TABEC
Civil Engineering Consultants

# BELMONT DEVELOPMENT AREA 6
# INFRASTRUCTURE SERVICING AND COST ESTIMATE REPORT

Taylor Burrell Barnett Planning

October 2019

**CLIENT: TAYLOR BURRELL BARNETT PLANNING**

**PROJECT: DEVELOPMENT AREA 6, CITY OF BELMONT**

**TITLE: INFRASTRUCTURE AND COST REPORT**

| **DOCUMENT REVIEW** | | | | |
|---|---|---|---|---|
| Revision | Date Issued | Written By | Reviewed By | Approved By |
| DRAFT | 19 March 18 | C Clay | J Small | B Smith |
| REV 1 | 4 July 18 | C Clay | J Small | B Smith |
| REV 2 | 02 October 19 | J Small | J Small | B Smith |
| REV 3 | 04 October 19 | J Small | J Small | B Smith |
| REV 4 | 11 October 19 | J Small | J Small | B Smith |
| REV 5 | 11 October 19 | J Small | J Small | B Smith |
| | | | | |

# TABLE OF CONTENTS

## APPENDICES

# 1 INTRODUCTION

TABEC Pty Ltd has prepared this report to support the proposed rezoning of Development Area 6 (DA6) excluding Perth Airport, within the City of Belmont. The majority of DA6 is residential and currently zoned R20 as depicted in Figure 1, with pockets of mixed use and commercial properties. The proposed future density increases will require various upgrades and extensions of existing infrastructure to accommodate the moderate and high growth scenarios which includes 2,930 dwellings and 4,255 dwellings accordingly. In addition there is 31,919m2 of commercial floor space shown on the Taylor Burrell Barnett (TBB) Plan. The Yield Analysis Plan, found in Appendix A, details the planned density increase and growth scenarios of DA6.

The report provides engineering advice on the capability and future infrastructure requirements of the site to support the proposed mixed residential and commercial development and the civil engineering influences on the development plan form. In particular we have considered earthworks, roads, drainage, wastewater, water, gas, power and communication servicing requirements to support development. The report also provides an estimate of cost for the upgrade of existing infrastructure and distributes responsibility between service authorities and proposed developers for the purposed of a Development Contribution Plan (DCP).

The site investigation and servicing recommendations are primarily based on preliminary advice from the City of Belmont, Public Transport Authority, Department of Water, Water Corporation, ATCO Gas, Western Power and various telecommunication providers. The information provided within this report is current as of September 2019 and is subject to change as further information and advice is sought from authorities.

The site is identified by the black boundary on Figure 1 presented below:

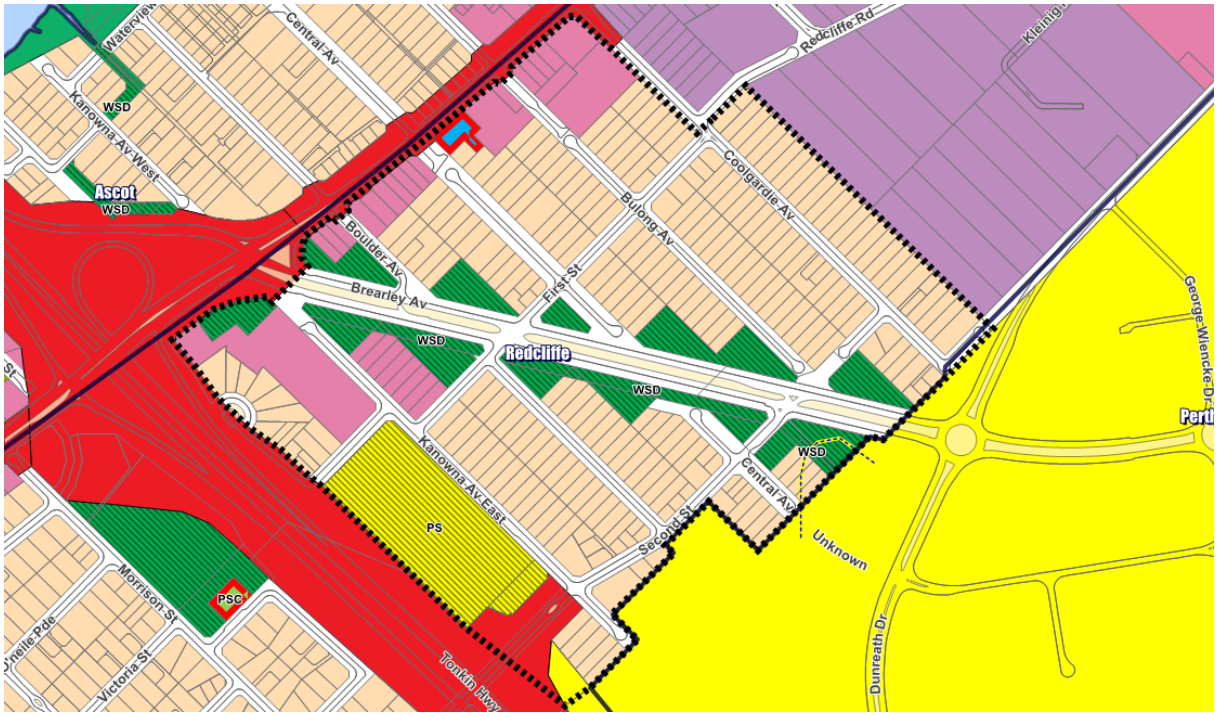


Figure 1 – City of Belmont Local Planning Scheme 15 (Intramaps)

# 2 THE STUDY AREA

## 2.1 Site Description

DA6 is situated within the suburb of Redcliffe, approximately 8km to the east of Perth within the City of Belmont. The development site spans an area of almost 50ha, bound by Great Eastern Highway (GEH) to the north-west, Tonkin Highway to the south-west and Perth Airport to the east.

Access to Perth Airport via Brearley Avenue has been closed at the intersection of First Street to make way for the construction of the Redcliffe Train Station and the creation of new roads and links to the existing roads. Parallel to Brearley Avenue is the Perth Airport Main Drain which grades from east to west, eventually discharging into the Swan River.

The site is currently mostly residential with the exceptions of the Redcliffe Primary School to the south west and commercial properties fronting GEH.

## 2.2 Landform / Topography

Natural surface contours available from Water Corporation's ESInet depicts the land falling steadily from RL18.0m in the southern corner to RL7.0m AHD in the northern corner. The overall topography is however relatively flat, as the 11m vertical difference across the site is experienced over a distance of 900m equating to a grade of 1%. The only significant deviation from the typical topography is the Main Drain at RL8.0m AHD running conversely to natural surface, grading from east to west.

Figure 2 is an aerial image of DA6 illustrating the large residential lots, with the now closed Brearley Avenue traversing the site centrally. Numerous small pockets of POS, wide road reserves and large residential lots have aided the retention of many large trees as depicted below.

Figure 2 – DA6 Aerial image (Nearmap)

### 2.3 Ground Conditions

A desktop review of the Perth Groundwater Atlas indicates the majority of DA6 contains Bassendean Sand (quartz sand) with only a small portion of the northern corner designated as Guildford Clay (alluvium, clay, loam, sand and gravel).

Individual Geotechnical Investigations will be required to determine the design parameters for future development within DA6.

### 2.4 Groundwater

The Perth Groundwater Atlas reveals the historical maximum groundwater levels range from RL12.0m in the southern corner to RL 5.0m AHD in the northern corner. It is therefore estimate that clearance to groundwater from natural surface ranges from approximately 6m in the south to 2m in the north of DA6.

### 2.5 Acid Sulfate Soils

A desktop review of the Swan Coastal Plain Acid Sulfate Soils (ASS) Risk Map designates the site location as having “moderate to low ASS disturbance risk” (within 3m from surface). Based on the anticipated ground conditions and depth to ground water, management of ASS is not likely to be a significant factor during the installation or upgrade of services in DA6.

## 3 SITE WORKS AND EARTHWORKS

Siteworks for urban development generally comprises the clearing of existing vegetation, stripping topsoil and the earth working of existing ground surfaces to facilitate a required form of development. This will apply in localised areas within DA6, noting this requirement will be undertaken on a smaller scale to address redevelopment proposal for increased densities.

Earthworks will need to be individually tailored to the proposed development type and contingent on geotechnical advice sought prior to detailed design.

## 4 ROADS

In response to the proposed rezoning and high density development within DA6, the existing road network is reviewed, with various upgrade, treatments, connections and intersections proposed as outlined below.

### 4.1 Existing Road Network

The site is primarily accessed via Brearley Avenue and Coolgardie Avenue from GEH. Central Avenue, Bulong Avenue and Boulder Avenue all intersect with GEH, though each are “no through roads” in order to direct the majority of traffic through the primary access roads.

With the exception of Brearley Avenue and Central Avenue, all road pavements are typically 6m wide within 20m wide roads reserves. Central Avenue has a 30m wide road reserve and 6m pavement width north of Brearley Avenue and is a dual carriageway south of Brearley Avenue, comprised of 5m wide

paved lanes separated by a median strip, including 1.5m wide cycle lanes. Boulder Avenue, Central Avenue, Bulong Avenue and Second Street currently are not continuous, cut off by Brearley Avenue.

## 4.2 Proposed Road Upgrades

Flyt Transport Consultancy have undertaken the traffic modeling and determined the upgrades proposed in the table below. A graphical representation of the list below can be found in Appendix B. The allowances included in the Opinion of Probable Cost for the various road upgrades is also captured in this table.

| Road Name | Proposed Works |
|---|---|
| Brearley Ave | - Complete closure and removal of remaining road pavements |
| Coolgardie Avenue | - Incorporation of on-street car parking.<br>- Modifications to existing pavements to construct meandering road.<br>- Installation of traffic calming devices.<br>- Localised Street drainage. |
| Road 1 | - New road to link Boulder Avenue to Kanowna Avenue.<br>- Installation of traffic calming devices.<br>- Modifications to existing pavements to construct meandering road.<br>- Localised Street drainage. |
| Kanowna Avenue | - Connection with new Road 1.<br>- Modifications to existing pavements to construct meandering road.<br>- Installation of traffic calming devices.<br>- Localised Street drainage. |
| Boulder Avenue | - Connection with new Road 1.<br>- Installation of traffic calming devices.<br>- Localised Street drainage. |
| First Street | - Installation of traffic calming devices.<br>- Modifications to existing pavements to construct meandering road.<br>- Localised Street drainage. |
| Second Street | - Street connection with Bulong Ave.<br>- Incorporation of on-street car parking.<br>- Localised Street drainage. |
| Bulong Avenue | - Street connection to provide access to GEH (ultimate design).<br>- Street connection with Road 3.<br>- Modifications to existing pavements to construct meandering road. |

| | |
|---|---|
| | - Installation of traffic calming devices.<br>- Localised Street drainage. |
| Central Ave | - Street connection to provide access to GEH.<br>- Removal of no through road.<br>- Street connection between First Street and Road 2.<br>- Central median and cycle path.<br>- Incorporation of on-street car parking.<br>- Modifications to existing pavements to construct meandering road.<br>- Installation of traffic calming devices.<br>- Localised Street drainage. |
| Victoria Street | - Footpaths and on-street car parking.<br>- Localised Street drainage. |
| The Court | - Footpaths and on-street car parking.<br>- Localised Street drainage. |
| Road 3 | - Connection of Bulong Avenue to Second Street.<br>- Traffic calming device. |
| Intersection Treatments | - Second Street signalized intersection at Central Avenue.<br>- Second Street roundabout at Boulder Avenue.<br>- Roadworks including raised median and traffic calming devices. |

Roads not listed in the above table have no proposed changes to existing surface treatment, kerbing or alignment.

Where road alignments are not suggested to be modified, the existing pavement appears to be in satisfactory condition and should be retained. Kerb profiles will need to be modified to suit the proposed adjacent development. It is assumed all intersections internal to DA6 will have brick paved thresholds or other discerning treatment which remain to be nominated. Beyond road upgrades and nominated alignment changes, no other costs associated with existing roads such as profiling, resurfacing or maintenance works are included in the cost schedule.

## 4.3 Great Eastern Highway

Brearley Avenue has been removed with works undertaken in lake 2018 and the former intersection with GEH re-configured. GEH now exists as a T-intersection with the Tonkin Highway off-ramp adjacent the DA6 site. There is no road access available into DA6 through Brearley Avenue.

## 4.4 Cost Estimate

The costs for all roadworks have been presented in the table below and are reflective of whole roads being upgraded at once in single contract.

| Road | Cost |
|---|---|
| Brearley Avenue | $200,000.00 |
| Coolgardie Avenue | $589,000.00 |
| Road 1 | $319,000.00 |
| Kanowna Avenue | $438,000.00 |
| Boulder Avenue | $384,000.00 |
| First Street | $294,000.00 |
| Second Street | $364,000.00 |
| Bulong Avenue | $648,000.00 |
| Central Avenue | $890,000.00 |
| Victoria Street | $178,000.00 |
| The Court | $159,000.00 |
| Intersection Treatments | $390,000.00 |
| Road 3 | $142,000.00 |
| **Total** | **$4,995,000.00** |

The Development Contribution Plan (DCP) cost per square metre is the cost each development will need to pay per square metre of their developable land in order to fund the all major infrastructure works detailed in this report.

Traffic will be generated from all proposed development with DA6, this volume increase will affect all roads and therefore the cost contribution is proposed to be spread evenly across all developable land.

# 5 STORMWATER DRAINAGE

In accordance with best practice Water Sensitive Urban Design (WSUD) principles, stormwater within the DA6 area is intended to be managed locally and infiltrated as close to source as possible. In accordance with the drainage management approach, the street scape will include source infiltration devises that will not add stormwater flows to the Southern Main Drain.

## 5.1 Existing Drainage Network

A vast network of pit and pipe drainage collects the runoff that falls within DA6. A review of Water Corporation's ESInet mapping shows several drainage connections to Perth Airport Main Drain. The Main Drain grades from east to west, ultimately discharging into the Swan River.

With increased density through the DA6 area, higher runoff from lots is anticipated. While new developments are ordinarily required to accommodate the drainage within their particular site, increases paved and hard surfaces throughout the road network is also anticipated.

Therefore, an integrated stormwater system in the streetscape network is necessary through a stormwater detention and infiltration strategy which should be investigated further and detailed through a Local Water Management Strategy.

### 5.2 Proposed Drainage Network

In order to achieve higher levels of stormwater infiltration through WSUD features in each of the local roads, roadside swales, bio-retention areas and rain gardens are envisioned. The purpose is to water quality is promoted, minimising the export of pollutants such as phosphorus, nitrogen and metals from road runoff from entering groundwater. Bio-retention and local surface treatments typically trap and infiltrate the minor events. Larger storm events require additional storage, which can be achieved with below-ground infiltration galleries. There are a variety of propriety products available, which are trafficable, however the general intention would be to locate in existing road verges, and beneath swale and bio-retention facilities.

Cost allowances within the DA6 area are included for localised street drainage facilities are included within the road upgrade cost contribution table above.

### 5.3 Cost of Upgrade

The estimated cost for the currently preferred Southern Main Drain option is included below, along with the anticipated LWMS preparation, modelling and detailed drainage design.

| **Southern Main Drain** | **Estimated Cost** |
|---|---|
| EPCAD Option C - Living Stream | $2,456,000.00 |
| Modelling, LWMS preparation and detailed design | $150,000.00 |
| **Sub-Total Cost** | **$2,606,000.00** |

## 6 WASTEWATER

### 6.1 Existing Wastewater Network

The wastewater reticulation for the entirety of DA6 falls to the Type 40 Coolgardie Avenue Pumping Station location in Coolgardie Avenue west of the intersection of Bulong Avenue. The existing network consists of mainly DN150 reticulation grading centrally to a DN225 pipe in First Street, Bulong Avenue and Coolgardie Street before travelling north to the pumping station.

A portion of sewerage reticulation can be found within easements at the rear of private properties or in POS, providing connections for existing dwellings. It has been assumed that these easements and the reticulation will be maintained during future development. There is no costs allowance for the relocation of these assets.

In addition to the existing gravity network, the Perth Airport is serviced by a DN150 private pressure main traversing the full length of First Street but does not discharge into the gravity network and completely bypasses the Coolgardie Avenue Pumping Station.

## 6.2 Proposed Wastewater Reticulation Upgrades

Both the "moderate" and "high" growth scenarios, detailed in Appendix A, trigger the same requirements for upgrading the existing wastewater reticulation.

The upgrades internal to DA6 and suggested to be included within the DCP are:

- 85m section of DN150 in Boulder Avenue will be need to be upgraded to a DN225. A plan depicting the areas requiring upgrade can be found in Appendix B; and
- 775m of DN225 upgraded to DN300 within First Street and Bulong Avenue down to the Coolgardie Avenue Pumping Station. This includes 375m outside of the DA6 boundary, west of GEH.

New DN150 sewer reticulation will be required where development occurs and a sewer main is not currently present. Entirely new mains are not required to form part of the DCP as they would be constructed solely on the basis of serving that particular future development, which is as yet undefined. New service extensions would therefore be attributed to individual developers as appropriate.

Further headworks upgrades downstream to the existing sewer network are required at the cost of Water Corporation as follows:

- Type 40 Coolgardie Avenue Pumping Station upgraded to a Type 90;
- 1,100m DN200 pressure main from the Coolgardie Avenue Pumping Station to a AC L3589 upgraded to DN300;
- 713m varied section of gravity main from AC L3589 to AC L7510 upgraded to DN450; and
- 980m varied section of gravity main from AC L7510 to AC L0246 upgraded to DN600.

A plan depicting the areas requiring upgrade can be found in Appendix B. The works listed immediately above are outside the DA6 boundary and will be funded through Water Corporation's Capital Works Program.

## 6.3 Estimated Wastewater Reticulation Upgrade Cost

The 85m upgrade of DN150 to DN225 would be fully funded by the DCP. However, when installing DN300 reticulation, the Water Corporation refunds the developer $600/m. This sum will be included with the cost estimate to balance the difference within the DCP.

The table below contains the cost estimate for the two separate wastewater upgrades:

| Upgrade | Estimated Cost | Refund | Total |
|---|---|---|---|
| DN150 to DN225 | $177,000.00 | N/A | $177,000.00 |
| DN225 to DN300 | $1,658,000.00 | $465,000.00 | $1,193,000.00 |
| **Sub-Total Cost** | $1,835,000.00 | | **$1,370,000.00** |

The contributions to wastewater have been divided into two catchments of 74,451m2 and 249,396m2 for DN225 and DN300 upgrades respectively. Wastewater is a gravity fed network with clear catchment boundaries that are depicted in Appendix 2. The total cost nominated above is summarised as an allocation across the combined catchments.

# 7 WATER SUPPLY

## 7.1 Existing Water Reticulation

The existing water supply consists of Cast Iron, Asbestos Cement, PVC and Steel pipes ranging from DN100, DN150 and DN205 internal to DA6. The area is supplied from a major distribution from a major DN800 steel distribution main in GEH, near Boulder Avenue.

## 7.2 Proposed Water Reticulation Upgrades

Due to the updated development yields, the two growth scenarios have been reassessed based on the lower total dwelling numbers. As a result, the previous low and desirable growth scenarios which previously resulted in separate upgrade requirements is now simplified with the same extensions and upgrades likely to be required under both the moderate and high growth scenarios.

The upgrade proposed by Water Corporation would see duplication of existing mains to the opposite side of the road and general increases in diameter of the water mains to ensure adequate supply. Abandonment and replacement of existing mains would also occur under this proposal illustrated in Appendix B.

Notwithstanding the extensions and upgrades identified, the works to increase water supply will ultimately not only depend entirely on the development rate with DA6, but also where development is taking place. The extensions or upgrades could be undertaken to minimise interruptions and reinstatements which may result in various sections being brought forward of otherwise planned timing.

The following outlines the most likely upgrade and extension works required to water supply:

| Street | Moderate and High Growth Scenario |
|---|---|
| Central Avenue | - New DN150P to eastern side of the road for full length of road.<br>- New DN100P through POS 3 across former Brearley Avenue. |
| Bulong Avenue | - New DN100P in northern verge between Road 2 and Road 3. |
| Road 1 | - New DN100P from Kanowna St to former Brearley Avenue.<br>- New DN150P from Boulder Ave to former Brearley Avenue. |
| Road 2 | - New DN100P full length of road. |
| POS1 | - Replace DN100CI with new DN100P.<br>- New D150P through to POS1 to Road 1. |
| Kanowna Avenue | - Abandon DN100AC. |

For information, P = PVC, AC = Asbestos Cement, CI = Cast Iron, S = Steel.

### 7.3 Estimated Water Reticulation Upgrade Cost

Water Corporation prefund the construction of all water mains DN300 and greater. However, the required upgrades associated with these growth scenarios are smaller reticulation mains arne therefore would be fully funded by the developers through the DCP.

The cost of the water reticulation main upgrades an extensions is estimated in the table below:

| Upgrade Density | Estimated Cost |
|---|---|
| Moderate and High Growth | $850,000.00 |

The water reticulation is generally comprised of numerous loops that circulate and maintain a clean free flow of water. Development and pressure demand anywhere in DA6 could trigger the need for an upgrade and would need hydraulic modelling by Water Corporation each time a new development is proposed in order to determine the impact. For this reason, the contribution for the ultimate water upgrade shall be the same for the entire development area.

## 8 GAS SUPPLY

### 8.1 Existing Gas Reticulation

The suburban streets of Belmont DA6 contain numerous medium pressure reticulated gas mains varying DN50 – 100. The largest main, DN155, is present along Brearley Avenue, servicing Perth Airport.

### 8.2 Proposed Gas Reticulation

ATCO Gas have proposed relocating their existing main from Brearley Avenue to Boulder Avenue and Kanowna Avenue in order to tie back in and serve Perth Airport. The increased density will require a reinforcement to the existing upstream network which will consist of 2 High Pressure Regulators (HPR), 3.3km of DN160 polyethylene high pressure mains and 1.5km of DN100 Steel high pressure mains. The internal reticulation will require new mains to the new roads and road links created by the removal of Brearley Avenue as well as external network links via Coolgardie Avenue and First Street.

| Item | Estimated Cost |
|---|---|
| Removal and relocation of Brearley Avenue mains | $449,000.00 |
| New internal reticulation | $445,000.00 |
| External upgrade and network reinforcement (subject to negotiated outcomes with ATCO Gas)* | $4,700,000.00* |
| **Total Cost (including external upgrades)** | **$5,594,000.00** |

Clearly, there is a significant cost associated with the external upgrades and network reinforcement to provide capacity upgrades from the existing high pressure mains to the south of Perth Airport. Given the significant increase in potential customers for ATCO Gas, there is opportunity to recover the cost of the external upgrades through a negotiated outcome with ATCO Gas.

When assessing claims for capital contributions, ATCO Gas look at the projected gas volume versus the current demand and make assessments on the net present value. A positive net present value will be looked at favourably towards a contribution by ATCO Gas.

Furthermore, the supply of gas mains is not a subdivision condition with the West Australian Planning Commission. While there is a commercial interest for ATCO Gas to expand their network to service additional users, opportunity to reduce the significant cost associated with upgrades external toe the DA6 boundary should be sought.

# 9 POWER & COMMUNICATIONS

The existing and proposed upgrades to the power and telecommunications infrastructure is detailed in a report by 3E Consulting Engineers titled Electrical and Communication Infrastructure and Cost Analysis, located in Appendix 5.

It is acknowledged that 3E's analysis was undertaken in March 2018 based on a higher residential dwelling and commercial yield with an earlier concept plan than what is now being considered. However, in review it was not considered that the electrical or telecommunication upgrade requirements differed as a result of the revised dwelling yields or concept plan, and as such the extent of works and preliminary cost estimates remained the same as they are within the expected order of accuracy.

## 9.1 Power Cost

The power infrastructure scheduled for distribution via the DCP includes the relocation of existing Western Power assets, primarily in Brearley Avenue which contains LV cables and HV crossings. There are also existing below ground HV networks in Kanowna Avenue also, however the updated development proposal appears to accommodate the existing HV cables connecting through to GEH.

The existing overhead HV and LV power network is also required to be relocated underground. There is cause to underground the aerial network due to clashes between the poles and wires and the proposed development works. In order to avoid the otherwise ad-hoc approach which would prove inefficient, the City may elect to complete this underground conversion in advance, under the DCP to facilitate the future development. The costs to do so are therefore estimated and included below. However, it is noted that a DCP contribution for conversion of overhead power to underground is not typical practice.

Given that the initial asset relocation is most impacted by the Brearly Avenue closure, there may be opportunity for shared funding arrangements between the Local, State and Commonwealth Governments. These works involve the requirement to remove existing street lighting, and modification to the existing LV network to maintain supplies and interconnectivity. While cost allocations have been included below, it is noted that this should be further investigated to assess the opportunity.

If growth were to exceed 1.5MVA a year (approx. 500 units) an additional fee is likely to be associated with the augmentation of the HV feeder network as explained in item 2.3.2 of 3E's report. This would attract substantial cost, with dedicated HV feeders likely to be offsite extensions exceeding 3kms in length. Typically, additional load requests below 1.5MVA is considered natural growth and Western Power will augment the network at their own cost. Should larger development proposals, or shorter time frames for build out result, it is likely that Western Power would nominate the developers within DA6 to be responsible for the augmentation costs.

The HV feeder cable upgrades and extensions are currently excluded from the below estimated DCP cost contributions.

New LV and HV assets will be required to serve individual development needs but this would be paid for by the private developer similar to a greenfield situation which includes the Western Power HV Pool scheme.

Summary of costs for electrical related contributions are included in the following table:

| Item | Estimated Cost |
|---|---|
| Relocation works | $995,000.00 |
| Underground conversion of existing network | $7,350,000.00 |
| **Total Cost** | **$8,345,000.00** |

*HV feeder network costs subject to growth as detailed in section 2.3.2 of Appendix C.

## 9.2 Communications Cost

Several Telecommunication providers assets are present in Brearley Avenue, servicing Perth Airport. Telstra, Optus, NBN Co, Vocus and Nextgen assets are proposed for removal and relocation along Central Ave and Boulder Ave respectively, illustrated within Appendix 2.

A summary of the costs for the different providers relocations is below:

| Item | Estimated Cost |
|---|---|
| Removal and relocation of Brearley Ave assets | $5,359,000.00 |
| Other relocation costs | $613,000.00 |
| **Total Cost** | **$5,972,000.00** |

Other costs include raising of Telstra and NBN Co pits above the flood fringe near the POS and for decommissioning of the Perth Airport terminal and equipment recovery.

Costs associated with NBN Backhaul and Deployment are assumed to be at the individual developer's expense as would be the case for a typical greenfield development.

# 10 CONCLUSION

From an engineering perspective, the site requires significant relocations of existing services, and upgrades to existing infrastructure to satisfy the proposed moderate and high growth scenarios. While Opinions of Probable Cost have been nominated, the actual costs are subject to greater level of detailed design, staging and coordination of works.

Also, there is opportunity for various cost contributions due to off-site network reinforcements that should be negotiated further with servicing Authorities for clarifications on cost schedules.

Since the Opinions of Probable Cost are based on schematic design and concept sketches, we would consider the cost estimate provided above to be Class 4 based on the recommendation of Engineers Australia – Australian Cost Engineering Society ranging from -20% to +30%. Note all figures estimated exclude GST.

The total cost to be contained within the DCP is summarised in the following table:

| **Item** | **Cost** |
|---|---|
| Roadworks and Drainage | $4,995,000.00 |
| Southern Main Drain | $2,606,000.00 |
| Wastewater | $1,370,000.00 |
| Water | $850,000.00 |
| Gas | $5,593,000.00 |
| Power | $8,345,000.00 |
| Communications | $5,972,000.00 |
| **Total Cost** | **$29,731,000.00** |

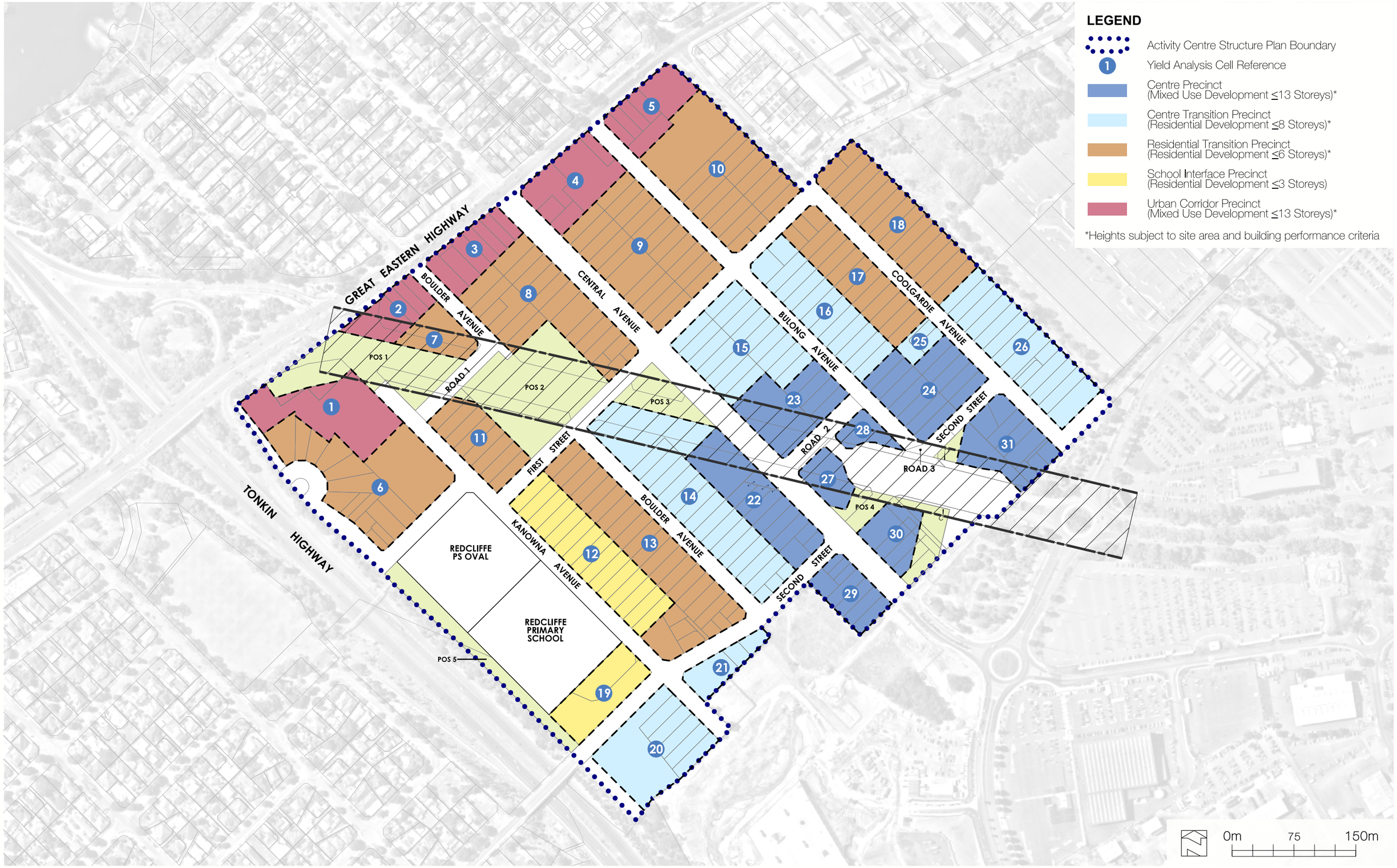
# 11 REFERENCES


- City of Belmont Intramaps, Geographic Information System. Local Planning Scheme 15
- Taylor Burrell Barnett, Moderate and High Growth Dwelling Yield Scenarios, September 2019
- Photomaps by Nearmap, Online Aerial Imagery. Redcliffe, September 2019.
- EPCAD Southern Main Drain Overall Plan Rec C, September 2019.
- Flyt Traffic Consulting, Traffic Modelling Report. Belmont DA6 Traffic and Transport Modelling Report, March 2018.
- 3E Consulting Engineers, Power and Communications Cost Report. Electrical and Communication Infrastructure and Cost Analysis, March 2018.

# APPENDIX A YIELD ANALYSIS PLAN & GROWTH SCENARIOS

Development Area 6, Belmont

TBB Planning (September 2019)

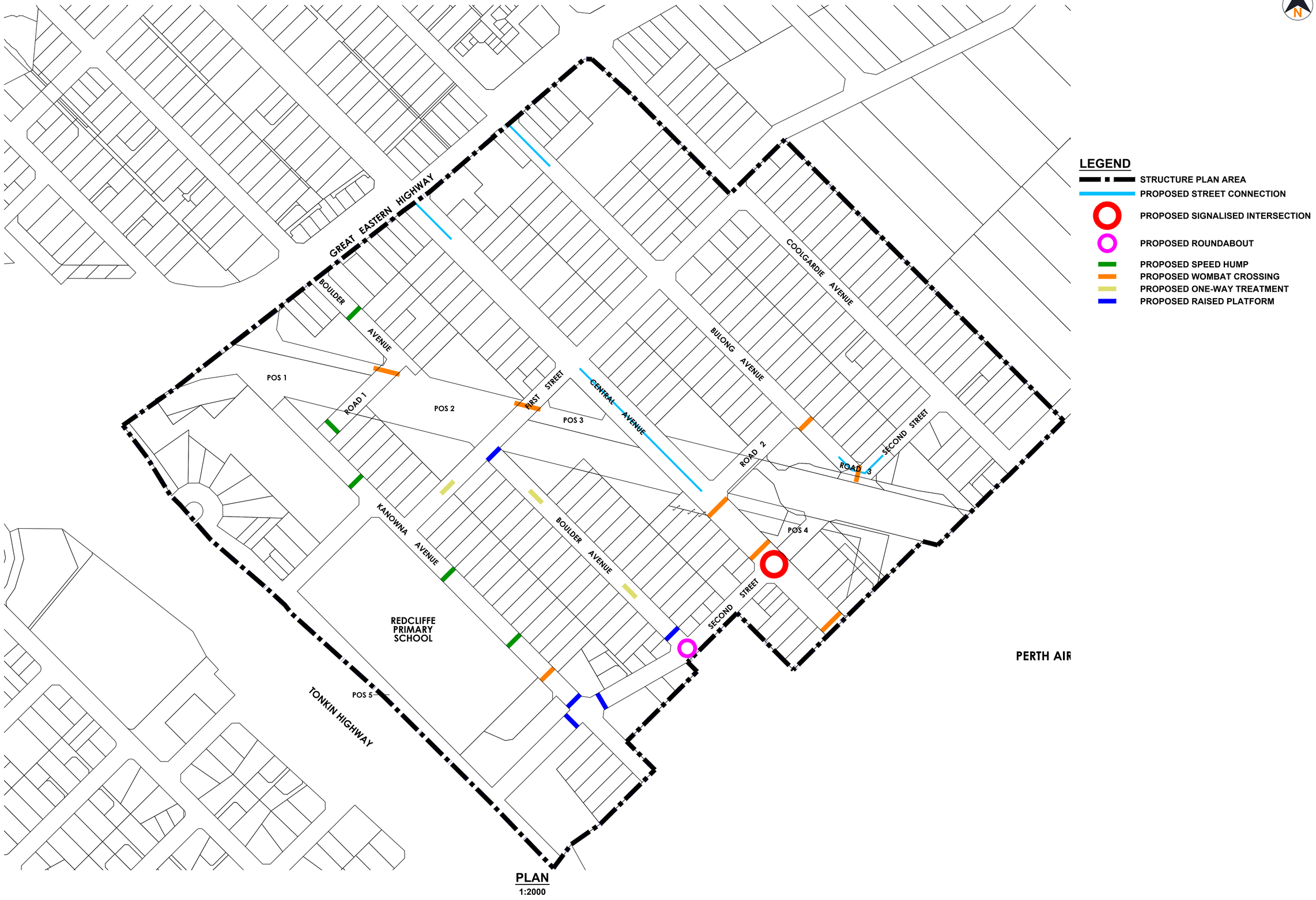

LEGEND
Activity Centre Structure Plan Boundary
Yield Analysis Cell Reference
Centre Precinct (Mixed Use Development ≤13 Storeys)*
Centre Transition Precinct (Residential Development ≤8 Storeys)*
Residential Transition Precinct (Residential Development ≤6 Storeys)*
School Interface Precinct (Residential Development ≤3 Storeys)
Urban Corridor Precinct (Mixed Use Development ≤13 Storeys)*
*Heights subject to site area and building performance criteria
GREAT EASTERN HIGHWAY
TONKIN HIGHWAY
BOULDER AVENUE
CENTRAL AVENUE
BULONG AVENUE
COOLGARDIE AVENUE
FIRST STREET
SECOND STREET
KANOWNA AVENUE
ROAD 1
ROAD 2
ROAD 3
POS 1
POS 2
POS 3
POS 4
POS 5
REDCLIFFE PS OVAL
REDCLIFFE PRIMARY SCHOOL
0m
75
150m

| Precinct | Moderate Growth Scenario | High Growth Scenario |
|---|---|---|
| **Centre** | | |
| Residential - Single/Grouped | - | - |
| Residential - Apartments (Units) | 752 | 895 |
| Commercial - Floorspace (m2) | 10,226 | 20,452 |
| **Centre Transition** | | |
| Residential - Single/Grouped | 260 | 121 |
| Residential - Apartments | 459 | 888 |
| **Residential Transition** | | |
| Residential - Single/Grouped | 514 | 377 |
| Residential - Apartments | 445 | 1,218 |
| **School Interface** | | |
| Residential - Single/Grouped | 79 | 74 |
| Residential - Apartments | 32 | 74 |
| **Urban Corridor** | | |
| Residential - Single/Grouped | - | - |
| Residential - Apartments | 389 | 608 |
| Commercial - Floorspace | 18,244 | 29,190 |
| **Total Single/Grouped Dwellings** | **853** | **573** |
| **Total Apartments (units)** | **2,077** | **3,682** |
| **Total Dwellings** | **2,930** | **4,255** |
| **Total Commercial Floorspace (m2)** | **28,470** | **49,642** |

**APPENDIX B PROPOSED INFRASTRUCTURE UPGRADE PLANS**

Development Area 6, Belmont

TABEC (September 2019)




**PLAN**
1:2000

# City of Belmont - Development Area 6

## Road Upgrade Plan

DRAWING NUMBER 2373-SK-008

ISSUE C

TABEC Civil Engineering Consultants

TABEC PTY LTD
ACN 090 796 204
14 Wickham Street, East Perth WA 6004
t 08 9425 5900 e info@tabec.com.au
www.tabec.com.au

SCALE 1:2000 — 0 40 80 120

A1

Plotted By: ksharland Plot Date: 09/10/19 - 16:46 Cad File: T:\Projects\2373\Design\CAD\Drawings\Sketches\2373-SK-008 Exist Road Upgrades.dwg


## LEGEND

- STRUCTURE PLAN AREA
- EXISTING GRAVITY SEWER
- EXISTING SEWER PRESSURE MAIN
- PROPOSED GRAVITY SEWER UPGRADE
- PROPOSED GRAVITY SEWER PRESSURE MAIN UPGRADE

**PLAN**
N.TS.

# City of Belmont - Development Area 6

## Sewer Upgrade Plan

DRAWING NUMBER 2373-SK-004

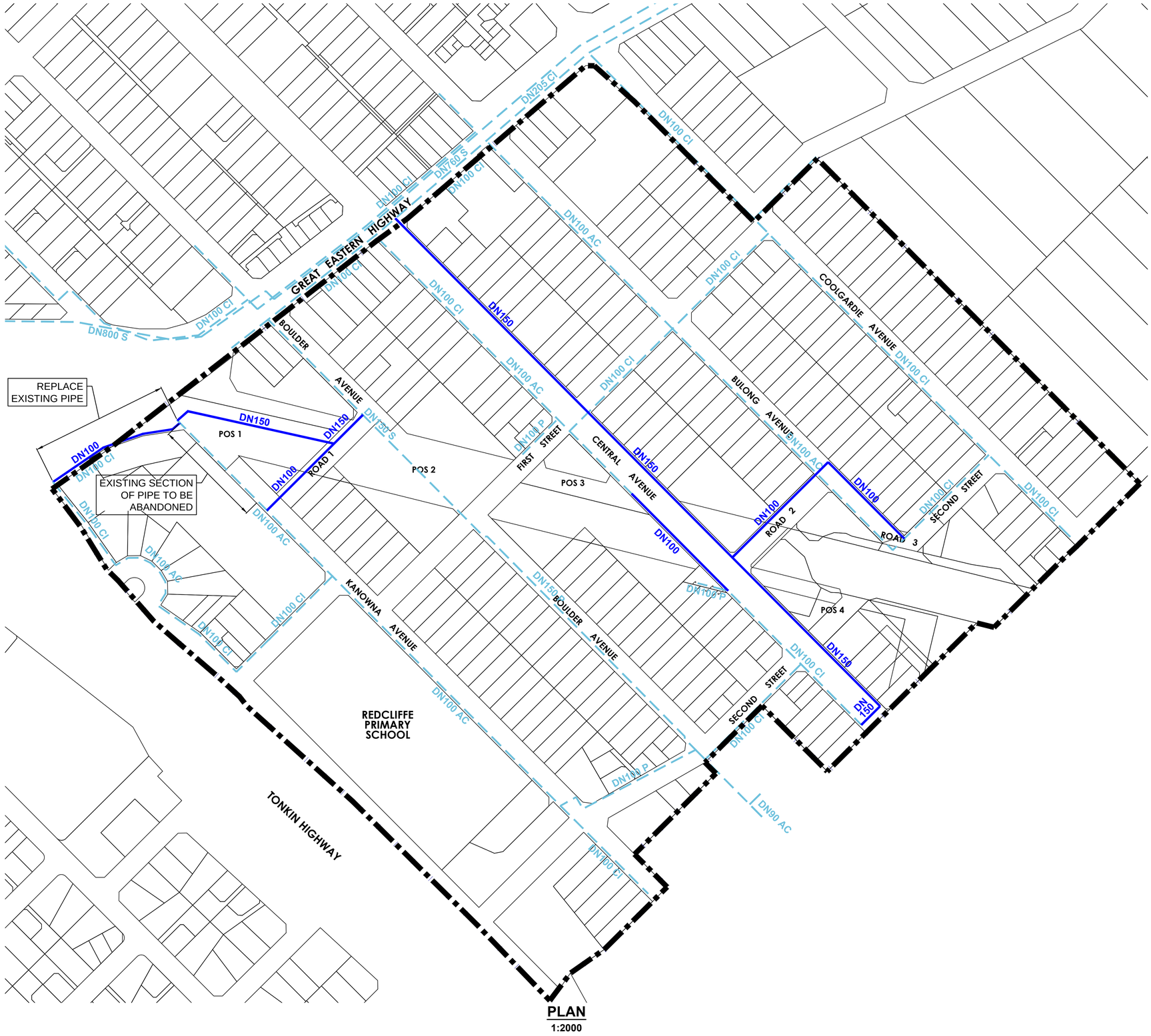
ISSUE B

TABEC
Civil Engineering Consultants
TABEC PTY LTD
ACN 090 796 204
14 Wickham Street, East Perth WA 6004
t 08 9425 5900 e info@tabec.com.au
www.tabec.com.au

SCALE N.TS.

A1

Plotted By: revans Plot Date: 10/10/19 - 16:39 Cad File: T:\Projects\2373\Design\CAD\Drawings\Sketches\2373-SK-004 Exist Sewer Upgrades.dwg




## LEGEND

- STRUCTURE PLAN AREA
- EXISTING WATER MAINS
- DN100 CI — PIPE SIZE & MATERIAL
  - CI CAST IRON
  - AC ASBESTOS CEMENT
  - S STEEL
  - P PVC
- PROPOSED WATER UPGRADE
- DN150 — PIPE SIZE (ALL PVC)

**PLAN**
1:2000

# City of Belmont - Development Area 6

## Water Upgrade Plan

DRAWING NUMBER 2373-SK-005-1

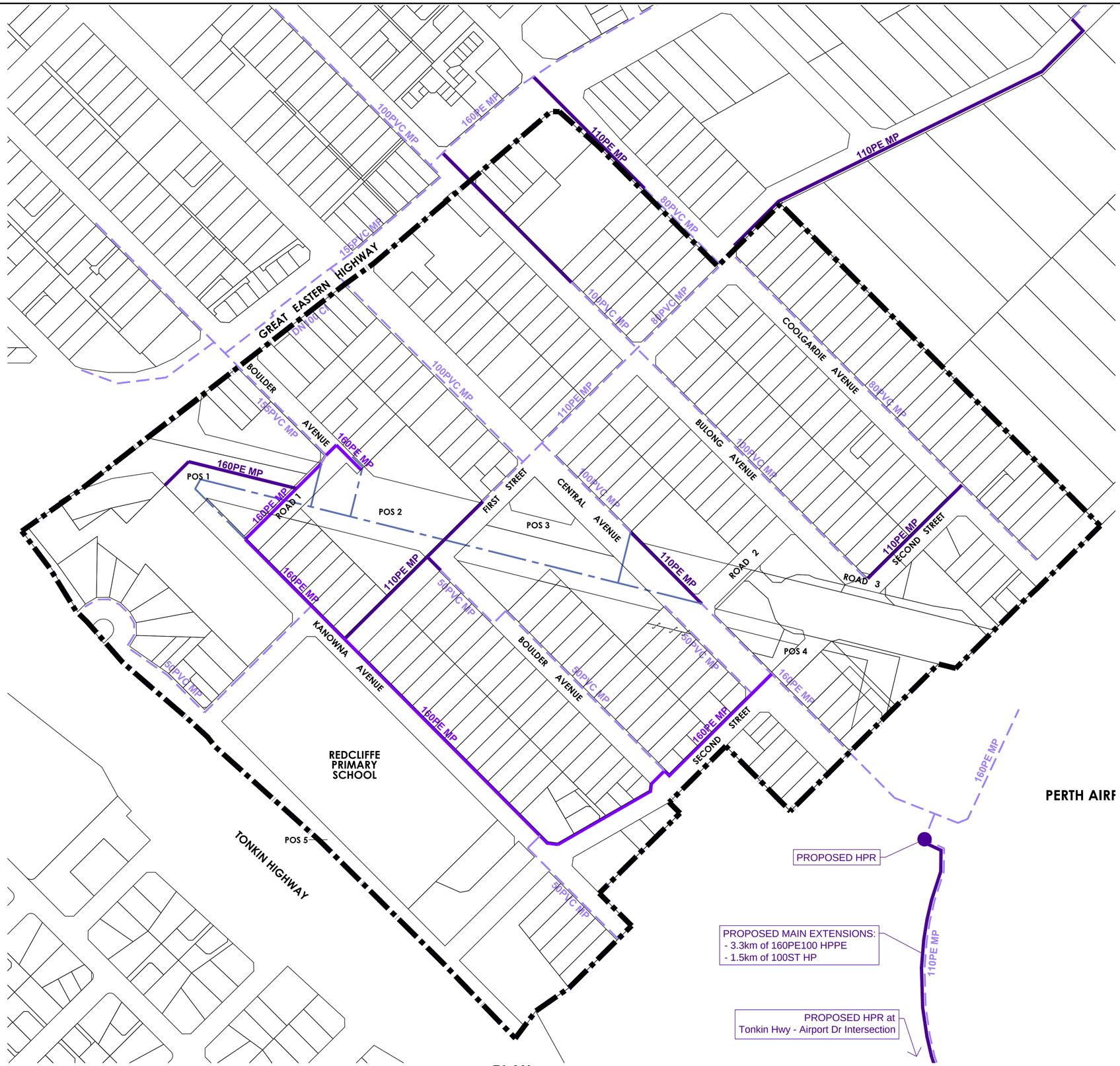
ISSUE C

SCALE 1:2000 (0, 40, 80, 120)

A1

TABEC Civil Engineering Consultants
TABEC PTY LTD
ACN 090 796 204
14 Wickham Street, East Perth WA 6004
t 08 9425 5900 e info@tabec.com.au
www.tabec.com.au

Plotted By: revans Plot Date: 10/10/19 - 16:40 Cad File: T:\Projects\2373\Design\CAD\Drawings\Sketches\2373-SK-005 Exist Water Upgrades.dwg




**PLAN**
1:2000

## LEGEND

- STRUCTURE PLAN AREA
- EXISTING GAS MAINS
- 110PE MP — PIPE SIZE, MATERIAL & PRESSURE
- PROPOSED GAS UPGRADE
- 110PE MP — PIPE SIZE, MATERIAL & PRESSURE
- EXISTING GAS TO BE REPLACED
- 110PE MP — PIPE SIZE, MATERIAL & PRESSURE
- EXISTING GAS TO BE DECOMMISSIONED

# City of Belmont - Development Area 6

## Gas Upgrade Plan

DRAWING NUMBER 2373-SK-009

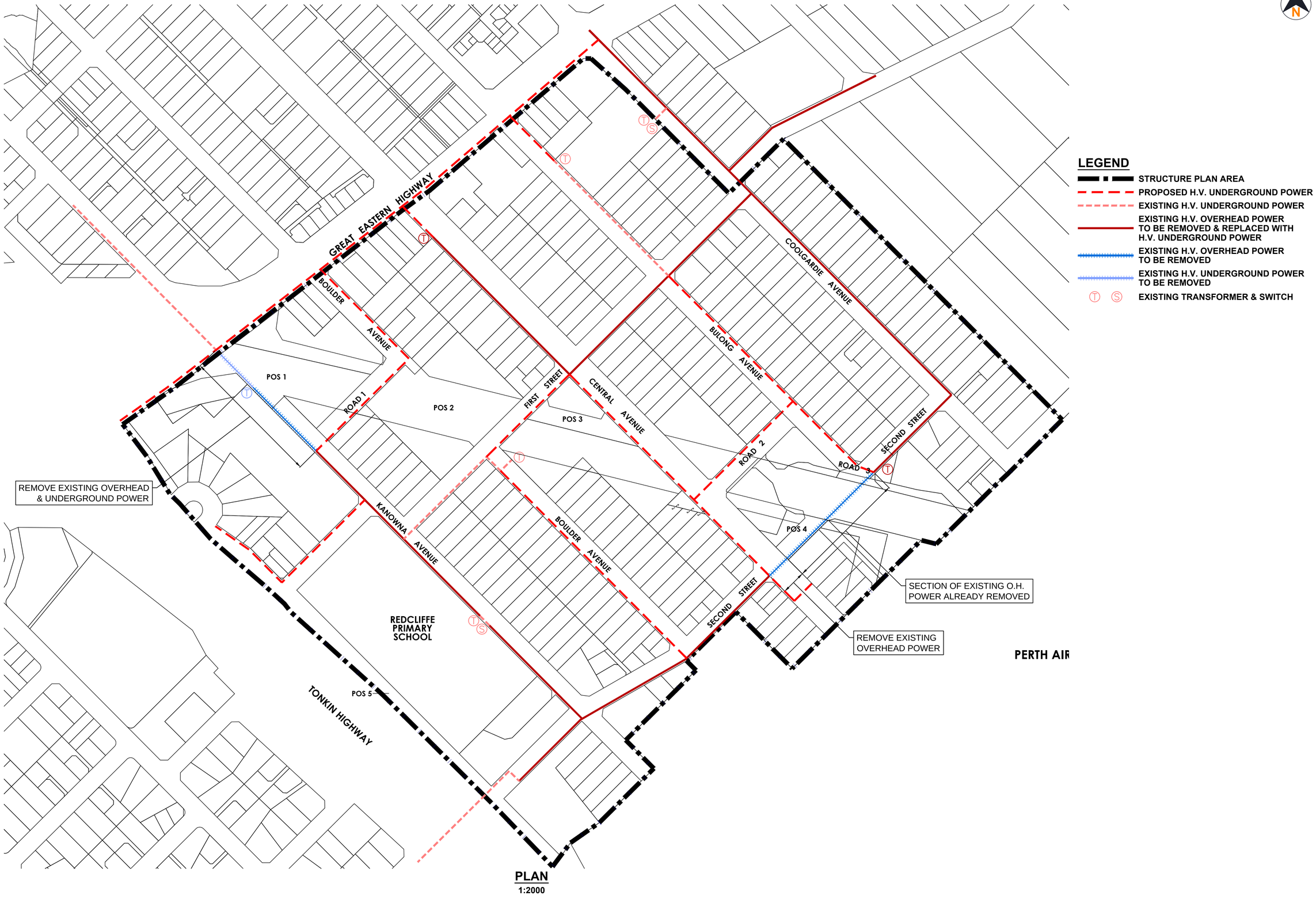
ISSUE B

SCALE 1:2000 — 0 40 80 120

A1

TABEC Civil Engineering Consultants
TABEC PTY LTD
ACN 090 796 204
14 Wickham Street, East Perth WA 6004
t 08 9425 5900 e info@tabec.com.au
www.tabec.com.au

Plotted By: ksharland Plot Date: 09/10/19 - 16:47 Cad File: T:\Projects\2373\Design\CAD\Drawings\Sketches\2373-SK-009 Exist Gas Upgrades.dwg




## LEGEND

- STRUCTURE PLAN AREA
- PROPOSED H.V. UNDERGROUND POWER
- EXISTING H.V. UNDERGROUND POWER
- EXISTING H.V. OVERHEAD POWER TO BE REMOVED & REPLACED WITH H.V. UNDERGROUND POWER
- EXISTING H.V. OVERHEAD POWER TO BE REMOVED
- EXISTING H.V. UNDERGROUND POWER TO BE REMOVED
- Ⓣ Ⓢ EXISTING TRANSFORMER & SWITCH

**PLAN**
1:2000

# City of Belmont - Development Area 6

## H.V. Power Upgrade Plan

DRAWING NUMBER 2373-SK-006

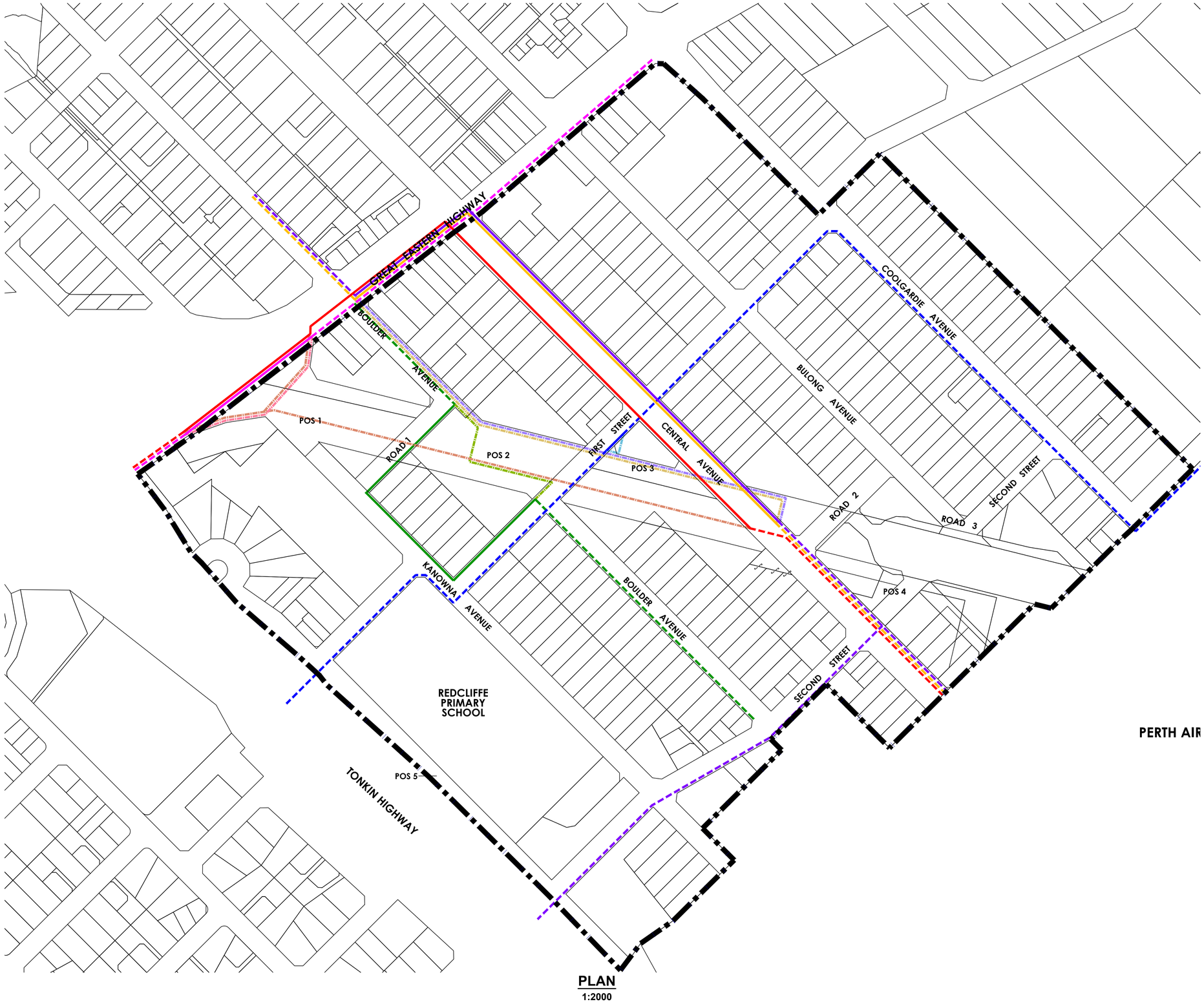
ISSUE B

TABEC Civil Engineering Consultants
TABEC PTY LTD
ACN 090 796 204
14 Wickham Street, East Perth WA 6004
t 08 9425 5900 e info@tabec.com.au
www.tabec.com.au

SCALE 1:2000 — 0 40 80 120

A1

Plotted By: kshartland Plot Date: 09/10/19 - 16:43 Cad File: T:\Projects\2373\Design\CAD\Drawings\Sketches\2373-SK-006 Exist Power Upgrades.dwg




**PLAN**
1:2000

## LEGEND

- STRUCTURE PLAN AREA
- EXISTING TELSTRA
- PROPOSED TELSTRA
- EXISTING TELSTRA - To Be Relocated
- EXISTING VOCUS
- PROPOSED VOCUS
- EXISTING VOCUS- To Be Relocated
- EXISTING NEXTGEN
- PROPOSED NEXTGEN
- EXISTING NEXTGEN- To Be Relocated
- EXISTING WP
- PROPOSED WP
- EXISTING WP- To Be Relocated
- EXISTING NBN Co
- PROPOSED NBN Co
- EXISTING NBN Co- To Be Relocated
- EXISTING OPTUS
- PROPOSED OPTUS
- EXISTING OPTUS- To Be Relocated

# City of Belmont - Development Area 6

## Communications Relocation Plan

DRAWING NUMBER 2373-SK-007

ISSUE B

SCALE 1:2000 — 0 40 80 120

A1

TABEC Civil Engineering Consultants
TABEC PTY LTD
ACN 090 796 204
14 Wickham Street, East Perth WA 6004
t 08 9425 5900 e info@tabec.com.au
www.tabec.com.au

Plotted By: ksharland Plot Date: 09/10/19 - 16:45 Cad File: T:\Projects\2373\Design\CAD\Drawings\Sketches\2373-SK-007 Exist Comms Relocation.dwg

# APPENDIX C ELECTRICAL & COMMUNICATIONS INFRASTRUCTURE & COST ANALYSIS REPORT

Development Area 6, Belmont

3E Consulting Engineers (March 2018)

PROJECT:

**DEVELOPMENT AREA 6 (REDCLIFFE)**

REPORT FOR:

**ELECTRICAL AND COMMUNICATION INFRASTRUCTURE AND COST ANALYSIS**

DOCUMENT NO: **3E18007-R-01**

CIVIL ENGINEERS:

**TABEC CIVIL ENGINEERING CONSULTANTS**

DOCUMENT PREPARED BY:

**3E Consulting Engineers Pty Ltd**
Tel: +61 8 6314 9000
Fax: +61 8 9325 3351

**Document History and Status**

| Revision | Date issued | Author | Reviewed by | Approved by | Revision Description |
|---|---|---|---|---|---|
| 0 | 15/03/18 | JH & BB | VH | DJ | For Review |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Distribution of copies**

| Revision | Copy no | Quantity | Issued to |
|---|---|---|---|
| 0 | Digital PDF | 1 | Tabec Civil Engineering Consultants |
| | | | |
| | | | |
| | | | |
| | | | |

# SECTION 1 INTRODUCTION

## 1.1 SCOPE, BASIS OF SERVICING ESTIMATES AND ASSUMPTIONS

We understand that the subject site is a portion of Development Area 6 (DA6), as defined by the City of Belmont's Planning Scheme No. 15. This portion is bound by Tonkin Highway, Great Eastern Highway, the Perth Airport's western property boundary and a line just east of Coolgardie Avenue, as shown on the City of Belmont's DA6 Vision Plan (May 2015).

We understand that the proposed re-development of this area consist of the construction of a new Public Transport Authority (PTA) train station "Airport West" station, the closure of Brearley Avenue, other road extensions and widening's, as well as other broader works to suit traffic flows, such as a new interchange on the Tonkin Highway. We also understand that re-development includes significant re-zoning of land that would allow much higher density and multi-level development for both residential and commercial purposes.

The zoning information and the related yield used in ths servicing estimates is as per information provided by the City of Belmont and Town Planner's Taylor Burrell Barnett. The summary of the yield is below, as it relates to this report.

| | **Yield – Floor space** | **Yield - Units** |
|---|---|---|
| **Residential Dwellings (~75m$^2$/unit)** | ~500,000 m$^2$ | 6,620 |
| **Commercial/Retail Floor Space (~120m$^2$/unit)** | ~32,000 m$^2$ | 267* |

*Refer to the detailed yield dimensioning for communications services in the communications section below.

This report assumes that desirable residential growth scenario yields are approved in the Development Application with commercial yields based on 120m$^2$ per unit. The proposed use of the sites is mixed between residential, commercial and retail.

It is understood that the existing properties would be acquired by independent developers, likely amalgamated in to super lots on which multi-storey buildings are then constructed. It's assumed that actual development will occur over a period of 20 to 30 years.

We understand that the order of the current residential dwellings is 250. The site also includes the Redcliffe School, the Maracoonda hotel and several commercial facilities, generally closer to the Great Eastern Highway.

This report shall provide information on the state of the existing electrical and communications networks within the subject site, including the capacity of the interconnecting or upstream networks. It shall then provide analysis of the effects of the proposed re-development on the networks, in terms of capacity and any reinforcement that may be required, as well as any asset relocations that may be applicable. Where applicable, it will provide options to address constraints, or to facilitate future development. Lastly, it will provide order of cost estimates for the proposed works.

# SECTION 2 ELECTRICAL SERVICES

## 2.1 EXISTING POWER NETWORK DISTRIBUTION

### 2.1.1 PHYSICAL NETWORK

The existing Western Power (WP) distribution infrastructure within the site comprises of a network which consist mostly of an aerial 22kV three phase aerial High Voltage (HV) and Low Voltage (LV) power lines. This includes three pole top transformers and several pole top HV fuse frames. There are four ground mounted substations, with short sections of associated underground power cables. As a minimum, the LV aerial network extends through the majority of streets, supplying the existing premises.

The power to the site appears to be from the nearby WP Belmont Zone (132kV/22kV) Substation (BEL), which is approximately 2.5km south west of the DA6 site, at the corner of Alexander Rd and Belgravia St. The HV network meanders through the area in between the Zone Substation and the DA6 site, servicing a large number of premises, before entering the site via Stanton Rd.

Through the site, the main HV network splits in two directions at Kanowna Ave East. One line heads north along Kanowna Ave East, exciting the site under the Great Eastern Highway, while the other continues along Second st and then Coolgardie st, before splitting and exiting the site at Redcliffe Rd and under the Great Eastern Highway again. There are several short HV spur lines from the main HV line, feeding transformers.

There is a WP communications network, consisting of an underground cable entering the under the Great Eastern Highway at Central Avenue and continuing along Brearley Avenue in to the Perth Airport's land. There is a junction on that cable near the intersection of Second street and Brearley Avenure, where the cable then runs along Second Ave and exits the site at Stanton Rd. Refer to Section 3 "Communication Services" for more detail.

### 2.1.2 NETWORK CAPACITY

**ZONE SUBSTATION CAPACITY**

Some information on the capacity of the nearby Zone Substations can be determined from Western Power's public Network Capacity Mapping Tool (NCMT). The following table summarises the available capacity at the time of writing, at 2026 and at 2036 (the limit of currently available forecasting information).

| Zone Substation | Available Capacity | | |
|---|---|---|---|
| | 2018 | 2026 | 2036 |
| Belmont (BEL) | 30+MVA | 30+MVA | 30+MVA |
| Morley (MO) | 20-25MVA | 20-25MVA | 20-25MVA |
| Hadfields (H) | 25-30MVA | 25-30MVA | 20-25MVA |
| Kewdale (KDL) | 30+MVA | 30+MVA | 30+MVA |

It is assumed that Western Power has not included the anticipated load of the DA6 re-development in its forecasting. Therefore, the load required for the re-development is assumed to come out of the listed spare capacity.

**HV FEEDER CIRCUITS**

The capacity of HV feeder circuits is typically in the order of 8MVA. As the HV network from the Belmont substation that supplies the DA6 site is shared with a large number of customers outside of the site, there is likely to be significant load on the network. The order of the load on the network is not known at the time of writing. Further information can be obtained on this by way of a Feasibility Study application to Western Power.

Please refer to extract of WP NCMT plans in the Appendix.

## 2.2 LIKELY ELECTRICAL LOAD

The load allocations are based on the listed types of development that are expected to be realised. For the residential component, the Western Power standard ADMD power allocation of 3.1kVA/unit for high density residential estates is used. For the commercial component, the AS3000 power allocations for retail (140VA/sqm) and office space (120VA/sqm) have been applied.

Based on the yield listed on in section 1 the contributions to the load are as follows:

| Load Type | Estimate Of Order Of Load |
|---|---|
| 6620 residential units | 20.5 MVA |
| 32,400 sqm | 4.2 MVA |
| TOTAL | 24.7 MVA |

Note that of the areas being redeveloped that there are existing dwellings and facilities, and so some existing load allocation to the site exists, supplied from existing infrastructure. The broad estimates of the order of the existing load are as follows:

- Residential: ~1MVA
- Commercial: ~1MVA

Therefore the total existing demand is anticipated to be in the order of 2MVA. Note that this excludes existing facilities that are anticipated to remain, such as the school. A power supply for the Airport West train station may in the process of being provisioned, but would not be significant in terms of the order of total load of the ultimate development.

As the existing residential load will be disconnected as part of the re-development, the total increase in power demand is therefore anticipated to be in the order of 23MVA.

## 2.3 LIKELY POWER SUPPLY SCENARIO

### 2.3.1 ELECTRICAL NETWORK WITHIN DA6 SITE

**INITIAL ASSET RELOCATIONS**

Any entity or agency that requires that WP assets are relocated or removed, whether above ground or below ground, will be responsible for the costs for WP to do so.

The proposed construction of the Perth Airport train station, and the closure of Brearley Avenue and other road reserves, will force some significant relocations of existing Western Power assets. The main areas identified are described below.

***Train Station Area***

The train station intersects the main HV aerial network line along Second st, as well as a section of both of the WP communication cable runs. New underground cables will need to be installed along new routes to replace both of these affect networks. The train station as well as the proposed road works to connect Bulong Ave and Second st will require that an existing pole mounted transformer be removed and replaced with a new ground mounted substation consisting of a HV Switchgear unit and a 22kV/415V transformer. With the train station works underway, and from recent DBYD maps from WP, it appears that the process to modify the existing network, as described here, has already commenced.

***Brearley Ave***

The closure of the remainder of the Brearley Avenue road reserve will require the relocation of the existing WP assets within that road reserve. The network predominantly consists of LV network and street lighting. The street lighting would be removed, and the LV network would need to be modified to maintain supplies and interconnectivity. The LV network removed from Brearley Ave would likely introduce the need for new LV link across the new road reserve of Road 2. This means that the availability of that road reserve would be a constraint on the closure of Brearley Ave and the associated asset relocation.

***Kanowna Ave***

There is an existing HV cable link under the Great Eastern Highway, in line with Kanowna Ave, linking the aerial network along Kanowna Ave East within the site and Kanowna Ave West, outside of the site. The land above this cable route is earmarked for development, and so the cable will be required to be re-routed along the new road reserves, likely Road 2 & Boulder Avenue, to maintain that HV link. This means that the availability of these new road reserves are a possible constraint on the development of the land in the area.

A sketch showing the existing HV network, with the key asset relocations highlighted, is included in the appendix of this report. An indicative order of costs estimate for the works is included in the cost estimate section.

**UNDERGROUND CONVERSION OF EXISTING HV & LV NETWORK**

It's likely that the existing aerial power network throughout the site will need to be converted to a new underground network. This is anticipated to be required to facilitate development in terms of the capacity of the electrical network. There may also be cause to underground the aerial network due to clashes between the poles and wires and the proposed works or for aesthetic reasons. The City may opt to complete this underground conversion in advance to facilitate the future development. The costs to do so may be included in any development contribution fund, although we understand this is not typical practice. The City would more likely opt to allow this to be completed in an incremental fashion by the ultimate developers. If the City is funding works that cause the underground conversion works, such as drainage works, or new roundabouts etc, the costs will be the responsibility of the City.

If the overhead to underground power network conversion where to occur while the existing residences are still standing and connected, the existing aerial network would need to be replaced with a new underground cable network, which closely mimics the existing network. To replace the existing pole top fuse frames and transformers, new ground mounted substations (HV switches and transformers) will be required. Power pillars will be installed to allow each premise to access the new underground power network. The connection from the premise to the power network will need to be converted to a new underground consumer cable, connecting to the new power pillar. New free standing street light poles will need to be

installed to replace the existing lighting mounted to the existing power poles. This will be to the specification of the City of Belmont and AS1158. An indicative order of costs estimate for the works is included in the cost estimate section.

**ULTIMATE NETWORK THROUGH DEVELOPMENT AREA**

***HV NETWORK UPGRADES***

The HV network will also require reinforcement and extension, to provide suitable access to power for the ultimate development. Generally, it's envisaged that the City would not be responsible for this and that this would be the responsibility of the ultimate developers.

The detailed layout of the ultimate HV network will likely be determined in more detail during a further planning phase of this project, in conjunction with Western Power.

There are sections of the development area that do not have access to HV power, and the network will need to be extended to these areas, including existing roads without HV network, as well as any new road extensions. In Addition to this, there will be some significant reinforcing of the HV network throughout the site, to create HV ring networks with sufficient redundancy to provide a suitably reliable power supply to all connections.

A re-zoning process does not bring with it the need to install or upgrade WP infrastructure to provide a supply. So, the City would not be obligated to install a new underground HV network through the site. The costs to do so may be included in any development contribution fund, although we understand this is not typical practice. Developers will generally be required, for technical reasons, and through the WAPC process for creating titled lots, to provide HV infrastructure in the immediate vicinity of their development, and also outside of their site to facilitate an appropriate connection to the existing network. Western Power's "HV pool" provides refunds to Developer's, for HV materials installed for residential developments that meet certain conditions.

A broad concept of the ultimate HV network is included in the appendix of this report An indicative order of costs estimate for the works is included in the cost estimate section, which are most likely to be shared across all of the eventual developer's. This includes a broad estimate on the number and type of transformer substations that will be required to supply the load at the buildings.

***EXTERNAL HV SUBSTATION LOCATIONS***

HV Switchgear substations that are required for the backbone HV network (district substations) will be installed outside, in the advance of any buildings, and will be located strategically throughout the development. District transformer substations that supply multiple smaller buildings, streetlights and other general services will also be located outside, in advance of the buildings. Dedicated (sole-use) substations that feed larger buildings may be located within the building, and would then only be installed once the building is nearing completion.

The preference for locating new external ground mounted substations would be on Public Open Space (POS) lots to avoid affecting an existing private property. This cannot always be achieved as POS space may not be available, or due to the location of the substation needing to meet particular technical requirements.

It is recommended that a HV concept plan, which aims to plan the locations of these units in conjunction with all relevant parties, is completed as part of further planning for the re-development of this site.

District substations are required to be setback behind property lines, in a road reserve extension in to that lot. Typical land requirements for HV substations are as follows (the units are approximately 1.6m – 1.8m tall):

- HV Switchgear and transformer 6.2m (W) x 4m (D)
- Transformer only 3.7m (W) x 4m (D)
- Switchgear only 4.5m (W) x 3m (D)

**LIGHTING FOR NEW ROADWAYS OR UPGRADES TO ROADS**

All newly created or upgraded roadways (including roundabouts) will require new lighting to satisfy the specification of the City of Belmont and AS1158.

The lighting could consist of standard or decorative Western Power lighting poles, or if the Local Government preferred, “privately” (Local Government) owned lighting, where any range of suitable lighting products could be utilised, opening up the opportunity to use broader technologies and strategies, including:

- Architectural lighting poles and luminaires.
- High efficiency and low glare LED luminaires.
- Multi-technology poles, including banner mounts, CCTV cameras and power outlets.
- Time based, light level and motion detection controlled lighting operation and output levels
- Incorporating other Internet of Things (IoT) type technologies.

### 2.3.2 HEADWORKS REQUIRED TO SUPPLY ESTIMATED LOAD INCREASE

**ZONE SUBSTATION CAPACITY**

According to the WP NCMT, the Zone substations listed above have spare sufficient capacity to service the estimated load of the development. Therefore no works are envisaged to augment the capacity at any Zone substations to service the development.

**HV FEEDER NETWORK**

WP typically limits the load on their HV networks to 8MVA. As the load on the existing HV network that feeds the site is not known, it’s unknown how much of the additional load can be placed on to the existing network. With an estimated load increase in the order of 23MVA, it’s likely that three new dedicated HV feeders will be required. The feeders will most likely emanate from the Belmont (BEL) and/or Hadfields (H) Zone Substations and each would terminate at a HV switchgear unit within the DA6 site, although this is subject to advice from WP. The length of the cable route of a feeder from the Belmont substation is estimated to be in the order of 3.5kms, while the cable route from the Hadfields substation is estimated to be in the order of 4kms. This is diagrammatically shown in a sketch in the appendix of this report. The cable routes are be determined during a detailed design phase, most likely by Western Power. Where two HV feeder cable circuits emanate from one zone substation, they will be required to utilise differing routes, to reduce the risk that both are damaged by a single event.

Further clarification on the load on the existing network, can be obtained from Western Power through a WP feasibility study.

**RESPONSIBILITY FOR COSTS TO AUGMENT WP HV FEEDER NETWORK**

It's our understanding, that under current WP policy that additional load requests below 1.5MVA are treated as underline (or natural) load growth. Under this policy, WP will augment the network at its own cost to support natural load growth.

With the ultimate build out potentially being beyond 2031, and assuming the first load increase occurs in 2016, there is a minimum of 15 years over which the load growth will occur.

WP charge for network augmentation to provide capacity on a per-application basis. The City of Belmont's involvement in the load increase, as we understand, will be limited to re-zoning of the subject land to allow for others to complete the actual development of living units or commercial floor space. So the City will not necessarily be the applicant who WP seek to charge for the augmentation costs.

There are three likely scenarios. The first scenario is, if development occurs by a number of independent developers, each with load below 1.5MVA, over the 15 years or more, then it's likely that Western Power would cover the network augmentation costs as mentioned above.

The second possible scenario is, if a single developer chose to complete a single significantly large development, or multiple medium sized developments a short time apart, then WP may nominate that developer as the responsible party for the augmentation costs. The parameters for a developer becoming the responsible party, we understand, would be a load of 1.5MVA, in a period of 1 – 2 years.

The third possible scenario is if two or more independent developers are completing medium sized developments within a short time of each other, such that they also exceed the 1.5MVA parameter within 1 – 2 years in combination, then WP may advise all the current developers that they will need to contribute to the HV network augmentation works, on a cost sharing basis. WP refers to this as a Competing Access Group (CAG).

The City might view the second and third scenarios as undesirable, if these costs restrict development. As such, the City may then choose to fund the augmentation works as to allow continued development in the area, without the burden of the costs for the HV upgrade works. The costs for this may be recovered through a development contribution fund, although we understand this is not typical practice.

**RESERVED CAPACITY IN NEW NETWORK**

It should be noted that WP do not reserve the spare capacity of any new network for the party that funded the works. Once the new network is installed to provide the load of the current application(s), it is then just seen as part of the broader network, available for anyone who applies to access. This shouldn't have an impact for this project, as the route of the dedicated HV feeder cable is most likely contained within the City of Belmont, through already built up residential areas.

## 2.4 POWER WORKS TIMELINES

The timelines for Western Power design and construction works depend on the complexity. Design and approval timeframes can vary from 1 to 6 months. Construction works would be at least 10 weeks, but could be many months for large and complex projects.

## 2.5 ELECTRICAL SERVICES COST ESTIMATES

### 2.5.1 COST ESTIMATES

Our very early order of probable cost estimates for power networks to service the development, separated in to phases or components, is as follows:

| Component | Cost |
|---|---|
| **INITIAL ASSET RELOCATIONS** | |
| Train Station | $500k |
| Brearley Ave | $250k |
| Kanowna Ave | $250k |
| **TOTAL** | **$1M** |
| **UNDERGROUND CONVERSION OF EXISTING HV & LV NETWORK** | **$6M** |
| **ULTIMATE NETWORK THROUGH DEVELOPMENT AREA** | **$12M** |
| **HV FEEDER NETWORK** | **$10M** |
| **GRAND TOTAL OPC** | **$29M** |

### 2.5.2 QUALIFICATIONS AND EXCLUSIONS

We confirm that the budgets presented are indicative only. If the reader intends to use these costs for financial purposes they should be satisfied that they are adequate. 3E Consulting Engineers does not accept liability or responsibility for their interpretation or use.

All cost in todays' dollars, all design costs and GST excluded.

With respects to the power headworks implications for the site, we have allowed for estimating the headworks implications based on the information available and we would have to qualify our estimates on this basis. More certainty with respect to Western Power capacity, implications and costs could readily be determined by the application to and provision of a Design Information Package or Feasibility Study from WP.

# SECTION 3 COMMUNICATION SERVICES

## 3.1 EXISTING NETWORK

### 3.1.1 AIRPORT WEST TRAIN STATION

Although most current versions of DBYD do not show communications networks relocated, we understand that affected networks have been relocated, in the vicinity of the proposed new train station. Networks that have been relocated are:

- Telstra
- Vocus (note that Vocus have now acquired ownership of Amcom and Nextgen but Nextgen yet to be fully integrated in the business and so will be treated separately from the purposes of relocations)
- WP
- Nextgen

See DBYD attached for all carriers attached.

### 3.1.2 BREARLEY AVE

Communications assets affected by the closure of Brearley Ave are:

- Telstra – Road 1, POS 1 and 2, Areas 5 and 19
- Vocus – may be some remaining assets to be cleared off Brearley Ave
- WP – Airport West relocation did not avoid area 21, so relocation required again. Also affects Area 19 and POS2
- Nextgen – would be shifted with WP assets, since they affect Area 21
- NBN Co – In the process of acquiring Telstra copper cable distribution assets under their Brownfields Rollout. However, Areas 5 and 19 and POS1
- Optus – only affected near the intersection of Brearley Ave and Great Eastern Hwy

### 3.1.3 REMAINDER OF DA6

Communications assets affected by the development of DA6 are:

Telstra – raising required for the northern part of the network – primarily pit and pipe

- POS 1 and 2. Area bounded by Great Eastern Hwy, First St, Boulder Ave, Road 1?

NBN Co – raising required for the northern part of the network – primarily cable
Nextgen – Boulder Ave to be raised
WP – Boulder Ave to be raised

### 3.1.4 EXISTING NETWORK CAPACITY

The most significant communication assets in DA6 route down part of Brearley Av and cross Brearley Ave, at the intersection of Great Eastern Hwy - as listed below:

**CROSSING BREARLEY AVE, ON GREAT EASTERN HWY**

| Telstra | Optus | NBN Co |
|---|---|---|
| 7xP100 + 1x P80<br>1000 PIUT<br>600 PIUT<br>312 SMOF<br>144 SMOF<br>72 SMOF<br>72 SMOF<br>72 SMOF<br>12 SMOF<br>100/0.64 PIUT<br>100/0.64 PIUT<br>1200/0.64 PIUT<br>2xP35 subducts | Assume leasing<br>Telstra ducts<br>Assume 144 SMOF | Assume leasing<br>Telstra duct<br>Assume 288 SMOF |

**ON BREARLEY AVE**

| Telstra | Vocus | Nextgen | Western Power |
|---|---|---|---|
| 2x A100 or 2xP100<br>300/0.64<br>300/0.64<br>300/0.64<br>120 SMOF<br>60 SMOF<br>6 SMOF<br>2xP35 subducts | Assume 1xP100<br>Assume 48 SMOF | (leasing WP duct)<br>12 SMOF in WP cable | P80<br>Assume 144 SMOF |

Telstra currently services DA6 from its Ascot Exchange on Hardy Rd, ranging from 2 -> 3.5 Km to the west. Telstra distribution network radiates out from two pillars (P23 and P13), located on Great Eastern Hwy, so works internal to DA6, apart from Brearley Av, would only affect the extremities of the Telstra network, minimising the cost impact. Telstra assets on Great Eastern Hwy are extensive and are located on both the north and south sides of the road. Telstra pipe and cable capacity on internal streets of DA6 would have limited potential to support growth and in one instance cable is direct buried. Prior to the NBN Co Brownfields Rollout the Telstra distribution network serviced the majority of home and businesses in DA6.

NBN Co would by now have acquired Telstra's distribution cable assets and most likely hauled SMOF to its nearest Fibre Access Node (FAN) – possibly at the Bassendean Telstra exchange. Inter-FAN and inter-POI SMOF may also be present on the Great Eastern Hwy route. NBN Co's DBYD record is silent on such assets.

## 3.2 RELOCATION OF ASSETS

We understand that relocations adjacent to the Airport West Train Station have already taken place, due to the commencement of construction of the new station. Carriers networks on other portions of Brearley Ave could be retained, until super lots encroaching on them forced relocation, but it would be much more efficient to relocate all assets out of Brearley Ave and any other road affected by the development proposal, in the short term, to permit orderly development. To do otherwise, would result in multiple prohibitive relocation costs.

Telstra, NBN Co and WP now charge for relocation quotes to be prepared. The option of relocating on Brearley Ave, is no longer practical, given the proposed footprint of the high rise buildings and storm water control. Relocation estimates below have been revised on the basis of more current information.

It is now clear that all remaining communications assets on Brearley Ave will require relocation. Since that the communications assets affected by the construction of the Airport West Train Station have occurred, it just remains to relocate residual assets on Brearley Ave. To avoid repeat relocations, we recommend shifting all assets off Brearley Ave and on to future or existing road reserves that are being retained in the long term – see Communications Relocations Plan attached. Whilst Telstra most would most likely prefer to route the west to Brearley Ave, to minimise attenuation for its remaining copper based point to point services, that is probably not possible, given the proposed road layout. Therefore, relocating down Central Ave, then back along Great Eastern Hwy to the west may be the only viable option. We estimate relocation costs to be of the following order or magnitude but actual quotes would need to be sought from individual carriers:

| **Brearley Av Comms Network** | | |
|---|---|---|
| **Affected Network** | **Proposed relocation** | **Relocation Cost ($K)** |
| **Telstra** | | |
| Crossing Brearley Av at Great Eastern Hwy | Straighten route to avoid truncations | 2,300 |
| On Brearley Ave, west of Airport West Train Station | Reroute via Central Ave to Great Eastern Hwy | 1,500 |
| | | |
| **Vocus** | | |
| Across Brearley Ave between Central Ave and First St | Relocate to remove dog leg on POS3 | 100 |
| | | |
| **Nextgen** | | |
| On Brearley Ave, west of Airport West Train Station | Reroute via Central Ave to Great Eastern Hwy | Under WP relocation |
| | | |
| **Optus** | | |

| | | |
|---|---|---|
| Crossing Brearley Av at Great Eastern Hwy | Straighten route to avoid truncations | 50 |
| | | |
| **Western Power** | | |
| On Brearley Ave, west of Airport West Train Station | Reroute via Central Ave to Great Eastern Hwy | 100 |
| | | |
| **NBN Co** | | |
| Possible inter-network route Crossing Brearley Av at Great Eastern Hwy West Train Station | Straighten route to avoid truncations Eastern Hwy | 200 |
| **SubTotal** | | **4,330** |

| **Network within DA6, other than on Brearley Av** | **$K** |
|---|---|
| **Proposed road extension works, for the establishment of super lots** | |
| | |
| **Telstra** | |
| Raising of network associated with storm water control | 80 |
| | |
| **NBN Co** | |
| Raising of network associated with storm water control | 120 |
| | |
| **Domestic Airport** | |
| Decommissioning of Terminal and Equipment Recovery | 300 |
| | |
| **SubTotal** | **500** |

**General Notes and Assumptions regarding Relocations**

- Telstra will replace network like for like – including both duct and subduct, regardless of whether or not the old network was built to current standards. Note that fibre will require replacing from Fibre Access Point (FAP) to nearest FAP, therefore the replacement may extend beyond the development boundary. New fibre enclosures will generally not be introduced as that will detrimentally affect the available optical power budget, the transmission design capability on the route or compromise the transmission capacity of existing systems. Also copper cable would normally be run from existing joint to existing joint
- Telstra and other carriers will only quote for the impact of relocations on existing assets. Cables hauled or ducts installed, subsequent to this report, would be the subject of additional relocation costs
- No major level changes within DA6, apart from on First St and Bulong Av, that affect communications assets on Brearley Av or elsewhere
- Great Eastern Hwy upgrades excluded from analysis
- All assets on old Brearley Av being relocated, except for those on existing or proposed roads reserves that cross Brearley Ave

- Common trenches not provided by Developer and allowance for individual trenching for each carrier on the basis that all alignments are unknown at this point in time
- Existing asset alignments will be required to properly assess the need and cost of relocation
- The presence of asbestos conduits or pits on this route may impact the cost of Telstra's relocation
- Carriers and utilities relocation costs are generally non negotiable
- No allowance made for cutover to Consolidated Terminal or provision of comms to Consolidated Terminal
- All costs exclude GST

## 3.3 PROPOSED NBN COMMUNICATIONS

### 3.3.1 Yield for Communications

We now understand that that the City of Belmont are considering the rezoning of DA6 to permit much higher density and multi-level development for both residential and commercial purposes. The scope of this redevelopment is understood to comprise 37 high rise buildings, with a potential communications yield as follows:

| Residential Dwelling Units (75m$^2$ av) Built Strata | Commercial Units (120m$^2$ av) Built Strata | Commercial Floor space (m$^2$) | Lift and Fire Services | Total Services |
|---|---|---|---|---|
| **6,620** | **275** | **31,919** | **74** | **6,969** |

This report assumes that proposed residential growth scenario yields are approved in the Development Application. Commercial yields have been based on 120m$^2$ per unit.

### 3.3.2 Telecommunications Policy, Technology, Charging and Costs

The NBN Co Brownfields Rollout for DA6 is currently in the build phase and was expected to be completed by the end February 2018, although NBN Co's Rollout map has yet to be updated to indicate that the network is in service. Regardless, NBN Co's wholesale broadband network will be in service in the immediate future, with technology being Fibre to the Node (FTTN).

Given that the area is within NBN Co's fixed line footprint and the Brownfields Rollout is under way, NBN Co must accept responsibility for providing infrastructure, should the Developer/s wish to engage them. If so, it is likely that Fibre to the Premises (FTTP) technology would be delivered, resulting in high speed broadband being available to all premises. Even if DA6 were developed incrementally, one lot at a time, with lower yields than currently proposed, NBN Co would continue to deploy FTTP technology. Now that the

NBN Co Brownfields conversion is in progress, Telstra would not accept IPOLR responsibility for development of DA6.

Under the Telecommunications Act 1997, Developers have the responsibility to provide fibre ready pit and pipe at their expense for new developments. Under recent changes to Federal Government policy for new developments, Developers are now also responsible for the cost of infrastructure. Should NBN Co decide against servicing the new development with fibre, the Coalition government have two policy initiatives that could permit fibre to be extended to the development – Fibre on Demand and Co-Funded Fibre. NBN Co have established a number of Points of Interconnect (POI) within the Perth Metro from which Retails Service Providers can deliver a range of services and content. It is likely that DA6 would be serviced from the POI in the Telstra Bassendean exchange. Unit owners would most likely have access to 59 Retail Service Providers, who operate on the NBN Co wholesale network, giving them a wide range of choice for product offerings.

NBN Co recover two infrastructure charges, Deployment and Backhaul Charges, from Developers. Assuming no single residential development occurred in DA6, Deployment charges of $400/multi dwelling unit premise would apply. Backhaul Charges would most likely be calculated to the nearest Fibre Access Node, which we understand is located at Bassendean Exchange. Total costs over the life of the project would be:

| NBN Co Charges | Premises | Deployment Charge ($K) | Backhaul Charge ($K) | Total ($K) |
|---|---|---|---|---|
| Residential -strata | 6,694 | 2,678 | 69 | 2,747 |
| Business - strata | 324 | 130 | 0 | 130 |
| **Total** | 7018 | **2,808** | **69** | **2,877** |

The Backhaul Charge would be recovered from the Developer of the super lots and the Deployment Charges from the Developers of the built form. These charges would be recovered from individual Developers. If DA6 were to be serviced with FTTP, under the Definite Agreement, Telstra must disconnect all existing telephony and broadband services on its copper network, once an area is declared NBN fibre ready. Following FTTP conversion, Telstra is unable to use the existing copper network for telephony and broadband, for 20 years, except where the NBN network is unavailable. The copper network can be utilised for point to point services. Telstra must utilise the NBN wholesale network for telephony and broadband, for the next 20 years.

NBN Co no longer install Fibre Distribution Hubs (FDH), since they have adopted a more economical skinny fibre architecture, which relies on optical splitters being installed in underground joint enclosures. FDH's were generally the only above ground device to be installed within Greenfields developments and were usually installed on road verge. It is likely that the 37 high rise buildings will be serviced with Premises Distribution Hubs (PDH's). PDH's are installed internal to buildings and would require a communications room or equivalent. The PDH does not require 240V AC power, since it forms part of the passive optical fibre network. Several of the larger buildings will require multiple PDH’s.

All Retail Service Providers can provide telephony and broadband on the NBN Co wholesale FTTN or FTTP network. Note that Telstra have the First Right of Refusal to provide point to point fibre, under the Definitive Agreement with NBN Co. Telstra exercise their right, where commercially attractive.

NBN Co support Third Party design and construction of pit and pipe and the costs below specify expected pit and pipe construction for the servicing of the super lots:

| **NBN Pit and Pipe Construction** | **$K** |
|---|---|
| External Street network | 620 |
| **Grand Total** | **620** |

Assumptions & Exclusions:

- All cost in todays' dollars, all design costs and GST excluded, expect for NBN Co charges which include GST.
- New NBN pit and pipe network installed throughout and network not leased off Telstra
- An open trench is available for installation of pit and pipe
- New NBN network for the redevelopment would normally be installed on the 0.9m alignment
- Costs of servicing, internal to the built form have been excluded
- Backhaul Charge estimated by NBN Co

### 3.4 SUMMARY OF COMMUNICATIONS COSTS

| | **($K)** |
|---|---|
| Brearley Ave Relocations | **4,330** |
| Other DA6 Relocations | **500** |
| Pit and Pipe Construction | **620** |
| NBN Backhaul Charge | **69** |
| NBN Deployment Charges | **2,778** |
| **Grand Total** | **8,297** |

# APPENDIX 1 – ELECTRICAL

# NCMT - HV Network

SK-E-01 v1 28-02-18
EXISTING HV NETWORK WITH LIKELY RELOCATION WORKS

HV EXITS SITE

NOTES:
1. GENERALLY, THE EXISTING NETWORK CONSISTS OF OVERHEAD POWERLINES.
2. THE ULTIMATE DEVELOPMENT WILL REQUIRE CONVERSION OF THE NETWORK TO AN UNDERGROUND POWER NETWORK, WITH SIGNIFICANT UPGRADE TO PROVIDE AN ADEQUATE SUPPLY TO ALL CONNECTIONS WITHIN THE DEVELOPMENT.

HV EXITS SITE

DEVELOPMENT IN THIS AREA WILL REQUIRE ASSET RELOCATION

ROAD CLOSURE WILL REQUIRE ASSET REMOVAL/RELOCATION (LV AND STREET LIGHT ASSETS NOT SHOWN HERE)

HV EXITS SITE

ROAD CLOSURE & TRAIN STATION CONSTRUCTION WILL REQUIRE ASSET RELOCATION

INCOMING HV FROM BELMONT ZONE SUB

2/1/2018, 3:51:36 PM

**High Voltage Distribution Lines : WP-003**

- HVOH 3Ph
- HVUG 3Ph
- Ex. PADMOUNT HV SWITCH
- Ex. PADMOUNT TRANSFORMER
- Ex. POLE TOP HV FUSE
- Ex. POLE TOP TRANSFORMER

1:5,000

0 0.0475 0.095 0.19 mi
0 0.075 0.15 0.3 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

Plans printed from the Network Capacity Mapping Tool (NCMT) are indicative only and are not to be used for "Dial Before You Dig" purposes. NOT ALL UNDERGROUND ASSETS ARE SHOWN.

SK-E-02 v1 28-02-18
INDICATIVE ULTIMATE U/G HV NETWORK CONCEPT

EXISTING HV CONNECTION

POSSIBLE NEW HV CONNECTION

EXISTING HV CONNECTION

EXISTING HV CONNECTION

POSSIBLE NEW HV CONNECTION

EXISTING HV CONNECTION

LEGEND

- STRUCTURE PLAN AREA (49.0907ha)
- MIXED USE
- RESIDENTIAL
- LOCAL OPEN SPACE
- PRIMARY SCHOOL
- STATION INFRASTRUCTURE
- PRIMARY REGIONAL ROAD
- MAXIMUM BUILDING HEIGHT AS PER VISION & IMPLEMENTATION STRATEGY
- RAIL TUNNEL CONSTRAINTS (PTA)
  - 45 Kpa
  - 75 Kpa
  - 180 Kpa
- TUNNEL ALIGNMENT

GREAT EASTERN HIGHWAY
BOULDER AVENUE
ROAD 1
ROAD 2
FIRST ST
CENTRAL AVENUE
KANOWNA AVENUE
BOULDER AVENUE
COOLGARDIE AVENUE
BULONG AVENUE
ROAD
SECOND STREET
SECOND STREET
TONKIN HIGHWAY

1 13 Storeys 1.0185ha
2 6 Storeys 7907m²
3 8 Storeys 9425m²
4 8 Storeys 3261m²
5 13 Storeys 5056m²
6 8 Storeys 4183m²
7 13 Storeys 5923m²
8 8 Storeys 5612m²
9 8 Storeys 1.0790ha
10 13 Storeys 8085m²
11 6 Storeys 9741m²
12 6 Storeys 8906m²
13 13 Storeys 6392m²
14 6 Storeys 1.2875ha
15 6 Storeys 6180m²
16 8 Storeys 9511m²
17 3 Storeys 1.6354ha
18 6 Storeys 1.5756ha
19 13 Storeys 1.0603ha
20 6 Storeys 9536m²
21 13 Storeys 1.3943ha
22 13 Storeys 8097m²
23 8 Storeys 1.7680ha
24 6 Storeys 1.6175ha
25 6 Storeys 2.8789ha
26 3 Storeys 3219m²
27 6 Storeys 3221m²
28 8 Storeys 1.1692ha
29 6 Storeys 3356m²
30 13 Storeys 3542m²
31 13 Storeys 6458m²
32 13 Storeys 2935m²
33 13 Storeys 1994m²
34 13 Storeys 4839m²
35 13 Storeys 4133m²
36 13 Storeys 2571m²
37 8 Storeys 5648m²

POS1 5697m²
POS2 1.2534ha
POS3 3757m²
POS4 5581m²
POS5 0.5073ha

REDCLIFFE PS OVAL 1.5154ha
REDCLIFFE PRIMARY SCHOOL 1.7470ha

1.2871ha

NOTES:
1. HV SUBSTATIONS ARE NOT SHOWN HERE AND THE LAYOUT OF SUBSTATIONS SHALL BE DETERMINED DURING FURTHER DETAILED DESIGN PHASES OF THE PROJECT.
2. THE CABLE LAYOUT SHOWS THE ROUTE ONLY, THE ULTIMATE CABLE CONFIGURATION WILL ALSO BE DETERMINED DURING FURTHER DETAILED DESIGN PHASES OF THE PROJECT.

# YIELD ANALYSIS PLAN (WORKING DRAFT)

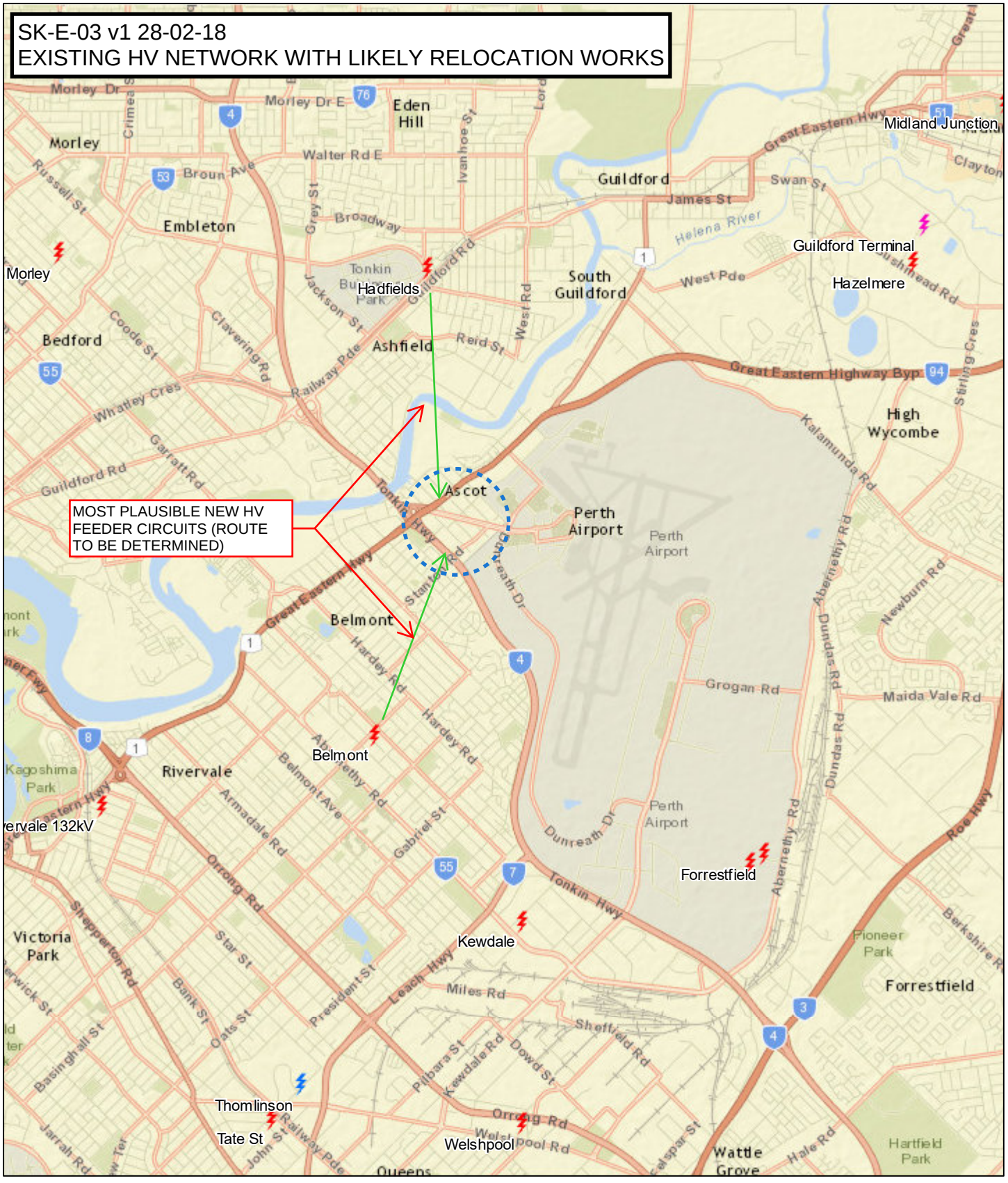
Development Area 6
A City of Belmont Project

DRAFT

0m 25 50m
s: 1:2,000@A1
d: 4 Dec 2017
p: 16/065/019C

**Taylor Burrell Barnett** Town Planning and Design
Level 7, 160 St Georges Terrace, Perth WA 6000
p: (08) 9226 4276 f: (08) 9322 7879
e: admin@tbbplanning.com.au

# NCMT - Zone Substations




2/28/2018, 12:27:20 PM

1:72,224

0 0.5 1 2 mi

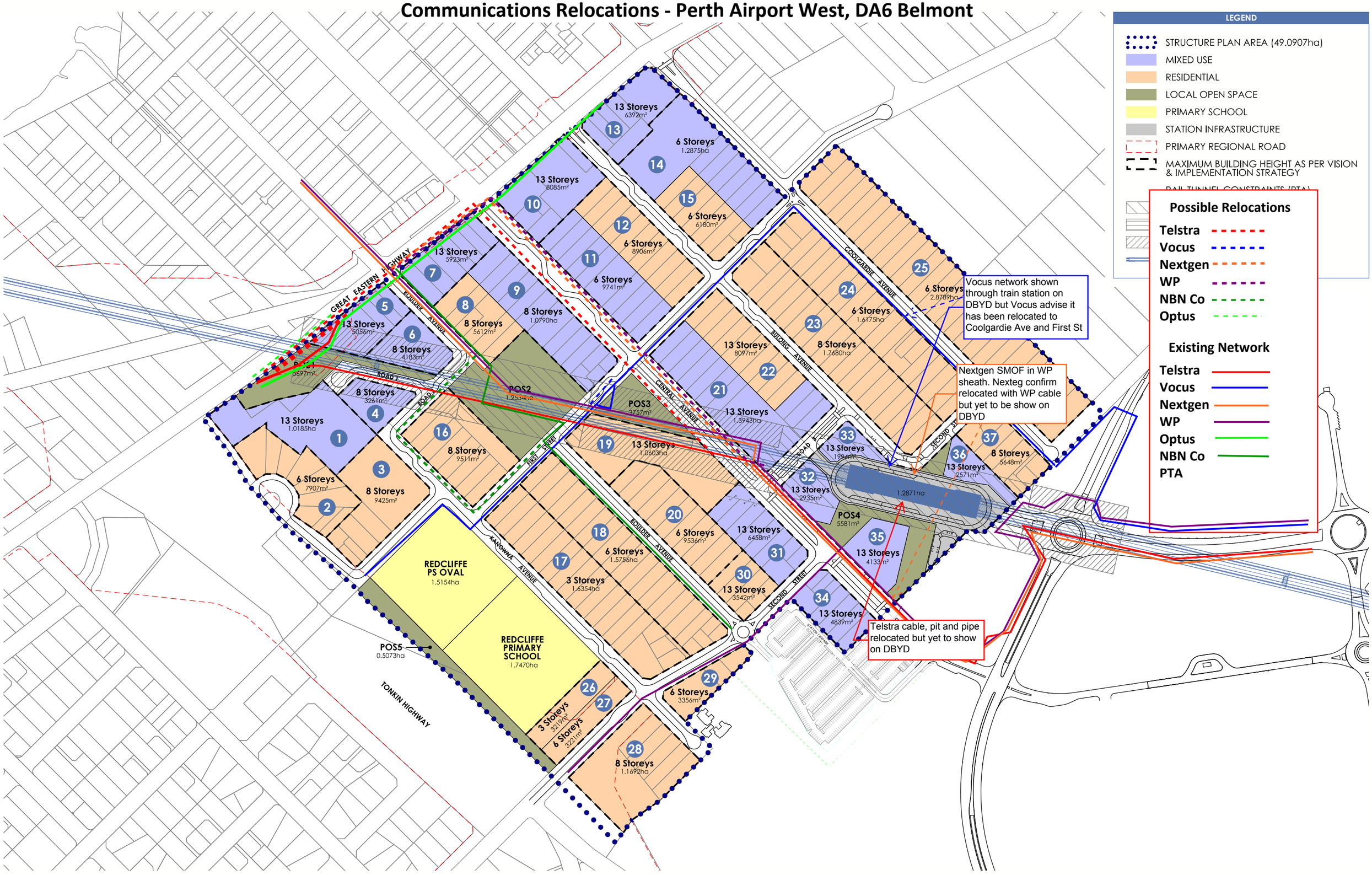
0 0.5 1 2 km

**Existing Substations/Terminals/Power Stations and APR info : WP-007**

- Existing Western Power Substation
- Current Non Western Power Substation
- Current Western Power Terminal/Power Station

# APPENDIX 2 – COMMUNICATIONS

# Communications Relocations - Perth Airport West, DA6 Belmont

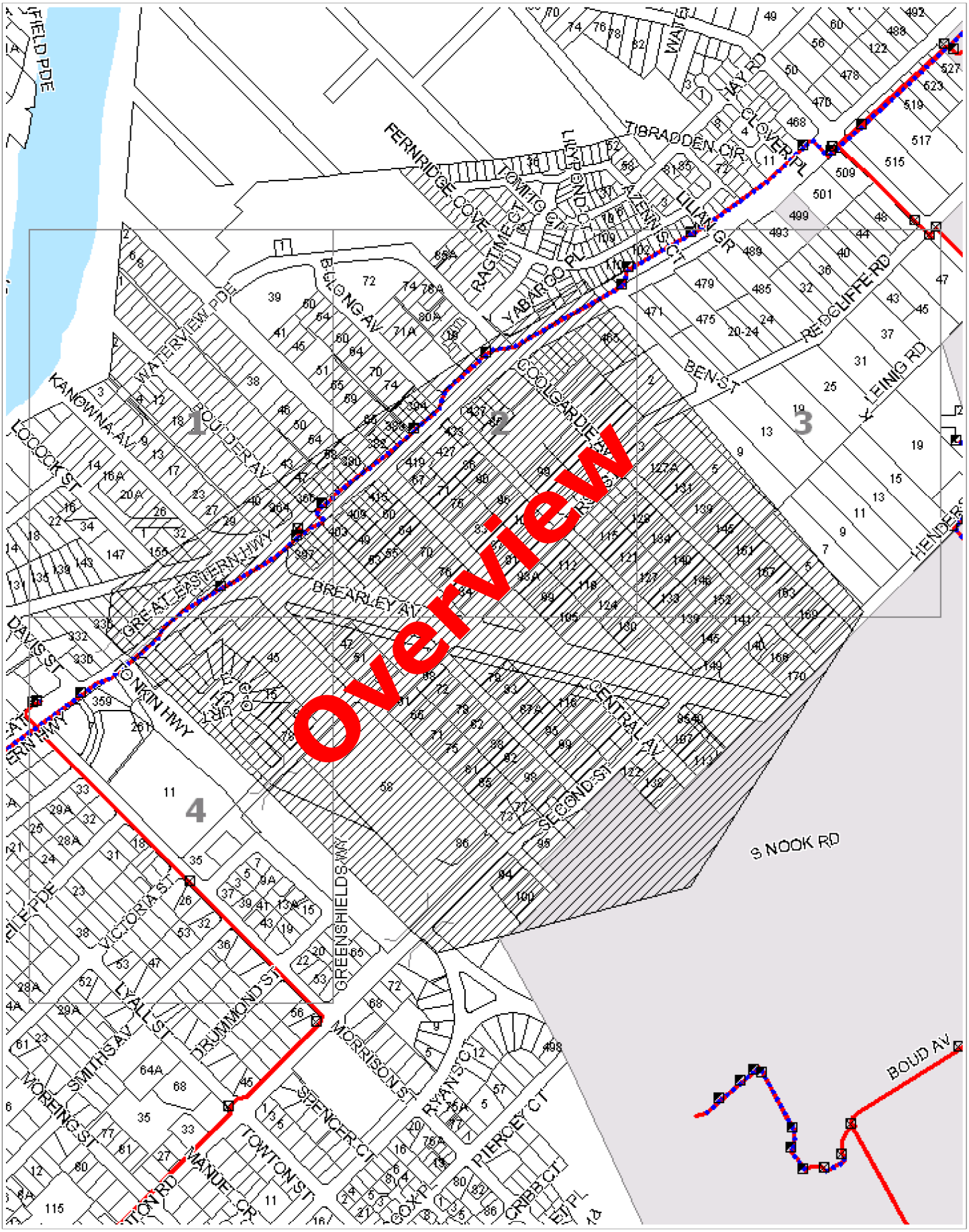



**YIELD ANALYSIS PLAN (WORKING DRAFT)**
Development Area 6
A City of Belmont Project

DRAFT

0m 25 50m
s: 1:2,000@A1
d: 4 Dec 2017
p: 16/065/019C


**Taylor Burrell Barnett** Town Planning and Design
Level 7, 160 St Georges Terrace, Perth WA 6000
p: (08) 9226 4276 f: (08) 9322 7879
e: admin@tbbplanning.com.au



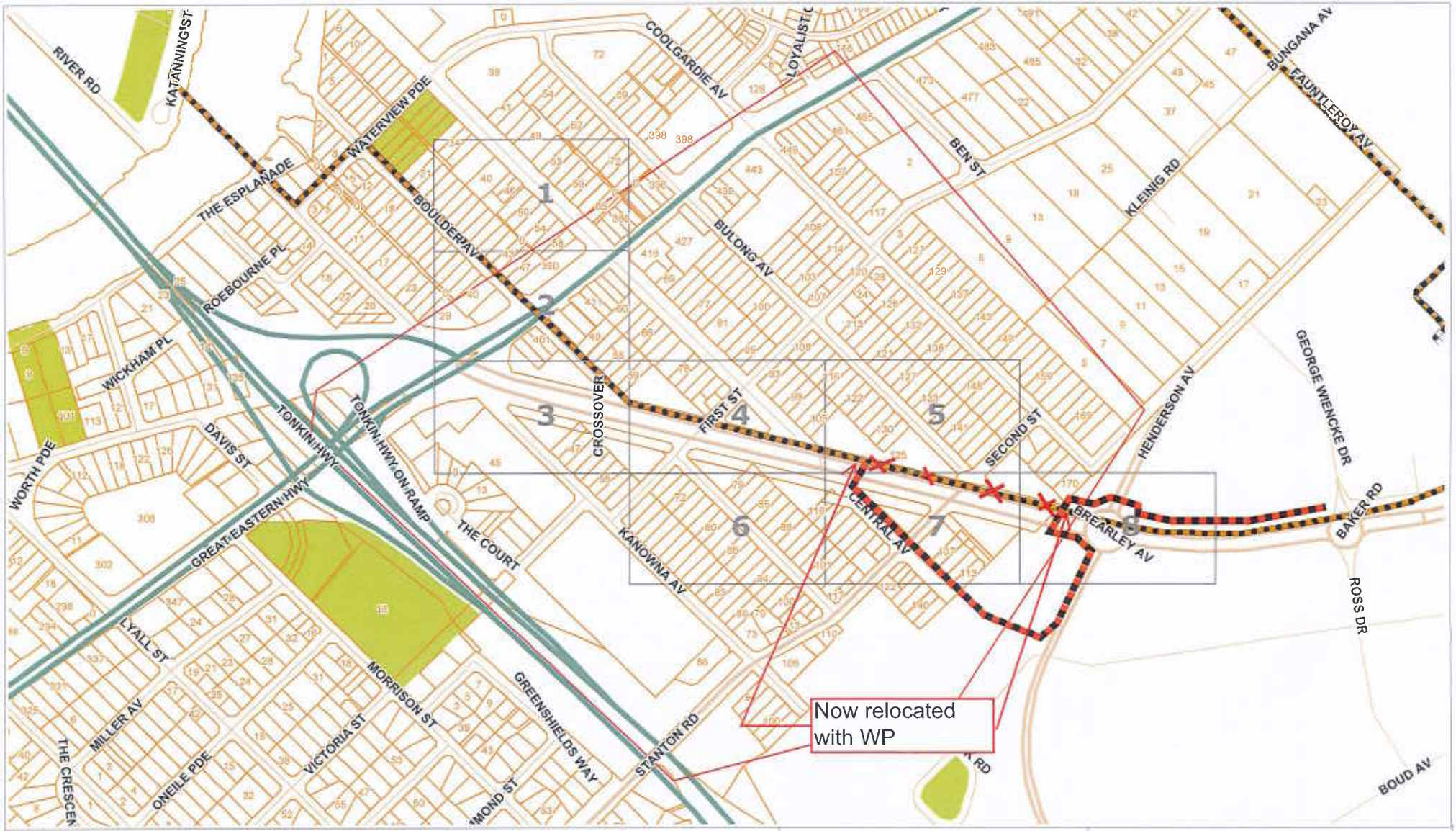



Sequence Number: 68185188

Date Generated: 01/02/2018

For all Optus DBYD plan enquiries –
Email: Fibre.Locations@optus.net.au
For urgent onsite assistance contact 1800 505 777
Optus Limited ACN 052 833 208


N
W
E
S
Type: Telco
Technology:Copper/F
Assets
IN-SERVICE:
Cable/ Duct/ Tren
DESIGNED/CONSTR
Cable/ Duct/ Tren
BREARLEY
CENTRAL
FIRST
KARONA
9
10




Sequence Number: 68185195

Date: 01/02/2018

*DISCLAIMER: THIS DRAWING SHOULD NOT BE SCALED TO LOCATE CABLES. NO WARRANTY IS GIVEN THAT THE INFORMATION IS ACCURATE OR COMPLETE. IF YOU REQUIRE INFORMATION REGARDING LOCATING THE CABLE PLEASE CALL NEXTGEN. THIS DOCUMENT HAS BEEN PREPARED SOLELY FOR DIAL BEFORE YOU DIG USE. THIS PLAN CONTAINS COMMERCIALLY SENSITIVE INFORMATION AND IS TO BE TREATED ACCORDINGLY. NO SUCH INFORMATION IS TO BE PASSED ONTO OTHER PARTIES WITHOUT WRITTEN CONSENT FROM NEXTGEN PTY LTD.*

nextgen GROUP

**LEGEND**

| Digsite | | Assets | |
|---|---|---|---|
| Point | | Cable | |
| Line | | 3rd Party Duct | |
| Area | | Marker Post | |


Sequence Number: 68185195

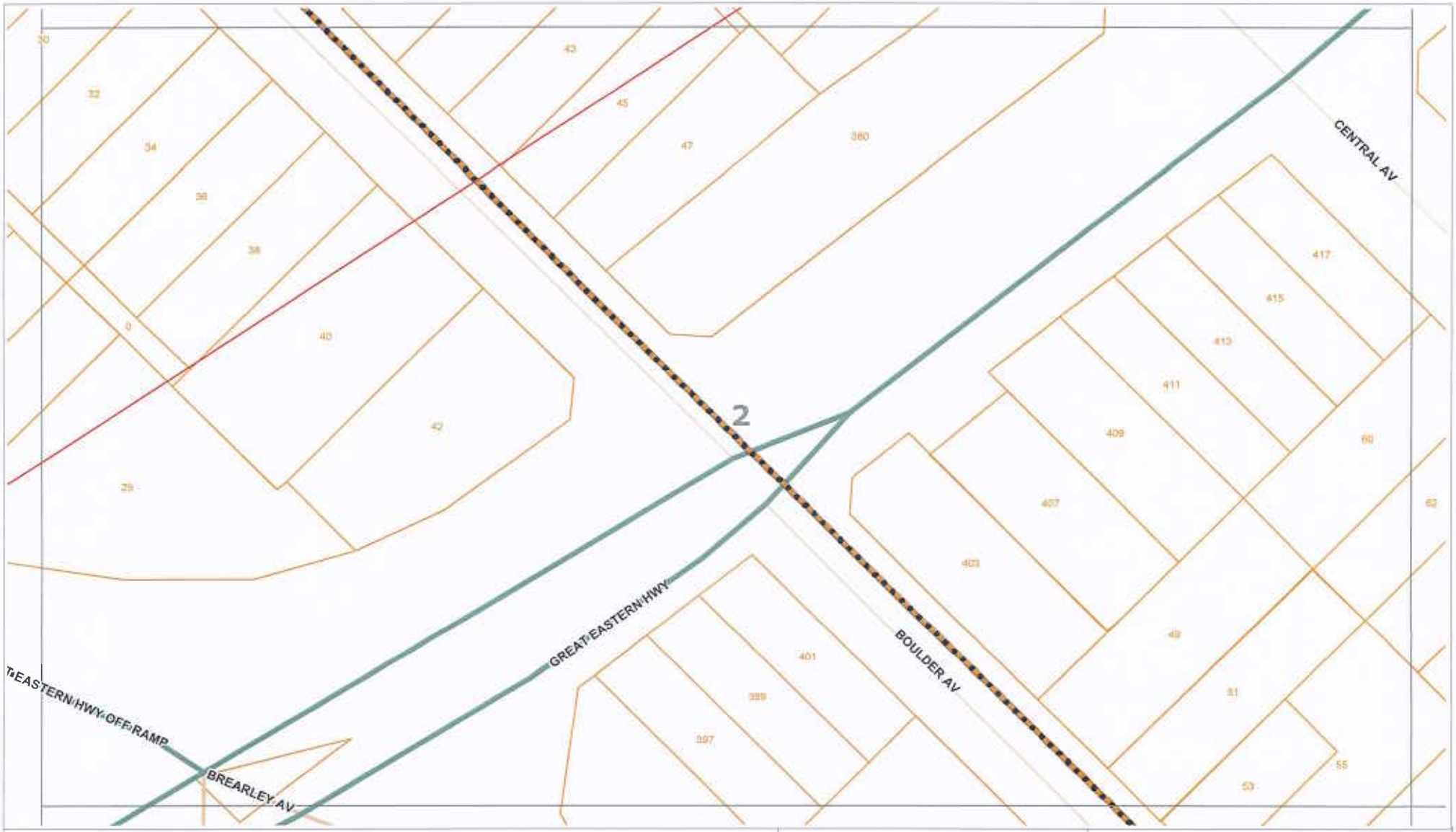
Date: 01/02/2018

*DISCLAIMER: THIS DRAWING SHOULD NOT BE SCALED TO LOCATE CABLES. NO WARRANTY IS GIVEN THAT THE INFORMATION IS ACCURATE OR COMPLETE. IF YOU REQUIRE INFORMATION REGARDING LOCATING THE CABLE PLEASE CALL NEXTGEN. THIS DOCUMENT HAS BEEN PREPARED SOLELY FOR DIAL BEFORE YOU DIG USE. THIS PLAN CONTAINS COMMERCIALLY SENSITIVE INFORMATION AND IS TO BE TREATED ACCORDINGLY. NO SUCH INFORMATION IS TO BE PASSED ONTO OTHER PARTIES WITHOUT WRITTEN CONSENT FROM NEXTGEN PTY LTD.*

nextgen GROUP

## LEGEND

| Digsite | | Assets | |
|---|---|---|---|
| Point | | Cable | |
| Line | | 3rd Party Duct | |
| Area | | Marker Post | |




Sequence Number: 68185195

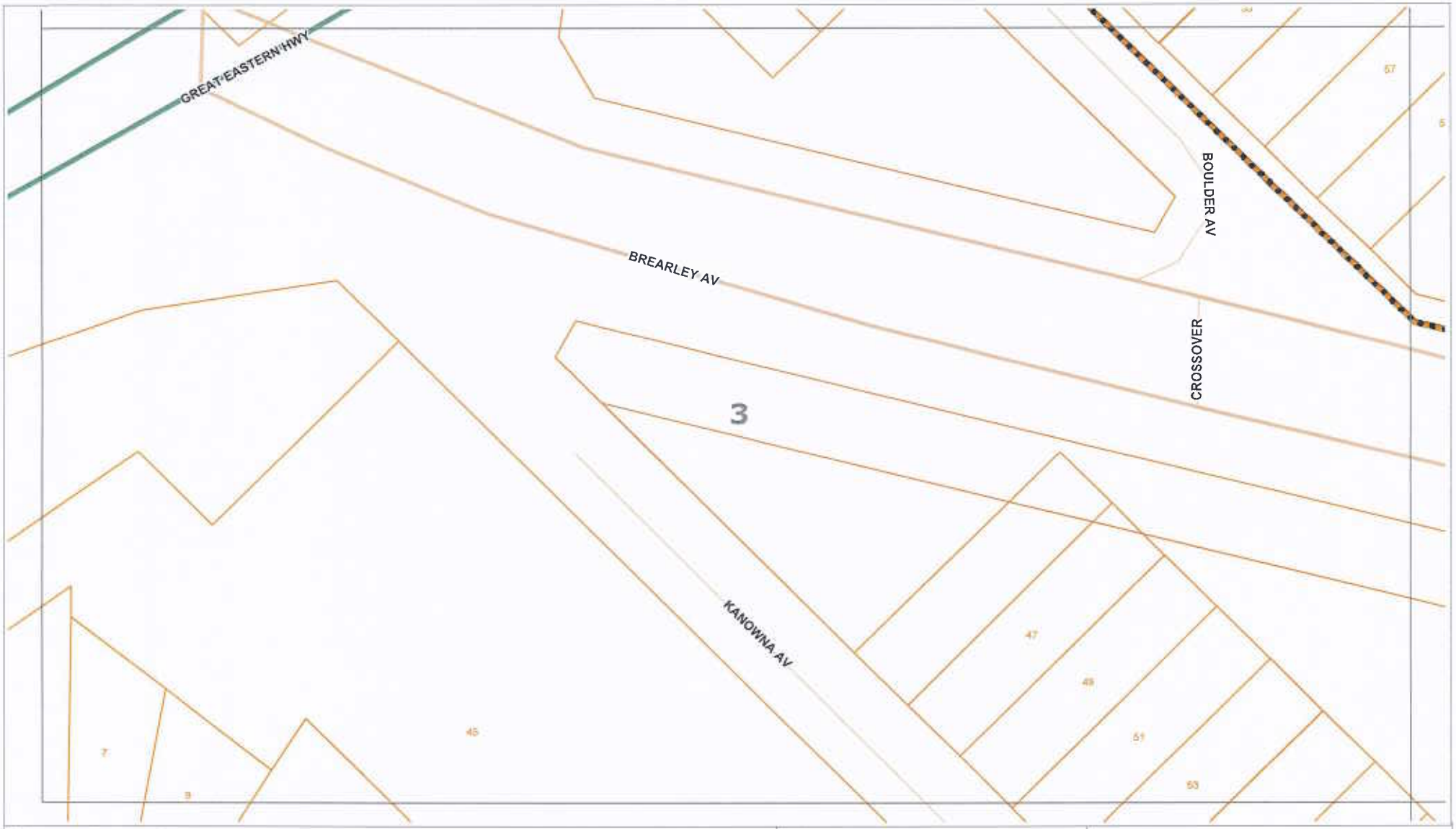
Date: 01/02/2018

*DISCLAIMER: THIS DRAWING SHOULD NOT BE SCALED TO LOCATE CABLES. NO WARRANTY IS GIVEN THAT THE INFORMATION IS ACCURATE OR COMPLETE. IF YOU REQUIRE INFORMATION REGARDING LOCATING THE CABLE PLEASE CALL NEXTGEN. THIS DOCUMENT HAS BEEN PREPARED SOLELY FOR DIAL BEFORE YOU DIG USE. THIS PLAN CONTAINS COMMERCIALLY SENSITIVE INFORMATION AND IS TO BE TREATED ACCORDINGLY. NO SUCH INFORMATION IS TO BE PASSED ONTO OTHER PARTIES WITHOUT WRITTEN CONSENT FROM NEXTGEN PTY LTD.*

nextgen GROUP

**LEGEND**

| Digsite | | Assets | |
|---|---|---|---|
| Point | | Cable | |
| Line | | 3rd Party Duct | |
| Area | | Marker Post | |




Sequence Number: 68185195

Date: 01/02/2018

*DISCLAIMER: THIS DRAWING SHOULD NOT BE SCALED TO LOCATE CABLES. NO WARRANTY IS GIVEN THAT THE INFORMATION IS ACCURATE OR COMPLETE. IF YOU REQUIRE INFORMATION REGARDING LOCATING THE CABLE PLEASE CALL NEXTGEN. THIS DOCUMENT HAS BEEN PREPARED SOLELY FOR DIAL BEFORE YOU DIG USE. THIS PLAN CONTAINS COMMERCIALLY SENSITIVE INFORMATION AND IS TO BE TREATED ACCORDINGLY. NO SUCH INFORMATION IS TO BE PASSED ONTO OTHER PARTIES WITHOUT WRITTEN CONSENT FROM NEXTGEN PTY LTD.*

nextgen GROUP

## LEGEND

| Digsite | | Assets | |
|---|---|---|---|
| Point | | Cable | |
| Line | | 3rd Party Duct | |
| Area | | Marker Post | |


Sequence Number: 68185195

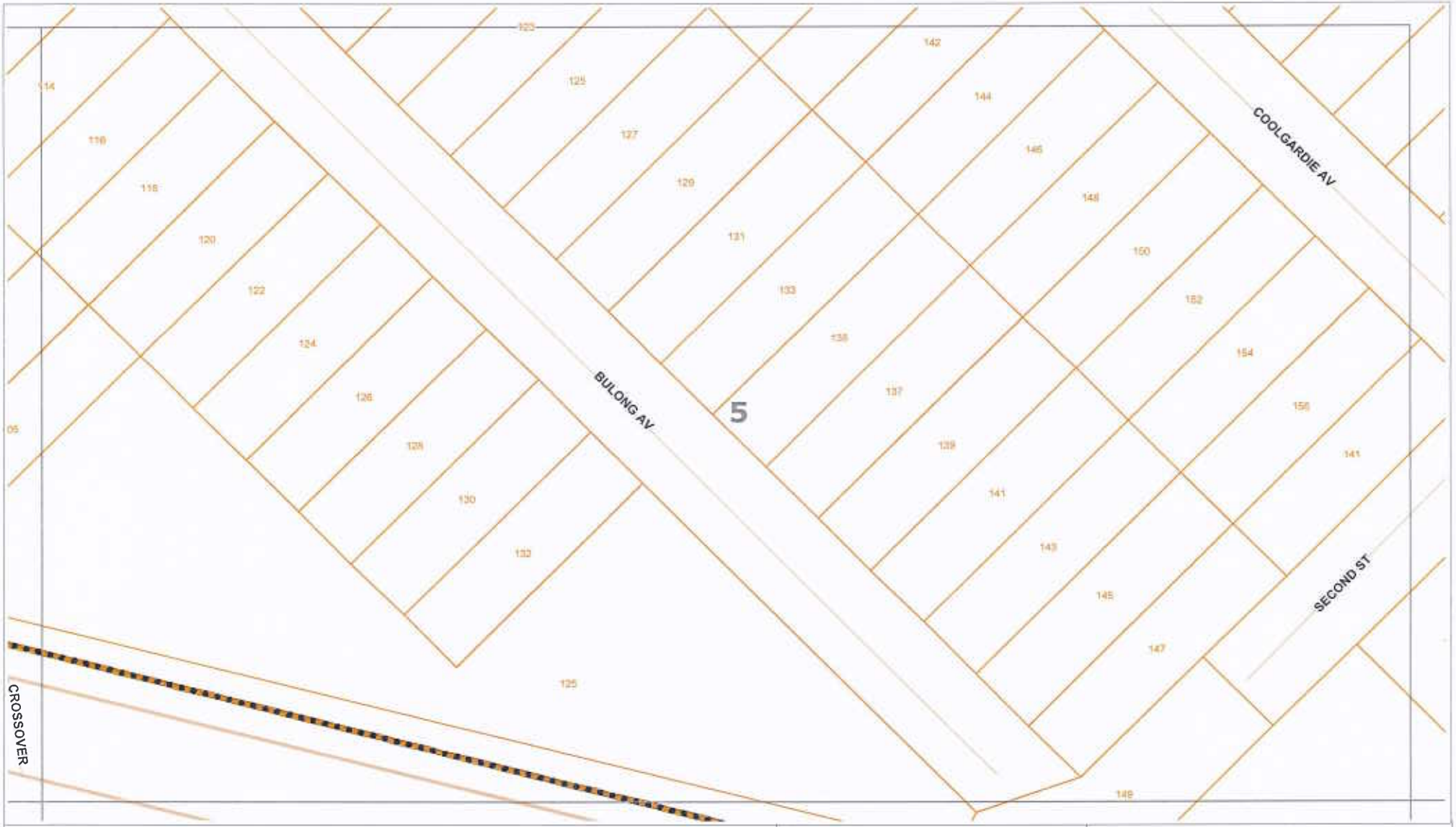
Date: 01/02/2018

*DISCLAIMER: THIS DRAWING SHOULD NOT BE SCALED TO LOCATE CABLES. NO WARRANTY IS GIVEN THAT THE INFORMATION IS ACCURATE OR COMPLETE. IF YOU REQUIRE INFORMATION REGARDING LOCATING THE CABLE PLEASE CALL NEXTGEN. THIS DOCUMENT HAS BEEN PREPARED SOLELY FOR DIAL BEFORE YOU DIG USE. THIS PLAN CONTAINS COMMERCIALLY SENSITIVE INFORMATION AND IS TO BE TREATED ACCORDINGLY. NO SUCH INFORMATION IS TO BE PASSED ONTO OTHER PARTIES WITHOUT WRITTEN CONSENT FROM NEXTGEN PTY LTD.*

nextgen GROUP

## LEGEND

| Digsite | | Assets | |
|---|---|---|---|
| | Point | | Cable |
| | Line | | 3rd Party Duct |
| | Area | | Marker Post |




Sequence Number: 68185195

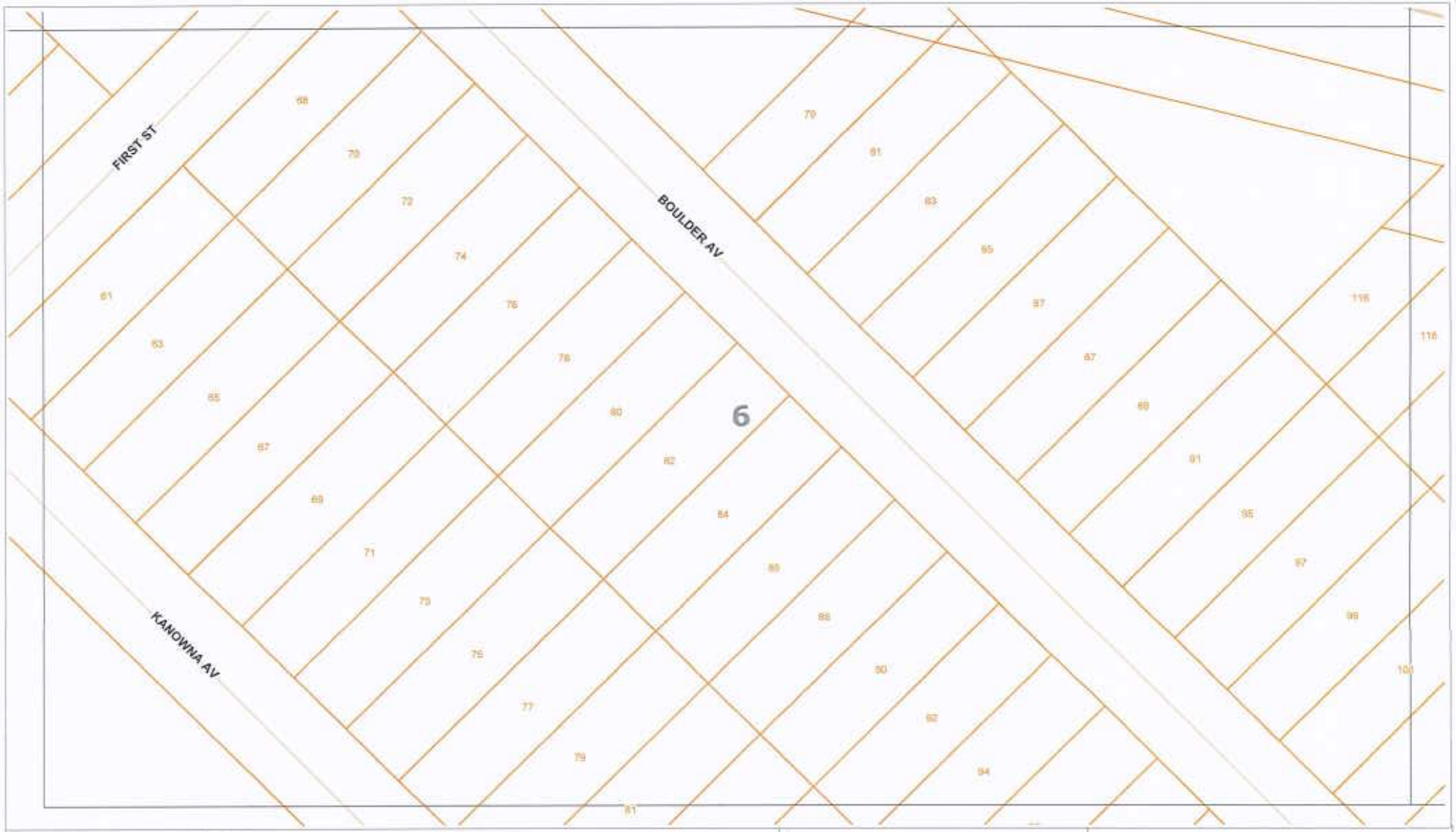
Date: 01/02/2018

*DISCLAIMER: THIS DRAWING SHOULD NOT BE SCALED TO LOCATE CABLES. NO WARRANTY IS GIVEN THAT THE INFORMATION IS ACCURATE OR COMPLETE. IF YOU REQUIRE INFORMATION REGARDING LOCATING THE CABLE PLEASE CALL NEXTGEN. THIS DOCUMENT HAS BEEN PREPARED SOLELY FOR DIAL BEFORE YOU DIG USE. THIS PLAN CONTAINS COMMERCIALLY SENSITIVE INFORMATION AND IS TO BE TREATED ACCORDINGLY. NO SUCH INFORMATION IS TO BE PASSED ONTO OTHER PARTIES WITHOUT WRITTEN CONSENT FROM NEXTGEN PTY LTD.*

nextgen GROUP

## LEGEND

| Digsite | | Assets | |
|---|---|---|---|
| Point | | Cable | |
| Line | | 3rd Party Duct | |
| Area | | Marker Post | |




Sequence Number: 68185195

Date: 01/02/2018

*DISCLAIMER: THIS DRAWING SHOULD NOT BE SCALED TO LOCATE CABLES. NO WARRANTY IS GIVEN THAT THE INFORMATION IS ACCURATE OR COMPLETE. IF YOU REQUIRE INFORMATION REGARDING LOCATING THE CABLE PLEASE CALL NEXTGEN. THIS DOCUMENT HAS BEEN PREPARED SOLELY FOR DIAL BEFORE YOU DIG USE. THIS PLAN CONTAINS COMMERCIALLY SENSITIVE INFORMATION AND IS TO BE TREATED ACCORDINGLY. NO SUCH INFORMATION IS TO BE PASSED ONTO OTHER PARTIES WITHOUT WRITTEN CONSENT FROM NEXTGEN PTY LTD.*

nextgen GROUP

## LEGEND

| Digsite | | Assets | |
|---|---|---|---|
| | Point | | Cable |
| | Line | | 3rd Party Duct |
| | Area | | Marker Post |


Sequence Number: 68185195

Date: 01/02/2018

*DISCLAIMER: THIS DRAWING SHOULD NOT BE SCALED TO LOCATE CABLES. NO WARRANTY IS GIVEN THAT THE INFORMATION IS ACCURATE OR COMPLETE. IF YOU REQUIRE INFORMATION REGARDING LOCATING THE CABLE PLEASE CALL NEXTGEN. THIS DOCUMENT HAS BEEN PREPARED SOLELY FOR DIAL BEFORE YOU DIG USE. THIS PLAN CONTAINS COMMERCIALLY SENSITIVE INFORMATION AND IS TO BE TREATED ACCORDINGLY. NO SUCH INFORMATION IS TO BE PASSED ONTO OTHER PARTIES WITHOUT WRITTEN CONSENT FROM NEXTGEN PTY LTD.*

nextgen GROUP

## LEGEND

| Digsite | | Assets | |
|---|---|---|---|
| Point | | Cable | |
| Line | | 3rd Party Duct | |
| Area | | Marker Post | |


Sequence Number: 68185195

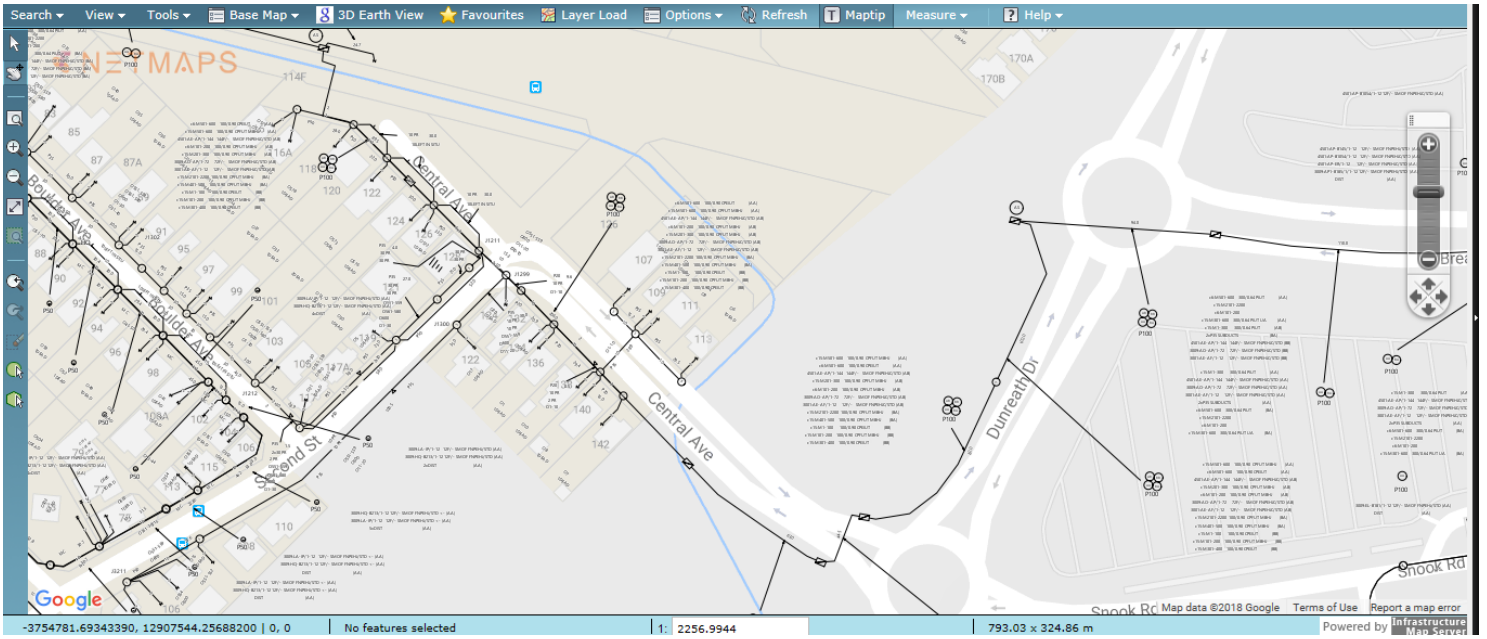
Date: 01/02/2018



nextgen GROUP

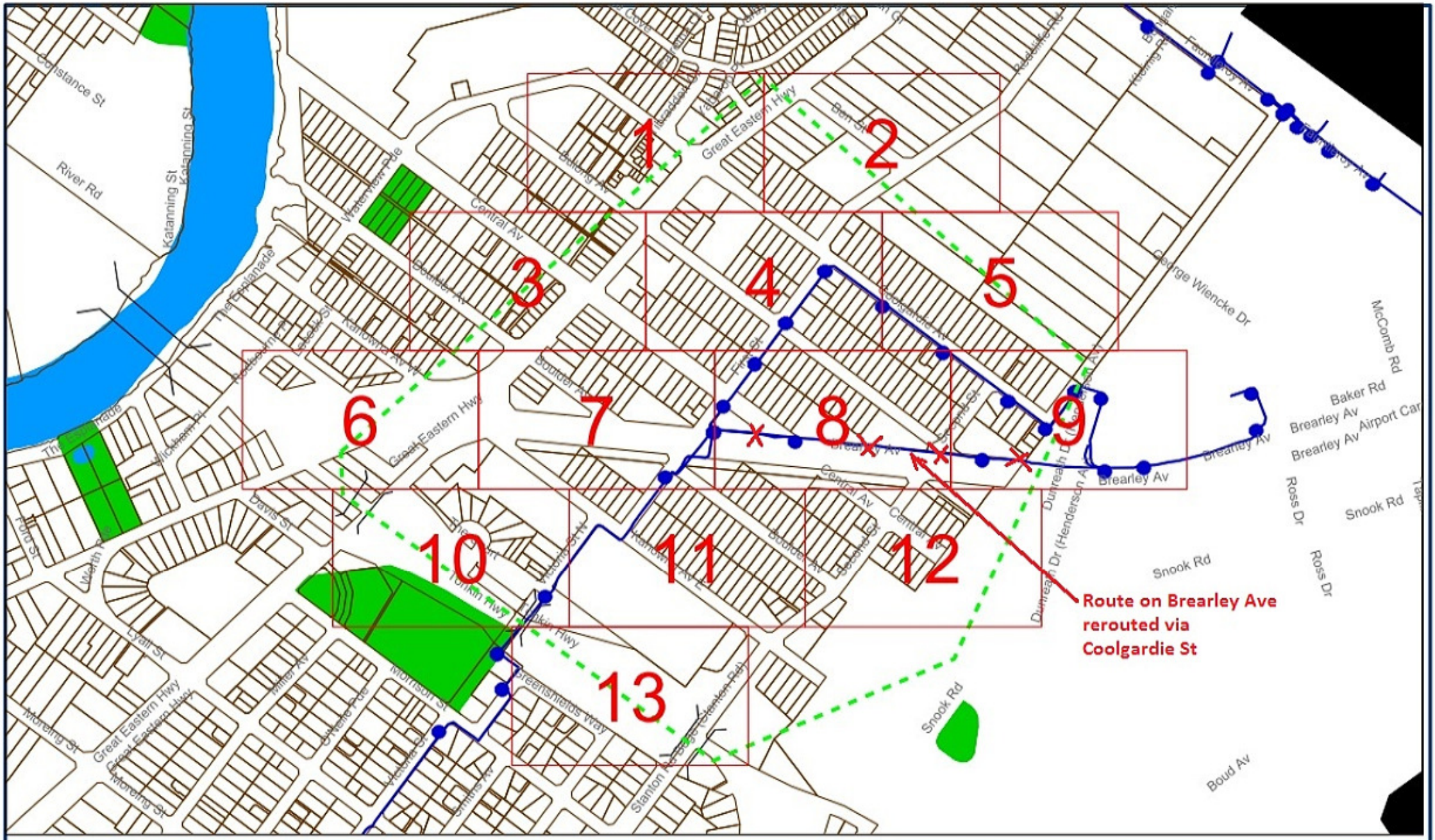
## LEGEND

| Digsite | | Assets | |
|---|---|---|---|
| Point | | Cable | |
| Line | | 3rd Party Duct | |
| Area | | Marker Post | |


Search
View
Tools
Base Map
3D Earth View
Favourites
Layer Load
Options
Refresh
Maptip
Measure
Help
MAPS
Boulder Ave
Central Ave
Dunreath Dr
Snook Rd
Google
Map data ©2018 Google
Terms of Use
Report a map error
-3754781.69343390, 12907544.25688200 | 0, 0
No features selected
1: 2256.9944
793.03 x 324.86 m
Powered by Infrastructure Map Server

GREAT EASTERN HIGHWAY
BOULDER AVENUE
ROAD 1
ROAD 2
ROAD 3
FIRST STREET
SECOND STREET
CENTRAL AVENUE
KANOWNA AVENUE
BUXONG AVENUE
COOLGARDIE AVENUE
REDCLIFFE
TONKIN HIGHWAY
AIRPORT STATION
REDCLIFFE PS OVAL
1.5154ha
REDCLIFFE PRIMARY SCHOOL
1.7470ha
POS1
1.5697m²
POS2
1.2534ha
POS3
375m²
POS4
558.1m²
POS5
0.5073ha
1.2871ha
13 Storeys
6392m²
6 Storeys
1.2875ha
13 Storeys
8085m²
6 Storeys
6180m²
13 Storeys
5923m²
6 Storeys
8906m²
6 Storeys
9741m²
13 Storeys
5056m²
8 Storeys
4183m²
8 Storeys
5612m²
8 Storeys
1.0790ha
8 Storeys
3261m²
13 Storeys
1.0185ha
8 Storeys
9511m²
6 Storeys
7907m²
8 Storeys
9425m²
13 Storeys
1.0603ha
8 Storeys
9536m²
6 Storeys
1.5758ha
3 Storeys
1.6354ha
3 Storeys
3219m²
6 Storeys
3221m²
8 Storeys
1.1692ha
6 Storeys
3356m²
13 Storeys
8097m²
13 Storeys
1.3943ha
8 Storeys
1.7680ha
6 Storeys
2.8789ha
6 Storeys
1.6175ha
13 Storeys
1994m²
13 Storeys
2571m²
8 Storeys
5648m²
13 Storeys
2935m²
13 Storeys
6458m²
13 Storeys
4133m²
13 Storeys
3542m²
13 Storeys
4839m²

# OVERVIEW

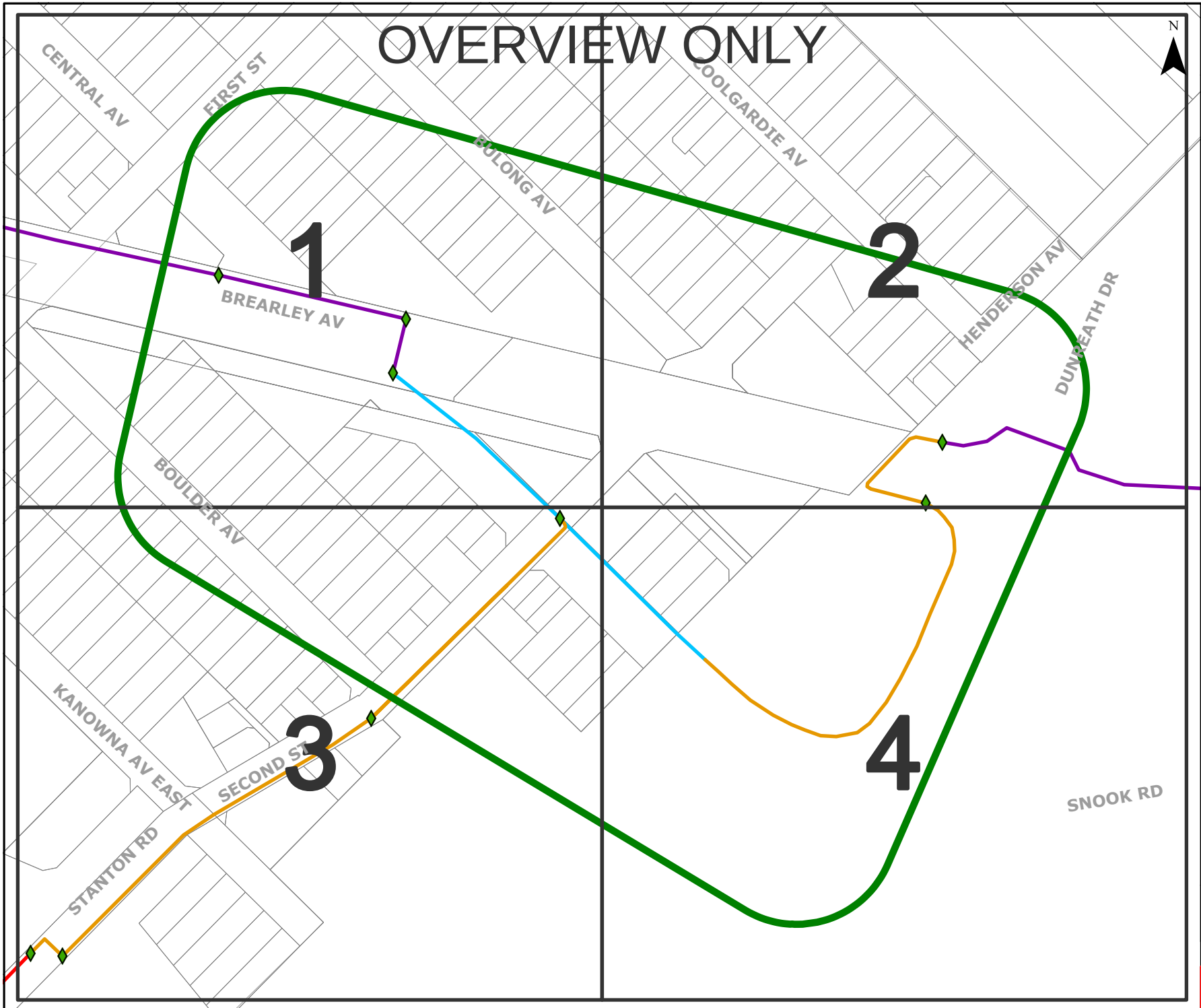



VOCUS communications

SEQUENCE NUMBER: 68185193
JOB NUMBER: 13624520
ADDRESS: Brearley Avenue belmont

SCALE 1:6000

0 0.07km




westernpower

## FIBRE NETWORK LEGEND

**Communications Assets**

- Fibre Network Pits
- 32mm Conduit
- 50mm Conduit
- 63mm Conduit
- 80mm Conduit
- 90mm Conduit
- 100mm Conduit
- 110mm Conduit
- Direct Buried (Bare Cables)
- Cable in Unused Gas Main

**Feature**

- Area of Interest

*** Please refer to coversheet**

**Privately owned cables NOT SHOWN (including house services)**

**This map is INDICATIVE ONLY. Hand exposure via pothole method is MANDATORY.**

**Network Management Centre**
**Telephone: 1800 752 075**
**Mon to Fri - 07:30 to 16:00**

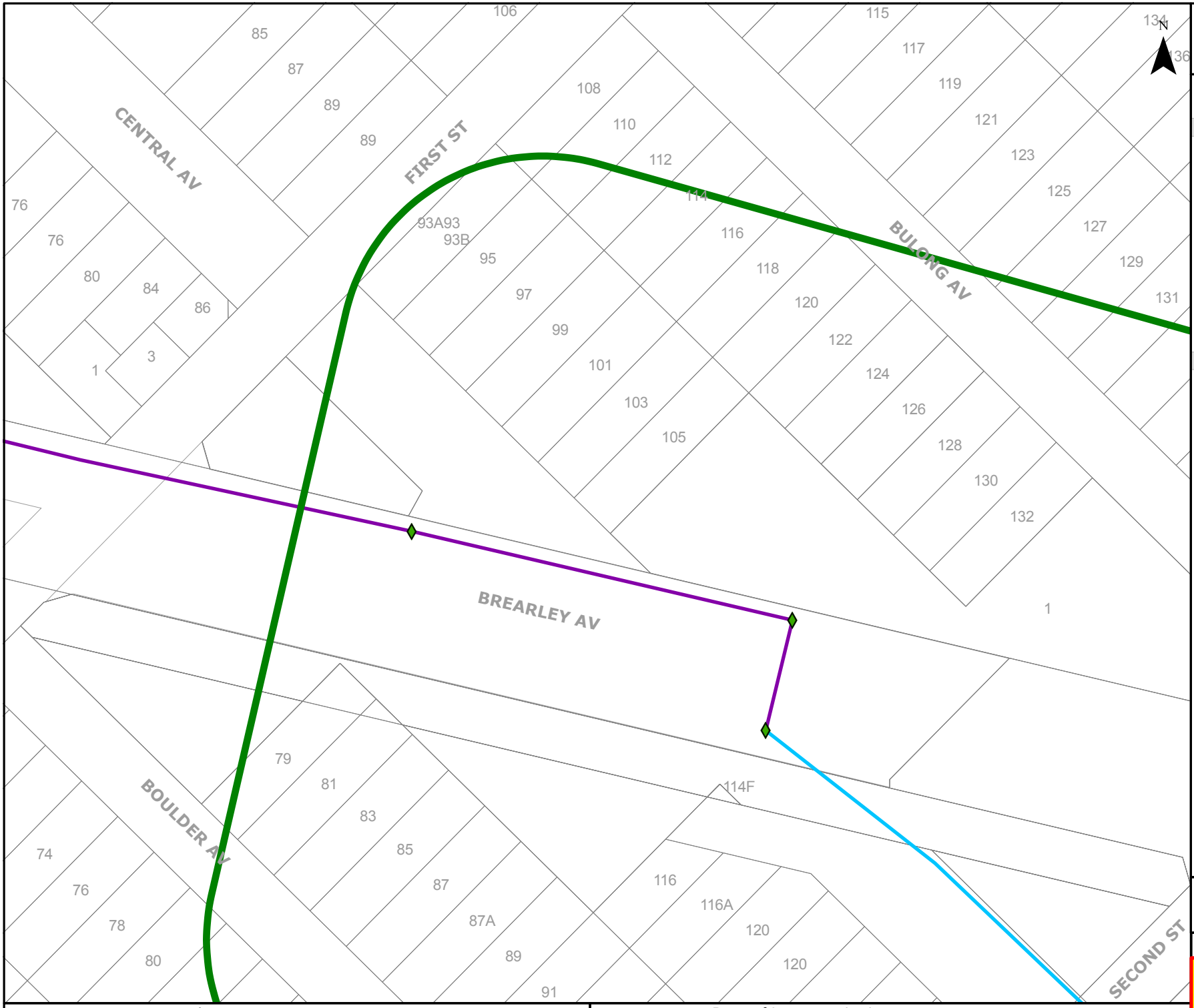
Information valid for 30 days from date of issue

| A4 | Scale : 1:3075 |
|---|---|

**WARNING! Look out for overhead power lines**

Sequence Number: 68156868

Date of Issue: 31/01/2018




westernpower

## FIBRE NETWORK LEGEND

**Communications Assets**

- Fibre Network Pits
- 32mm Conduit
- 50mm Conduit
- 63mm Conduit
- 80mm Conduit
- 90mm Conduit
- 100mm Conduit
- 110mm Conduit
- Direct Buried (Bare Cables)
- Cable in Unused Gas Main

**Feature**

- Area of Interest

*** Please refer to coversheet**

**Privately owned cables NOT SHOWN (including house services)**

**This map is INDICATIVE ONLY. Hand exposure via pothole method is MANDATORY.**

**Network Management Centre**
**Telephone: 1800 752 075**
**Mon to Fri - 07:30 to 16:00**

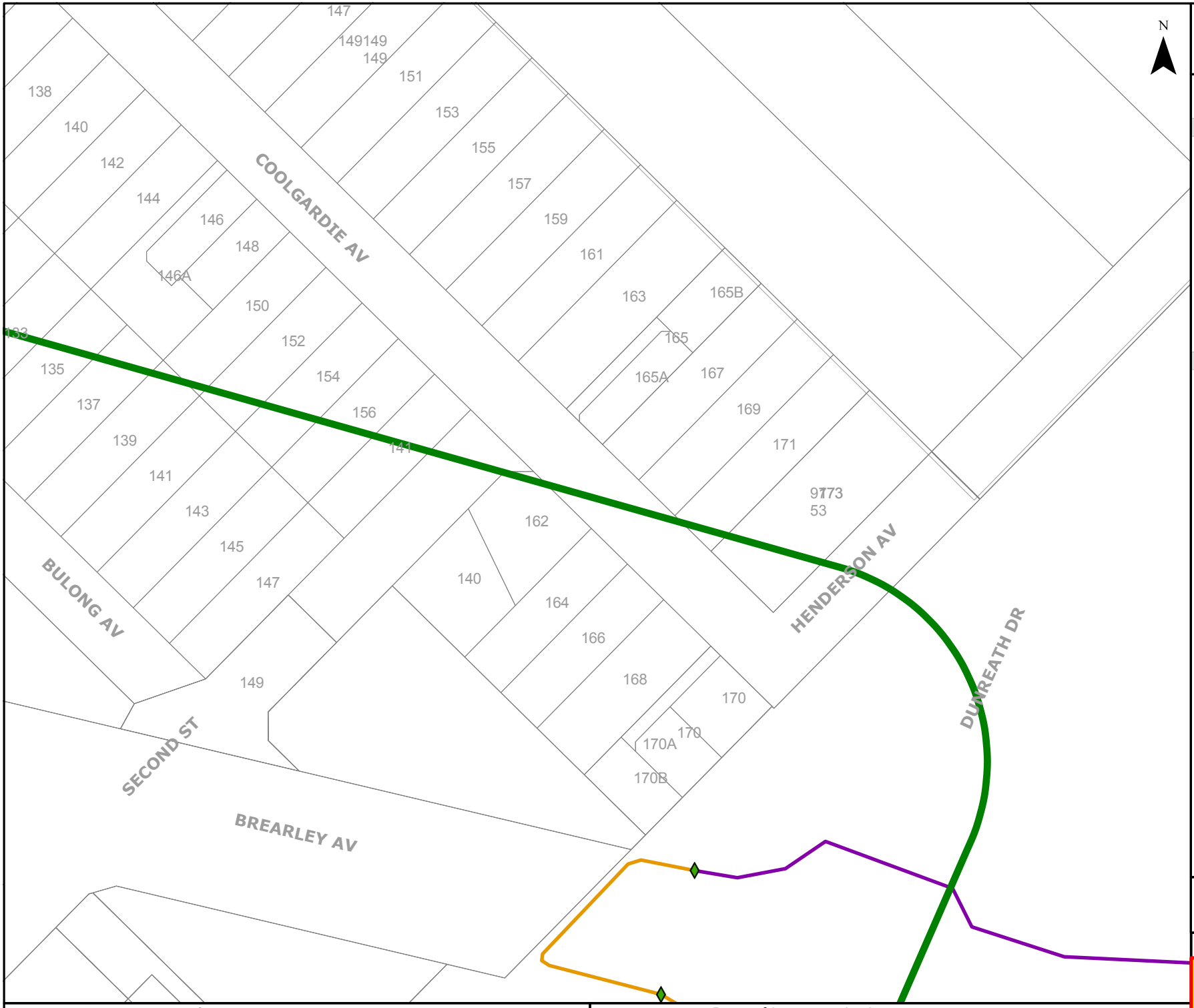
Information valid for 30 days from date of issue

| A4 | Scale : 1:1500 |
|---|---|

**WARNING! Look out for overhead power lines**

Sequence Number: 68156868

Date of Issue: 31/01/2018




westernpower

## FIBRE NETWORK LEGEND

**Communications Assets**

- Fibre Network Pits
- 32mm Conduit
- 50mm Conduit
- 63mm Conduit
- 80mm Conduit
- 90mm Conduit
- 100mm Conduit
- 110mm Conduit
- Direct Buried (Bare Cables)
- Cable in Unused Gas Main

**Feature**

- Area of Interest

*** Please refer to coversheet**

**Privately owned cables NOT SHOWN (including house services)**

**This map is INDICATIVE ONLY. Hand exposure via pothole method is MANDATORY.**

**Network Management Centre**
**Telephone: 1800 752 075**
**Mon to Fri - 07:30 to 16:00**

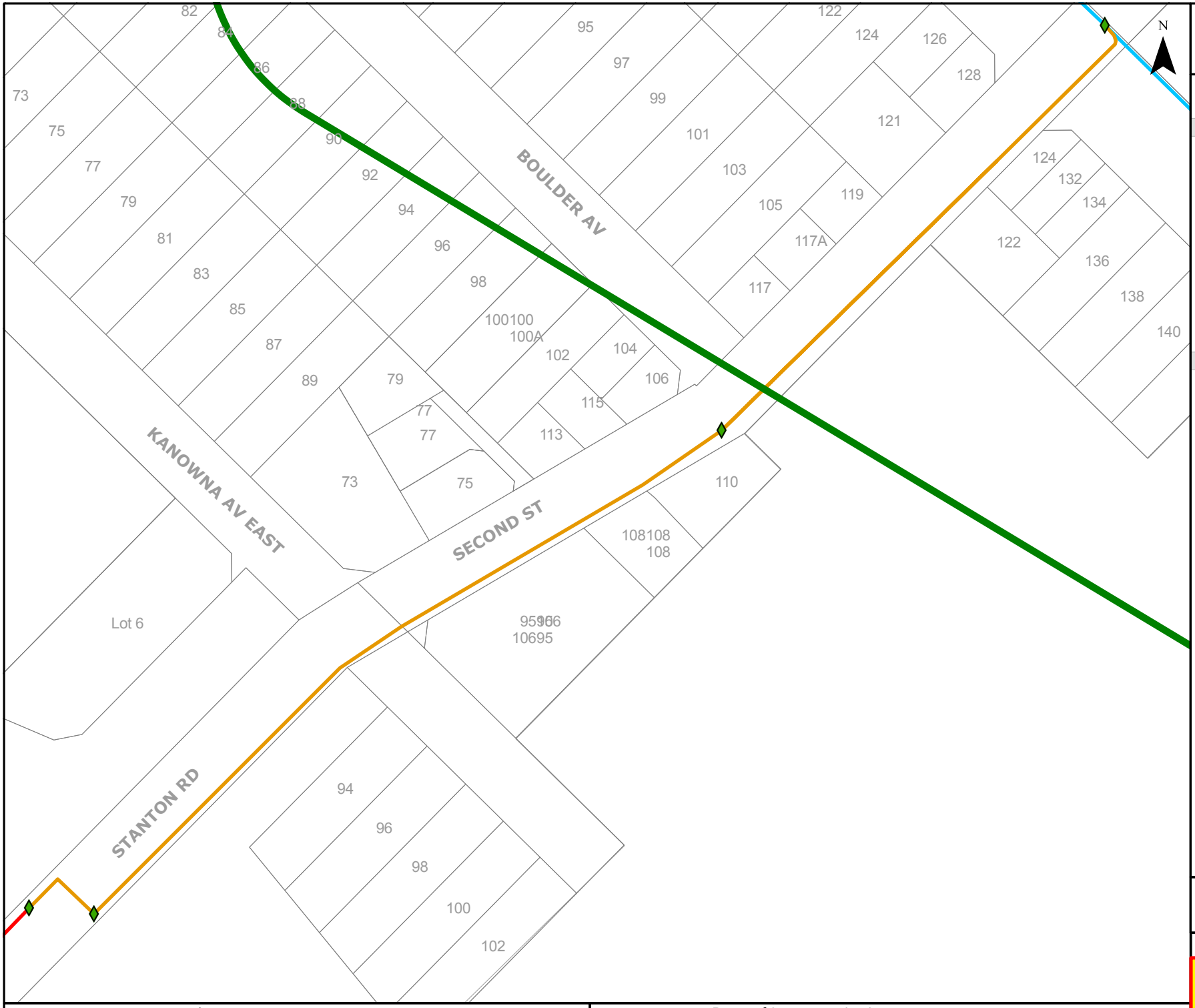
Information valid for 30 days from date of issue

| A4 | Scale : 1:1500 |
|---|---|

**WARNING! Look out for overhead power lines**

Sequence Number: 68156868

Date of Issue: 31/01/2018




westernpower

## FIBRE NETWORK LEGEND

**Communications Assets**

- Fibre Network Pits
- 32mm Conduit
- 50mm Conduit
- 63mm Conduit
- 80mm Conduit
- 90mm Conduit
- 100mm Conduit
- 110mm Conduit
- Direct Buried (Bare Cables)
- Cable in Unused Gas Main

**Feature**

- Area of Interest

*** Please refer to coversheet**

**Privately owned cables NOT SHOWN (including house services)**

**This map is INDICATIVE ONLY. Hand exposure via pothole method is MANDATORY.**

**Network Management Centre**
**Telephone: 1800 752 075**
**Mon to Fri - 07:30 to 16:00**

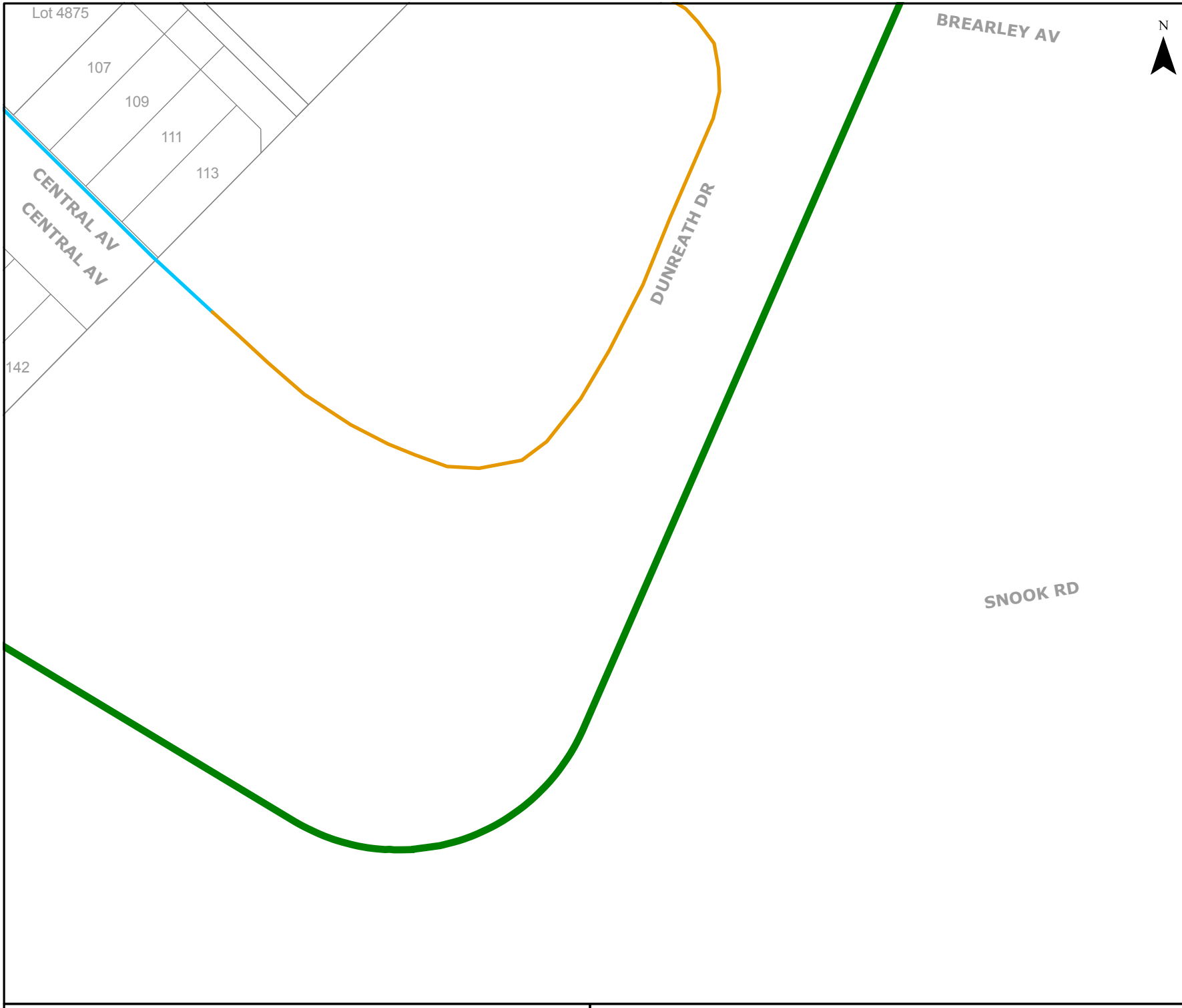
Information valid for 30 days from date of issue

| A4 | Scale : 1:1500 |
|---|---|

**WARNING! Look out for overhead power lines**

Sequence Number: 68156868

Date of Issue: 31/01/2018




westernpower

## FIBRE NETWORK LEGEND

**Communications Assets**

- Fibre Network Pits
- 32mm Conduit
- 50mm Conduit
- 63mm Conduit
- 80mm Conduit
- 90mm Conduit
- 100mm Conduit
- 110mm Conduit
- Direct Buried (Bare Cables)
- Cable in Unused Gas Main

**Feature**

- Area of Interest

*** Please refer to coversheet**

**Privately owned cables NOT SHOWN (including house services)**

**This map is INDICATIVE ONLY. Hand exposure via pothole method is MANDATORY.**

**Network Management Centre**
**Telephone: 1800 752 075**
**Mon to Fri - 07:30 to 16:00**

Information valid for 30 days from date of issue

| A4 | Scale : 1:1500 |
|---|---|

**WARNING! Look out for overhead power lines**

Sequence Number: 68156868

Date of Issue: 31/01/2018