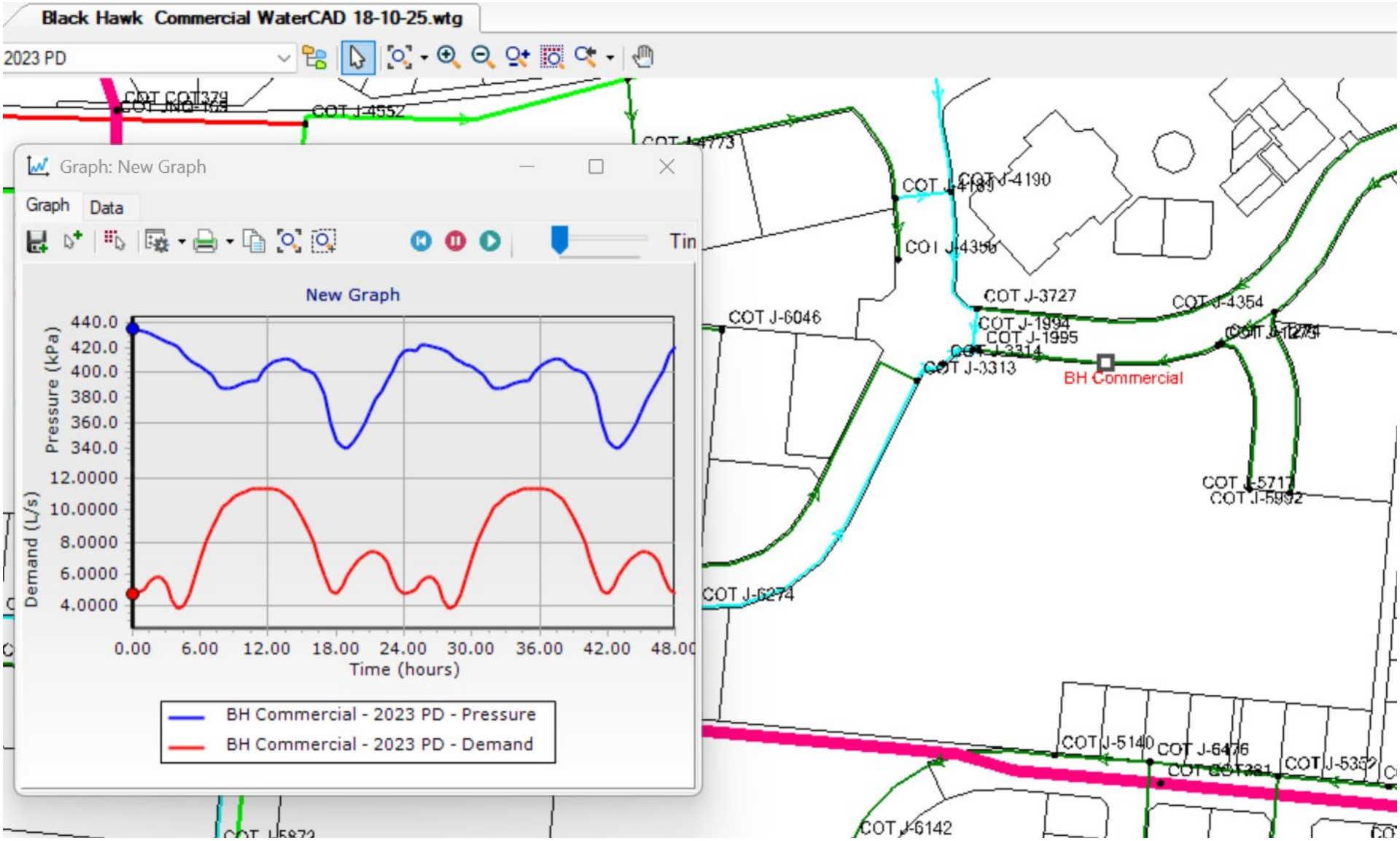
The site is located in Thuringowa Central, one of Townsville's key suburban hubs and a major growth corridor within the wider Townsville Region.

Positioned approximately 13 kilometres west of the Townsville CBD, the site benefits from excellent connectivity via major arterial roads including Thuringowa Drive and Dalrymple Road, linking it efficiently to both the northern and southern suburbs as well as industrial and port precincts.

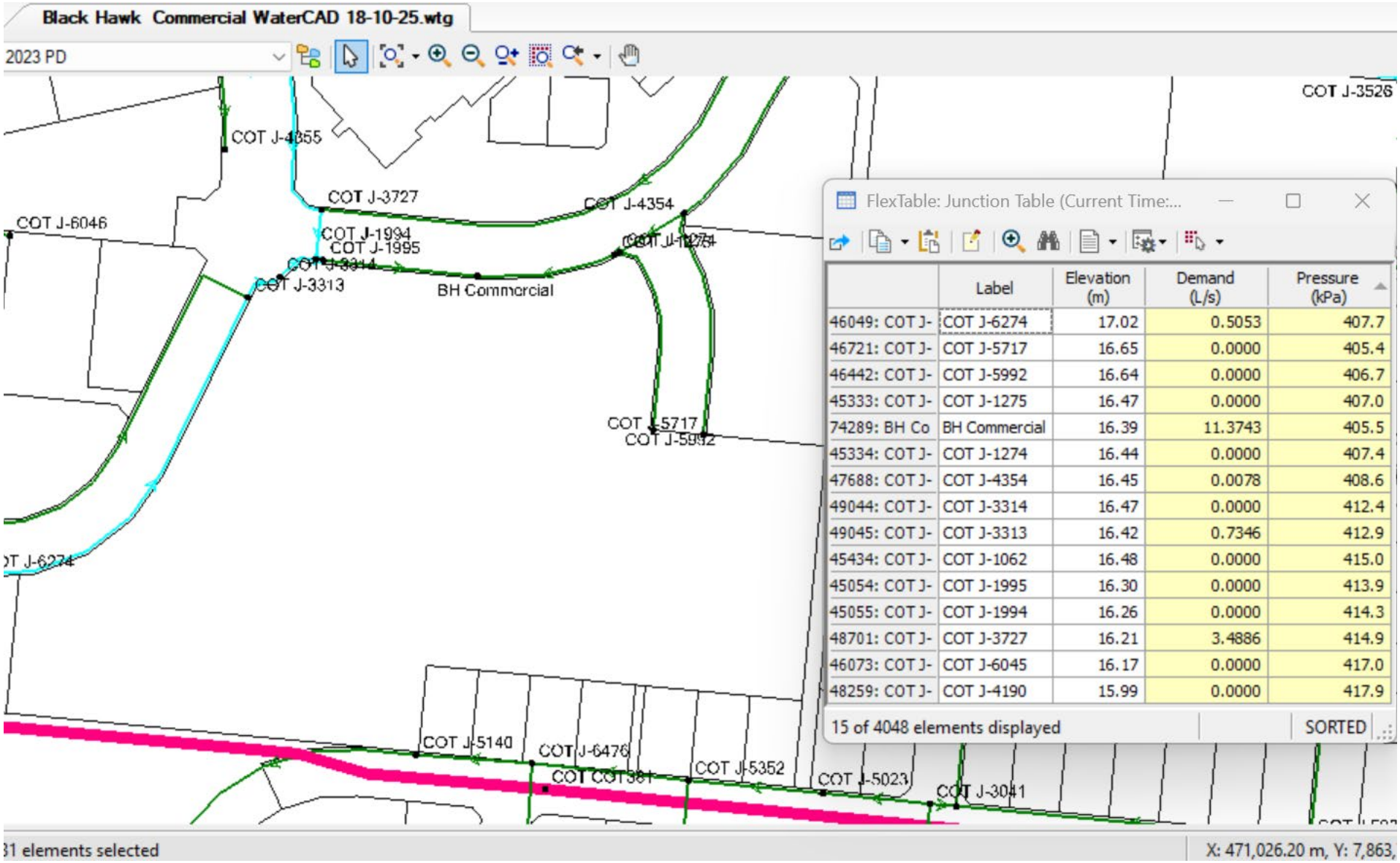
Thuringowa Central is a highly established precinct with strong infrastructure. The area is home to Willows Shopping Centre, Riverway precinct, schools, medical services and sports facilities.

With its central location, established amenities and strong growth outlook, 11 Black Hawk Boulevard, Thuringowa Central, presents a highly strategic opportunity for businesses seeking to capitalise on Townsville's expanding market.

APPENDIX B
WATER MODELLING FIGURES & RESULTS

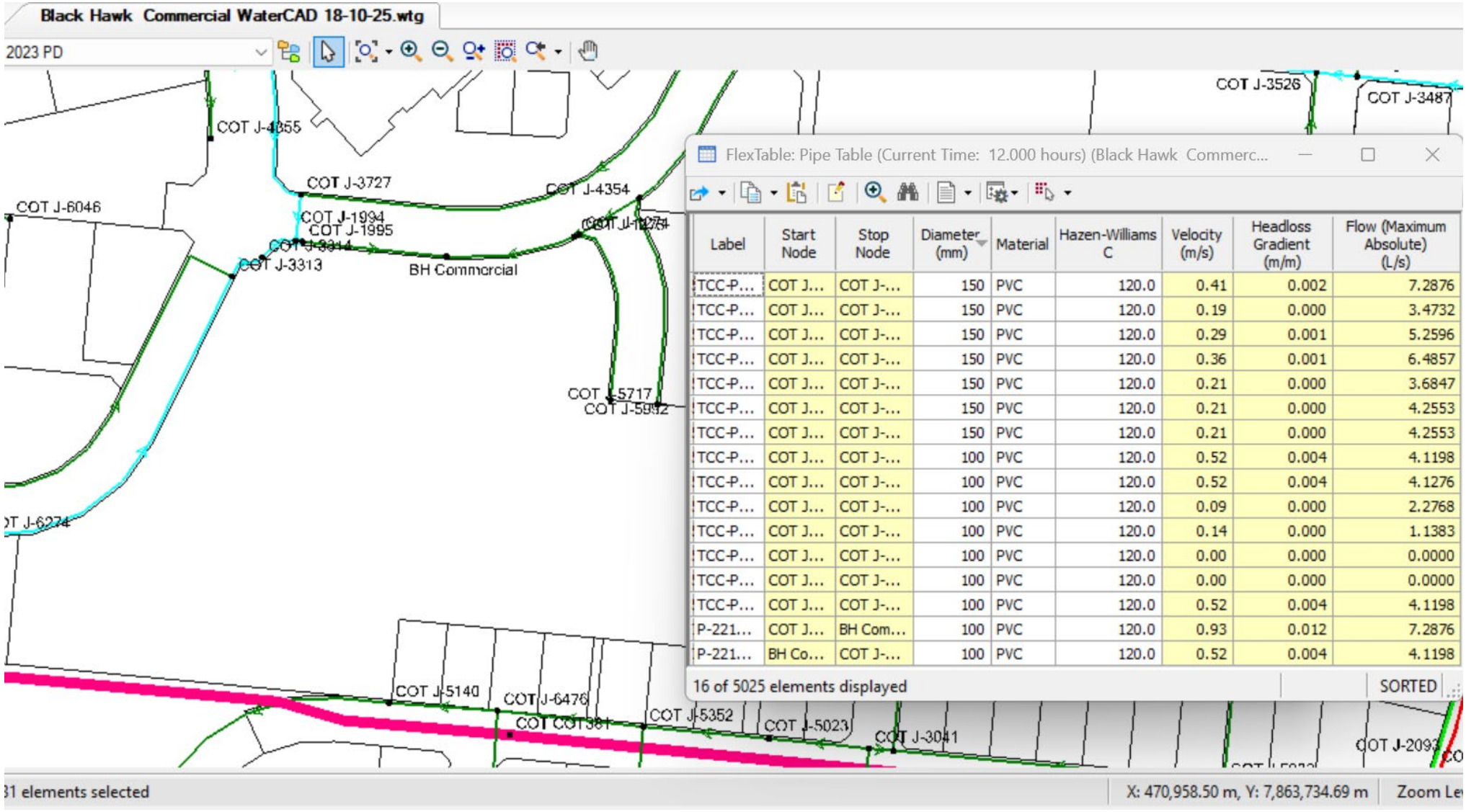


WATERGEMS FIGURE



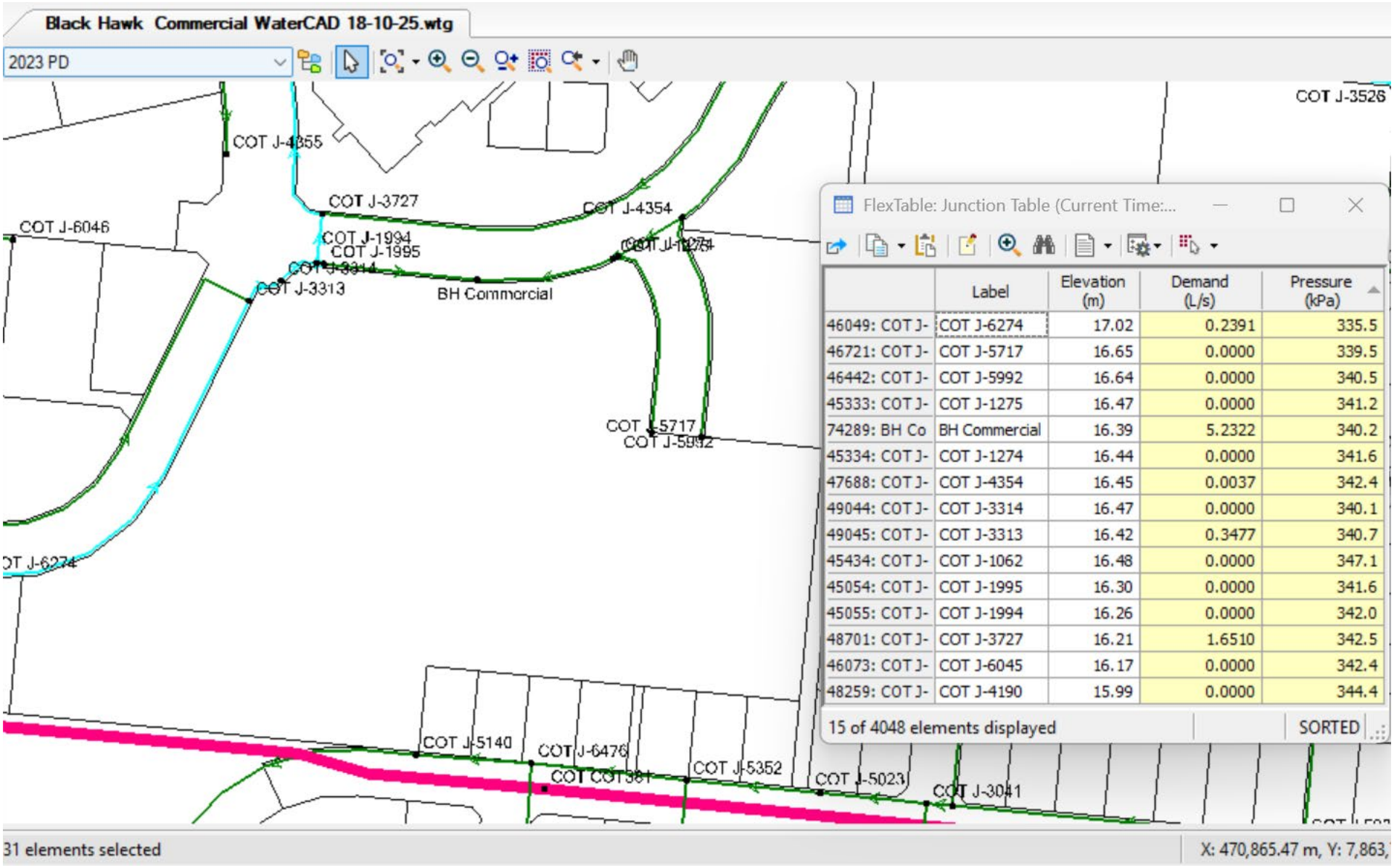
	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)
46049: COT J-	COT J-6274	17.02	0.5053	407.7
46721: COT J-	COT J-5717	16.65	0.0000	405.4
46442: COT J-	COT J-5992	16.64	0.0000	406.7
45333: COT J-	COT J-1275	16.47	0.0000	407.0
74289: BH Co	BH Commercial	16.39	11.3743	405.5
45334: COT J-	COT J-1274	16.44	0.0000	407.4
47688: COT J-	COT J-4354	16.45	0.0078	408.6
49044: COT J-	COT J-3314	16.47	0.0000	412.4
49045: COT J-	COT J-3313	16.42	0.7346	412.9
45434: COT J-	COT J-1062	16.48	0.0000	415.0
45054: COT J-	COT J-1995	16.30	0.0000	413.9
45055: COT J-	COT J-1994	16.26	0.0000	414.3
48701: COT J-	COT J-3727	16.21	3.4886	414.9
46073: COT J-	COT J-6045	16.17	0.0000	417.0
48259: COT J-	COT J-4190	15.99	0.0000	417.9

PEAK HOUR ASSESSMENT – NODES (12 NOON)



Label	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Velocity (m/s)	Headloss Gradient (m/m)	Flow (Maximum Absolute) (L/s)
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.41	0.002	7.2876
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.19	0.000	3.4732
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.29	0.001	5.2596
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.36	0.001	6.4857
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.21	0.000	3.6847
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.21	0.000	4.2553
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.21	0.000	4.2553
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.52	0.004	4.1198
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.52	0.004	4.1276
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.09	0.000	2.2768
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.14	0.000	1.1383
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.00	0.000	0.0000
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.00	0.000	0.0000
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.52	0.004	4.1198
P-221...	COT J...	BH Com...	100	PVC	120.0	0.93	0.012	7.2876
P-221...	BH Co...	COT J-...	100	PVC	120.0	0.52	0.004	4.1198

PEAK HOUR ASSESSMENT – PIPES (12 NOON)

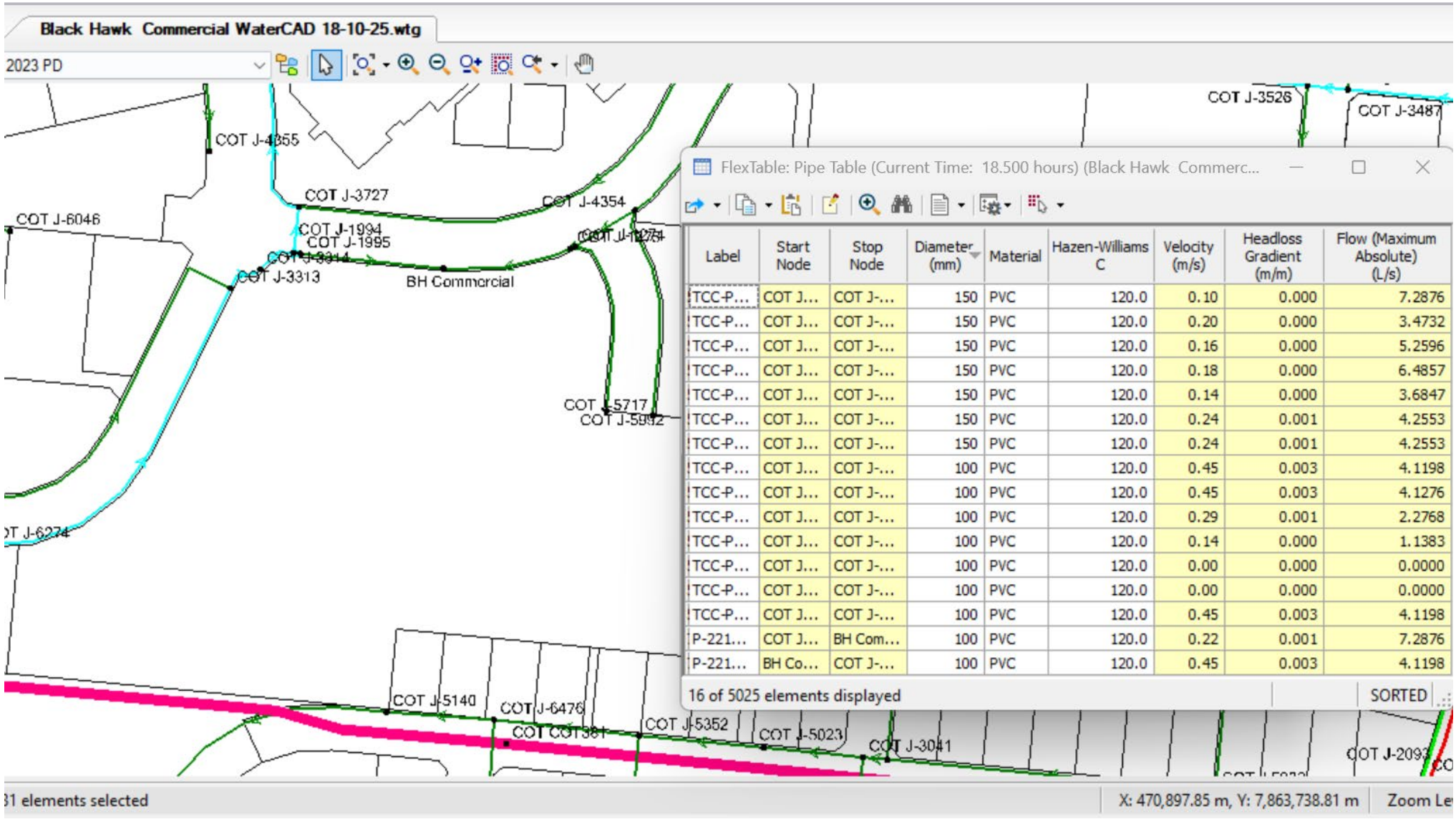


FlexTable: Junction Table (Current Time:...

	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)
46049: COT J-	COT J-6274	17.02	0.2391	335.5
46721: COT J-	COT J-5717	16.65	0.0000	339.5
46442: COT J-	COT J-5992	16.64	0.0000	340.5
45333: COT J-	COT J-1275	16.47	0.0000	341.2
74289: BH Co	BH Commercial	16.39	5.2322	340.2
45334: COT J-	COT J-1274	16.44	0.0000	341.6
47688: COT J-	COT J-4354	16.45	0.0037	342.4
49044: COT J-	COT J-3314	16.47	0.0000	340.1
49045: COT J-	COT J-3313	16.42	0.3477	340.7
45434: COT J-	COT J-1062	16.48	0.0000	347.1
45054: COT J-	COT J-1995	16.30	0.0000	341.6
45055: COT J-	COT J-1994	16.26	0.0000	342.0
48701: COT J-	COT J-3727	16.21	1.6510	342.5
46073: COT J-	COT J-6045	16.17	0.0000	342.4
48259: COT J-	COT J-4190	15.99	0.0000	344.4

15 of 4048 elements displayed | SORTED

PEAK HOUR ASSESSMENT – NODES (6:30PM)

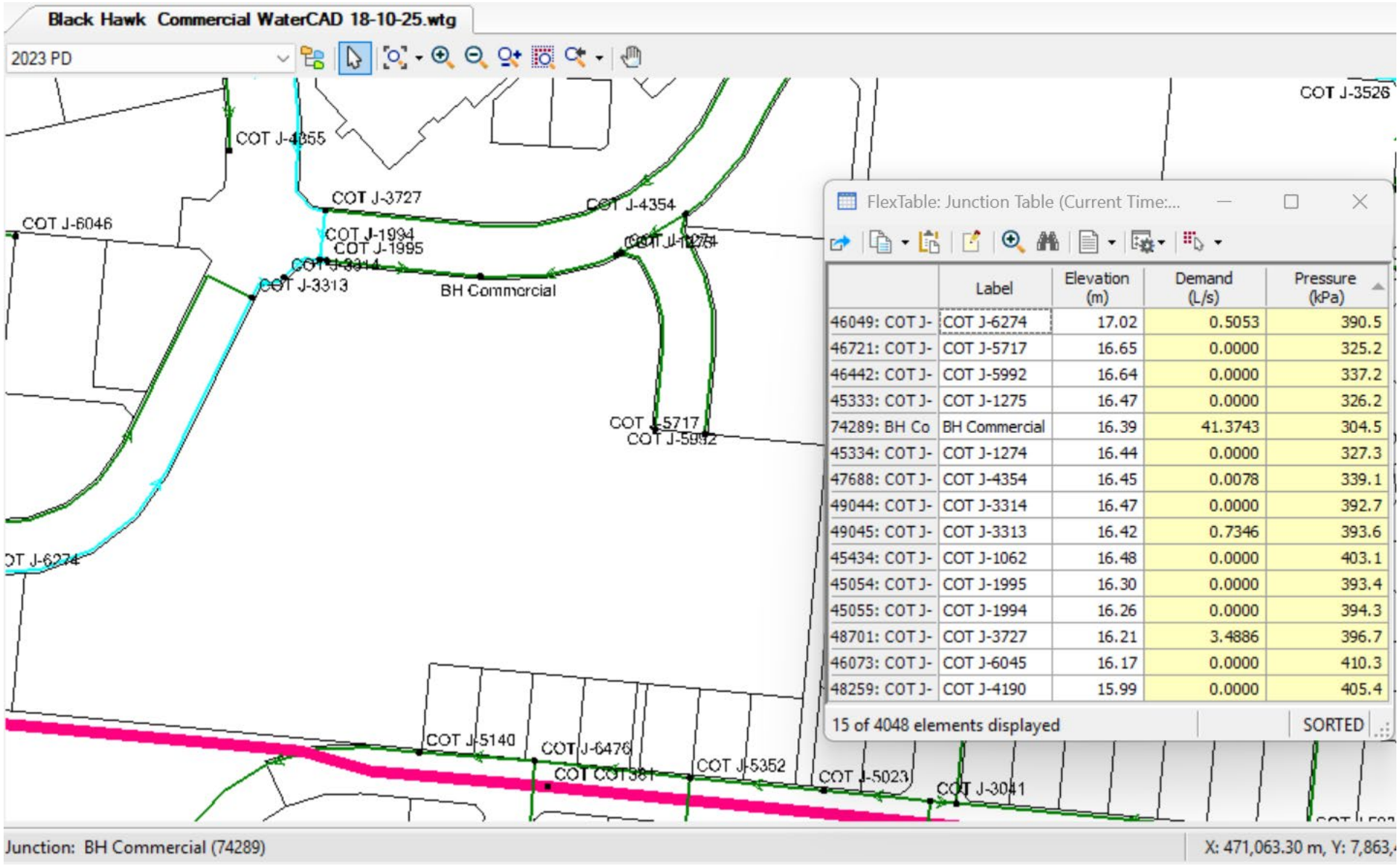


FlexTable: Pipe Table (Current Time: 18.500 hours) (Black Hawk Commerc...

Label	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Velocity (m/s)	Headloss Gradient (m/m)	Flow (Maximum Absolute) (L/s)
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.10	0.000	7.2876
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.20	0.000	3.4732
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.16	0.000	5.2596
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.18	0.000	6.4857
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.14	0.000	3.6847
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.24	0.001	4.2553
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.24	0.001	4.2553
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.45	0.003	4.1198
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.45	0.003	4.1276
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.29	0.001	2.2768
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.14	0.000	1.1383
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.00	0.000	0.0000
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.00	0.000	0.0000
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.45	0.003	4.1198
P-221...	COT J...	BH Com...	100	PVC	120.0	0.22	0.001	7.2876
P-221...	BH Co...	COT J-...	100	PVC	120.0	0.45	0.003	4.1198

16 of 5025 elements displayed SORTED

PEAK HOUR ASSESSMENT – PIPES (6:30PM)

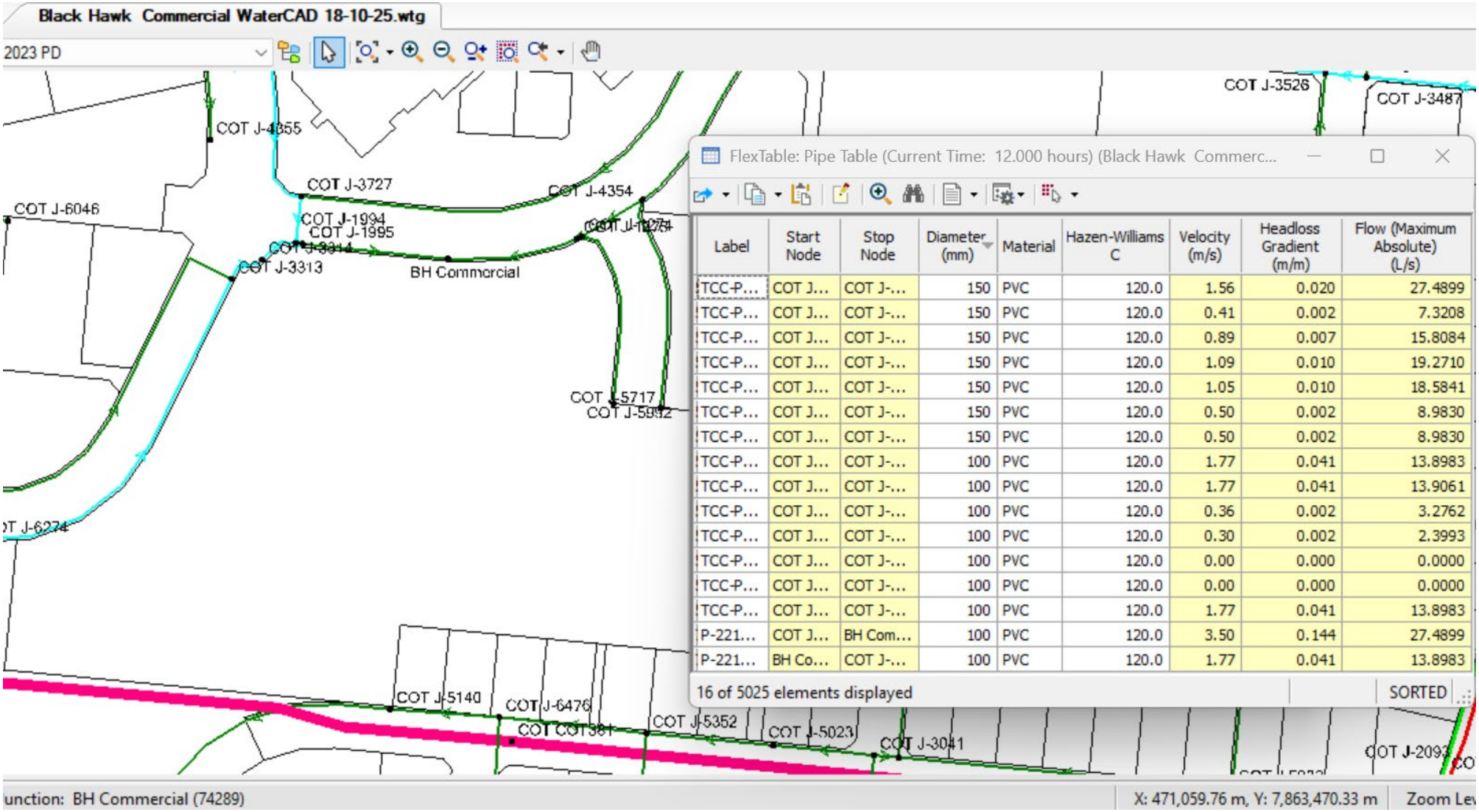


FlexTable: Junction Table (Current Time:...

	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)
46049: COT J-	COT J-6274	17.02	0.5053	390.5
46721: COT J-	COT J-5717	16.65	0.0000	325.2
46442: COT J-	COT J-5992	16.64	0.0000	337.2
45333: COT J-	COT J-1275	16.47	0.0000	326.2
74289: BH Co	BH Commercial	16.39	41.3743	304.5
45334: COT J-	COT J-1274	16.44	0.0000	327.3
47688: COT J-	COT J-4354	16.45	0.0078	339.1
49044: COT J-	COT J-3314	16.47	0.0000	392.7
49045: COT J-	COT J-3313	16.42	0.7346	393.6
45434: COT J-	COT J-1062	16.48	0.0000	403.1
45054: COT J-	COT J-1995	16.30	0.0000	393.4
45055: COT J-	COT J-1994	16.26	0.0000	394.3
48701: COT J-	COT J-3727	16.21	3.4886	396.7
46073: COT J-	COT J-6045	16.17	0.0000	410.3
48259: COT J-	COT J-4190	15.99	0.0000	405.4

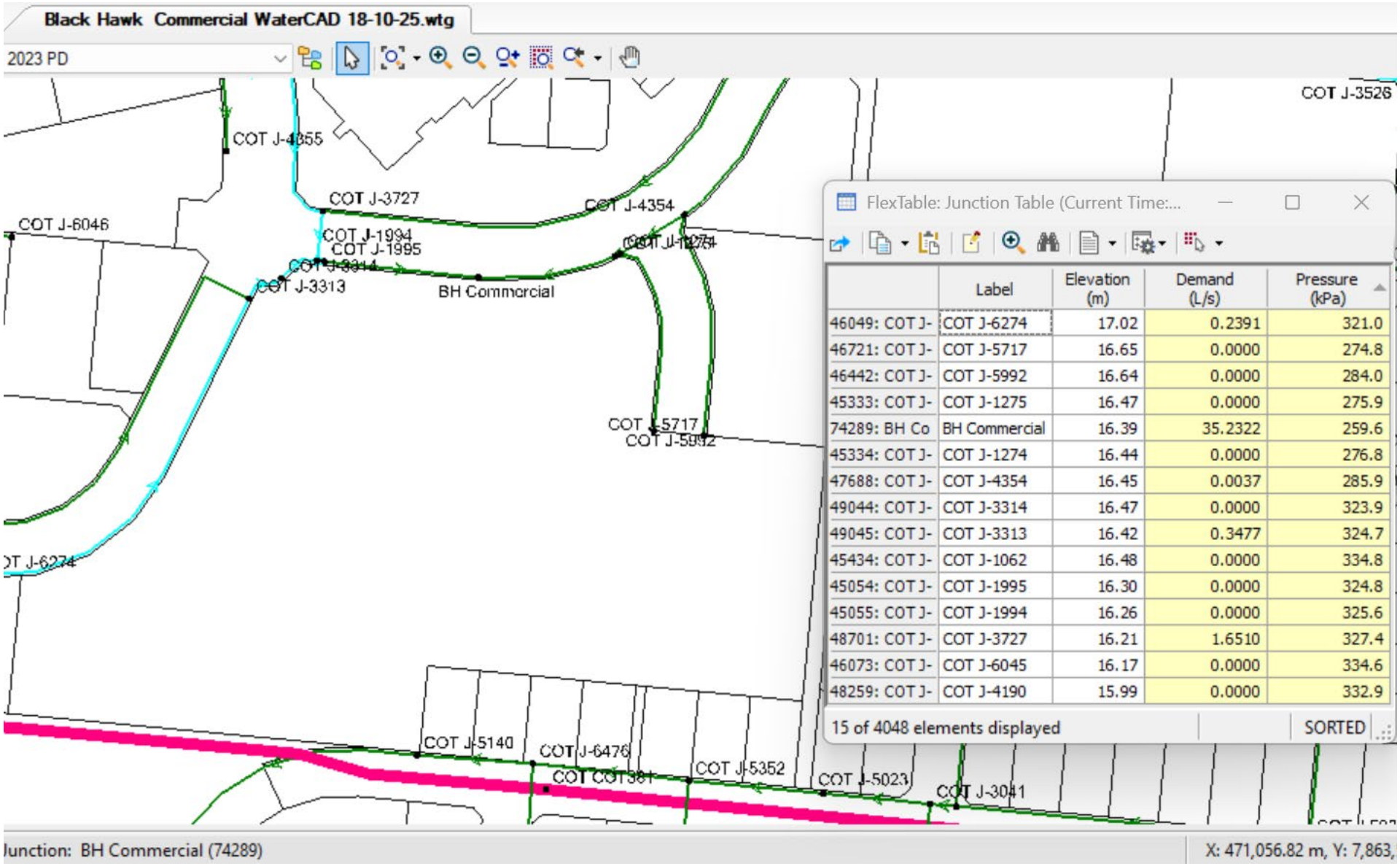
15 of 4048 elements displayed | SORTED

COMMERCIAL FIRE FLOW ASSESSMENT – NODES (12 NOON)



Label	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Velocity (m/s)	Headloss Gradient (m/m)	Flow (Maximum Absolute) (L/s)
TCC-P...	COT J...	COT J-...	150	PVC	120.0	1.56	0.020	27.4899
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.41	0.002	7.3208
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.89	0.007	15.8084
TCC-P...	COT J...	COT J-...	150	PVC	120.0	1.09	0.010	19.2710
TCC-P...	COT J...	COT J-...	150	PVC	120.0	1.05	0.010	18.5841
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.50	0.002	8.9830
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.50	0.002	8.9830
TCC-P...	COT J...	COT J-...	100	PVC	120.0	1.77	0.041	13.8983
TCC-P...	COT J...	COT J-...	100	PVC	120.0	1.77	0.041	13.9061
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.36	0.002	3.2762
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.30	0.002	2.3993
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.00	0.000	0.0000
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.00	0.000	0.0000
TCC-P...	COT J...	COT J-...	100	PVC	120.0	1.77	0.041	13.8983
P-221...	COT J...	BH Com...	100	PVC	120.0	3.50	0.144	27.4899
P-221...	BH Co...	COT J-...	100	PVC	120.0	1.77	0.041	13.8983

COMMERCIAL FIRE FLOW ASSESSMENT – PIPES (12 NOON)

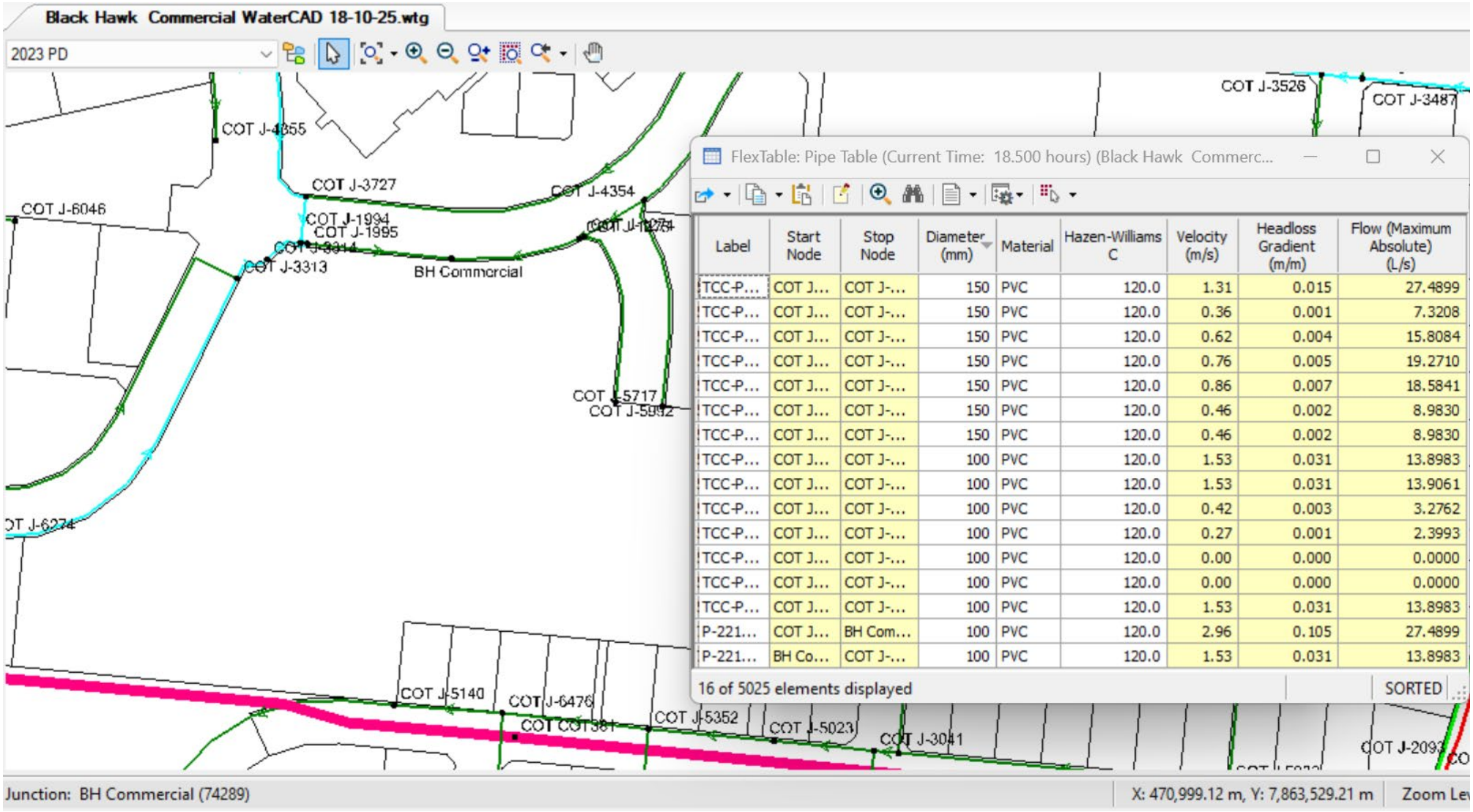


FlexTable: Junction Table (Current Time:...

	Label	Elevation (m)	Demand (L/s)	Pressure (kPa)
46049: COT J-	COT J-6274	17.02	0.2391	321.0
46721: COT J-	COT J-5717	16.65	0.0000	274.8
46442: COT J-	COT J-5992	16.64	0.0000	284.0
45333: COT J-	COT J-1275	16.47	0.0000	275.9
74289: BH Co	BH Commercial	16.39	35.2322	259.6
45334: COT J-	COT J-1274	16.44	0.0000	276.8
47688: COT J-	COT J-4354	16.45	0.0037	285.9
49044: COT J-	COT J-3314	16.47	0.0000	323.9
49045: COT J-	COT J-3313	16.42	0.3477	324.7
45434: COT J-	COT J-1062	16.48	0.0000	334.8
45054: COT J-	COT J-1995	16.30	0.0000	324.8
45055: COT J-	COT J-1994	16.26	0.0000	325.6
48701: COT J-	COT J-3727	16.21	1.6510	327.4
46073: COT J-	COT J-6045	16.17	0.0000	334.6
48259: COT J-	COT J-4190	15.99	0.0000	332.9

15 of 4048 elements displayed SORTED

COMMERCIAL FIRE FLOW ASSESSMENT – NODES (6:30PM)



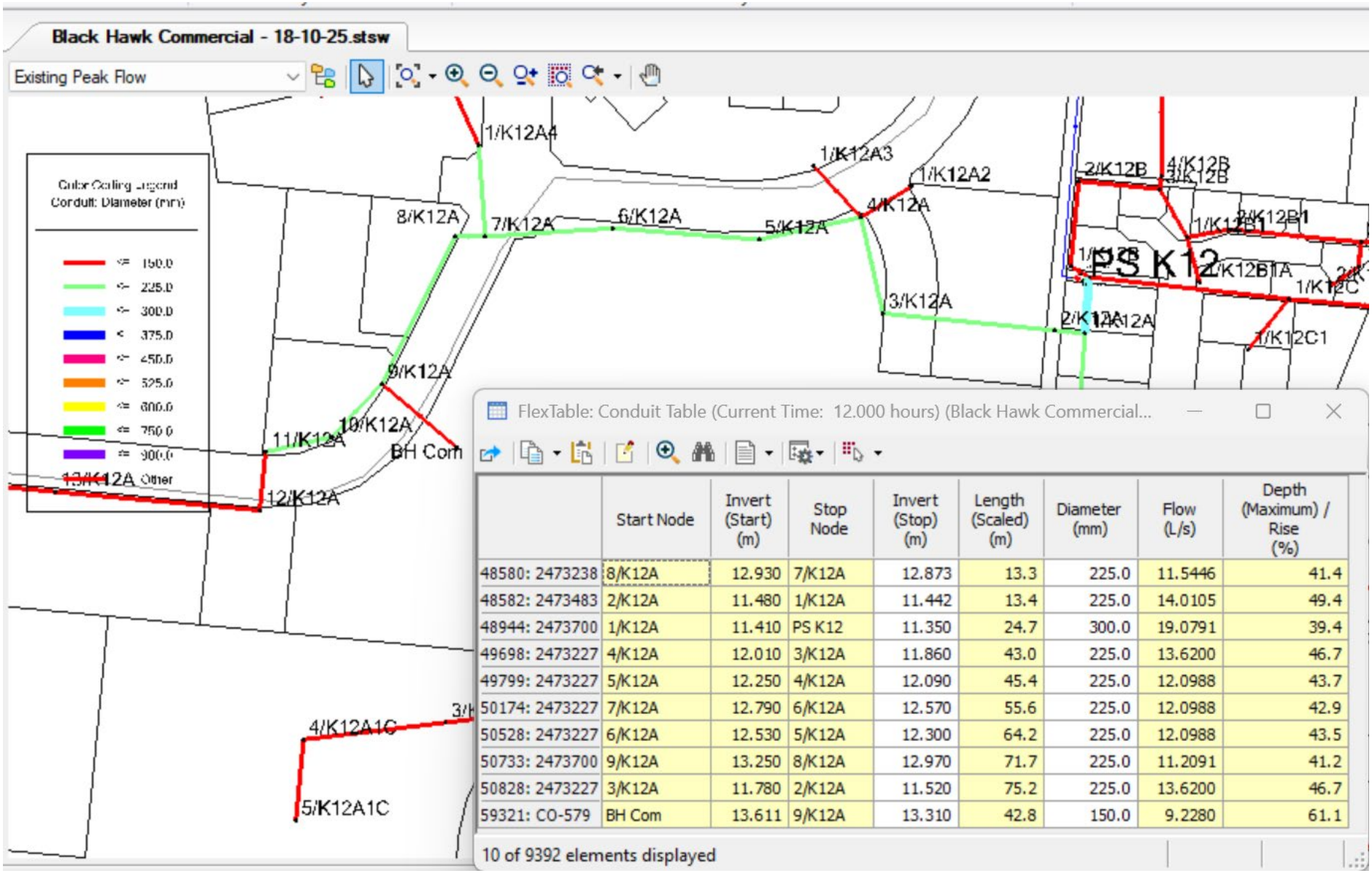
FlexTable: Pipe Table (Current Time: 18.500 hours) (Black Hawk Commerc...

Label	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Velocity (m/s)	Headloss Gradient (m/m)	Flow (Maximum Absolute) (L/s)
TCC-P...	COT J...	COT J-...	150	PVC	120.0	1.31	0.015	27.4899
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.36	0.001	7.3208
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.62	0.004	15.8084
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.76	0.005	19.2710
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.86	0.007	18.5841
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.46	0.002	8.9830
TCC-P...	COT J...	COT J-...	150	PVC	120.0	0.46	0.002	8.9830
TCC-P...	COT J...	COT J-...	100	PVC	120.0	1.53	0.031	13.8983
TCC-P...	COT J...	COT J-...	100	PVC	120.0	1.53	0.031	13.9061
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.42	0.003	3.2762
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.27	0.001	2.3993
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.00	0.000	0.0000
TCC-P...	COT J...	COT J-...	100	PVC	120.0	0.00	0.000	0.0000
TCC-P...	COT J...	COT J-...	100	PVC	120.0	1.53	0.031	13.8983
P-221...	COT J...	BH Com...	100	PVC	120.0	2.96	0.105	27.4899
P-221...	BH Co...	COT J-...	100	PVC	120.0	1.53	0.031	13.8983

16 of 5025 elements displayed | SORTED

COMMERCIAL FIRE FLOW ASSESSMENT – PIPES (6:30PM)

APPENDIX C
SEWER MODELLING FIGURES & RESULTS



FlexTable: Conduit Table (Current Time: 12.000 hours) (Black Hawk Commercial...

	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Length (Scaled) (m)	Diameter (mm)	Flow (L/s)	Depth (Maximum) / Rise (%)
48580: 2473238	8/K12A	12.930	7/K12A	12.873	13.3	225.0	11.5446	41.4
48582: 2473483	2/K12A	11.480	1/K12A	11.442	13.4	225.0	14.0105	49.4
48944: 2473700	1/K12A	11.410	PS K12	11.350	24.7	300.0	19.0791	39.4
49698: 2473227	4/K12A	12.010	3/K12A	11.860	43.0	225.0	13.6200	46.7
49799: 2473227	5/K12A	12.250	4/K12A	12.090	45.4	225.0	12.0988	43.7
50174: 2473227	7/K12A	12.790	6/K12A	12.570	55.6	225.0	12.0988	42.9
50528: 2473227	6/K12A	12.530	5/K12A	12.300	64.2	225.0	12.0988	43.5
50733: 2473700	9/K12A	13.250	8/K12A	12.970	71.7	225.0	11.2091	41.2
50828: 2473227	3/K12A	11.780	2/K12A	11.520	75.2	225.0	13.6200	46.7
59321: CO-579	BH Com	13.611	9/K12A	13.310	42.8	150.0	9.2280	61.1

10 of 9392 elements displayed

SEWERGEMS MODEL FIGURE & RESULTS

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