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MAY 2018

Infrastructure Planning Report - West Schofields Precinct

Final Report

COMMERCIAL IN CONFIDENCE

Calibre Consulting
Level 2, Burbank Place
NORWEST BUSINESS PARK
NSW 2153

Ph: (02) 8808 5000

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LIST OF ABREVIATIONS

ADWF	Average Dry Weather Flow
AHD	Australian Height Datum
DBYD	Dial Before You Dig
DN	Nominal Diameter (of a pipe)
DP&E	Department of Planning and Environment
EE	Endeavour Energy
EP	Equivalent Population
EPA	Environmental Planning and Assessment
EPL	Environmental Protection Licence
FSL	Full Supply Level
GSS	Growth Servicing Strategy
ha	Hectare
HV	High Voltage
HVC	High Voltage Customer
I/I	Inflow/Infiltration
ILP	Indicative Layout Plan
kL	Kilolitre
km	Kilometre
kW	Kilowatt
kPa	Kilopascals
LEP	Local Environment Plan
LGA	Local Government Area
L/s	Litres/second
m	metre
mm	millimetre
m/s	metres per second
MDD	Maximum Day Demand (Water)
MGH	Mean Gross Head
MHD	Maximum Hour Demand
ML	Megalitre
MLD	Megalitres per day
MVA	Mega Volt Amp - Magnitude of power consumption or required load
MPIP	Marsden Park Industrial Precinct

NWGC	North West Growth Centre
PAP	Precinct Acceleration Protocol
PDWF	Peak Dry Weather Flow
PWWF	Peak Wet Weather Flow
Res	Reservoir
RH	Residual Head
RL	Reduced Level
SPS	Sewage Pumping Station
SW	Sydney Water
WSA	Water Services Association
WSPP	West Schofields part Precinct
WWTP	Waste Water Treatment Plant

1 INTRODUCTION

The North West Growth Area (NWGA) covers approximately 10,000 hectares of land, located within the LGA boundaries of Blacktown, The Hills and Hawkesbury councils. Future urban development within the NWGA will accommodate up to 90,000 new homes and account for a total population of around 250,000 people.

In order to streamline the re-zoning processes to facilitate development of the NWGA, a Precinct Planning process has been used. This process coordinates the planning and delivery of water, wastewater, power, telecommunications, roads and other key services in order to facilitate new communities.

The West Schofields ("Part") Precinct was released for planning in August 2016 under the Precinct Acceleration Protocol. In May 2017 the Minister for Planning approved the release of the remainder of the precinct ("Balance") to allow planning to move forward for the entire precinct, providing more land for homes and jobs.

Calibre Consulting has been engaged by the Department of Planning and Environment (DP&E) to undertake an Infrastructure Assessment to inform the master planning process currently being undertaken for the entire West Schofields Precinct (the Precinct) located within the NWGA.

The purpose of this report is to identify key existing servicing infrastructure and outline requirements for new trunk infrastructure to service the ultimate development within the precinct. The report will also identify infrastructure (including interim servicing) required to service the likely initial development stage expected within the "Part" Precinct.

1.1 REGIONAL CONTEXT

The NWGA is strategically positioned to the north of the M7 Motorway at the top of the linear north south growth corridor that includes the Western Sydney Employment Area (WSEA), Western Sydney Growth Area (WSGA), the proposed Western Sydney Airport (WSA and the South West Growth Area (SWGA), and is located approximately 35 kilometres north-west of the Sydney Central Business District and 15 kilometres north-west of Parramatta. Its strategic position at the northern end of this growth corridor provides the potential to capitalise upon economies generated by the movement of people, goods and information.

Figure 1.1 below shows the overall NWGA structure layout and current re-zoning status

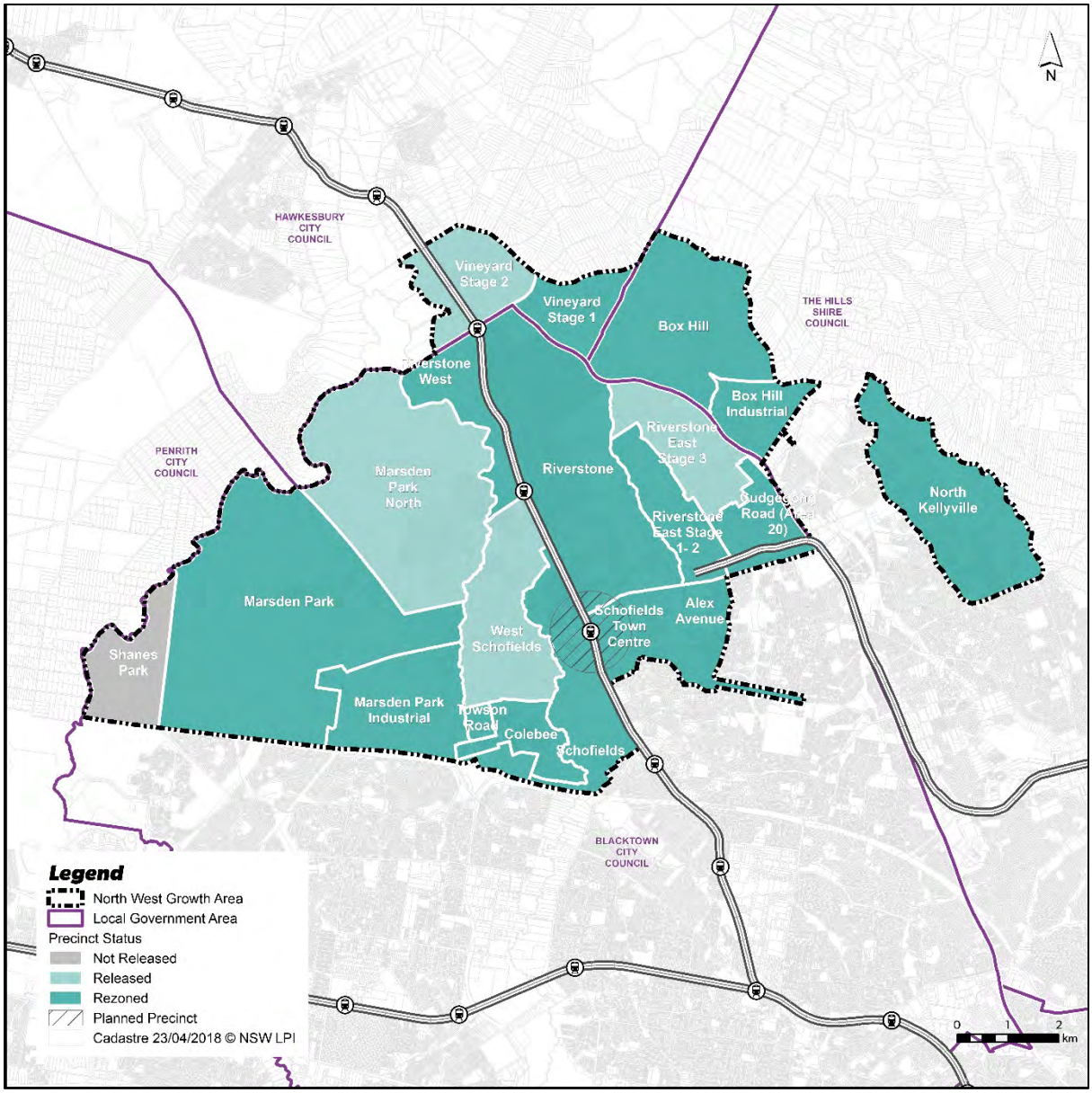
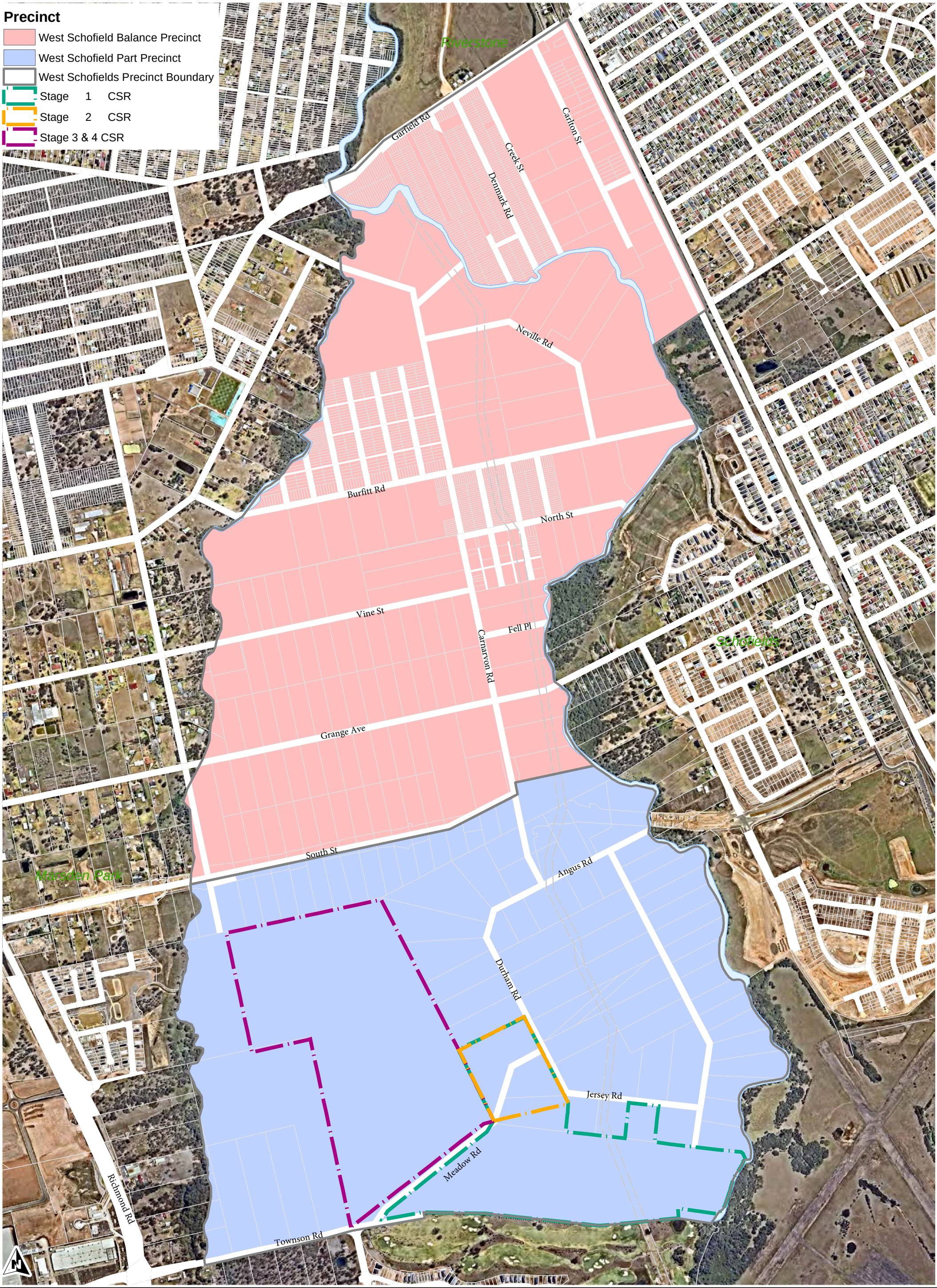


Figure 1-1: Location of West Schofields Precinct in the NWGA

1.2 THE SITE

The West Schofields precinct is located approximately 45 kilometres west of Sydney's CBD, in the local government area of Blacktown City Council. The site is bounded by Garfield Rd to the North, Eastern Creek to the East, Bells Creek to the West and Townsend Rd to the South (see Figure 1-2). The 576 hectare site is currently zoned rural (non-urban). CSR, the largest landowner, owns 87 hectares within the "Part" Precinct and currently carries out brickmaking and landfilling activities on the site.



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PROJECT NO. 15-004482

MAP SERIES:

PROJECT NAME: Infrastructure servicing - West Schofields Precinct

CLIENT:

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calibre

Drawing Title:

West Schofields Precinct
The Site

Figure No.

1.2

Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994

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1.3 EXISTING INFORMATION

Existing service location information has largely been obtained through a Dial Before You Dig (DBYD) services search and with consultation with the relevant agencies where required. The details shown on the plans should be considered as indicative only as the original DBYD information is not based on detailed survey data.

2 PROPOSED DEVELOPMENT

2.1 PROPOSED REZONING

DP&E has proposed a draft masterplan for the area which includes a new town centre, new residential areas, a proposed school, community facilities, and recreation areas. Figure 2.1 shows the draft indicative layout plan proposed for the Precinct.

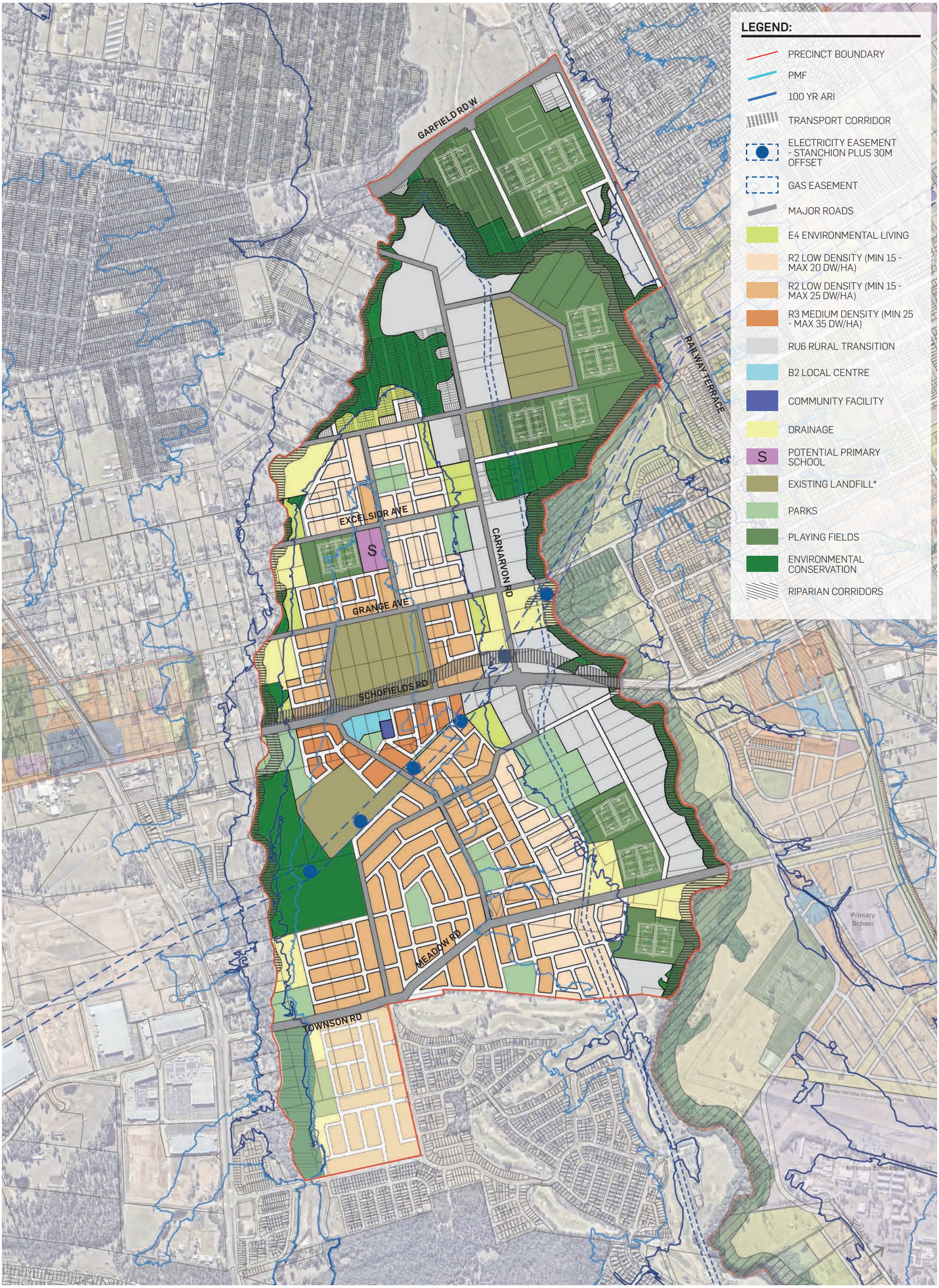
2.2 DEVELOPMENT YIELD

The likely development yields for the Precinct are summarised in the table below:

Table 2-1: Development Yields (excluding Townson Rd)

Development Category	Unit	West Schofields (Part)					West Schofields (Balance)	West Schofields (Total)
		CSR (Stage 1)	CSR (Stage 2, 3 & 4	Remainder East	Remainder West	Total (Part)		
Existing Residential	*dwellings*	*0*	*0*	*20*	*20*	*40*	*42*	*82*
Low Density Residential		*321*	*1058*	*789*	*135*	*2303*	*1218*	*3521*
Medium Density Residential		*0*	*146*	*136*	*137*	*419*	*0*	*419*
Town Centre		*0*	*0*	*0*	*67*	*0*	*0*	*0*
Environmental Living		*0*	*0*	*0*	*18*	*18*	*117*	*135*
TOTAL RESIDENTIAL		***321***	***1204***	***945***	***377***	***2847***	***1377***	***4224***
Commercial/Business	*Hectares*	*0*	*0*	*0*	*2.3*	*2.3*	*0*	*2.3*
TOTAL NON-RESIDENTIAL		***0***	***0***	***0***	***2.3***	***2.3***	***0***	***2.3***

Source: NSW Department of Planning & Environment



WEST SCHOFIELDS
FINAL DRAFT ILP

*Note: the surrounding landuses to the Grange Ave and CSR landfill sites are subject to change depending on final results from field investigations.

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2.3 DEVELOPMENT STAGING

The West Schofields (Part) Precinct was released for planning in August 2016 under the Precinct Acceleration Protocol. The "Part" Precinct was nominated by CSR Limited, the major landowner, to be released ahead of the DP&E timeline and have entered into a Planning Agreement with the Minister for Planning to fund the planning process for the early release of the precinct. Even though the northern remainder ("Balance") of the West Schofields precinct was released in May 2017, the initial development front is still expected to be within land owned by CSR.

The "Part" Precinct has a total area of 240 Ha of which CSR the largest landowner owns approximately 87 Ha. Figure 1.2 shows the major parcels of land owned by CSR within the "Part" Precinct which is proposed to be developed in three stages.

Discussions with CSR have indicated that Stage 1 will be the initial development front for their proposed development. CSR intend to continue with brickmaking and landfilling activities on the site shown as Stage 3 and this is expected to finish in 2020. The current brick pits will be rehabilitated suitable for urban development.

Proposed development yields and timeframes for West Schofields Precinct are shown in Table 2.2.

Table 2-2: Indicative Development Staging of West Schofields

YEAR	Number of Dwellings (Residential zoned)				
	CSR (Stage 1)	CSR (Stages 2, 3 & 4)	Remainder in Precinct	Total	Cumulative
2019-2024	321	401	-	722	722
2024-2029	-	803	447	1,250	1,972
2029-2034	-	-	900	900	2,872
2034-2039	-	-	850	850	3,722
2039-2041	-	-	285	285	4,007

Notes 1. Dwelling numbers exclude existing dwellings (82) and proposed Environmental Living dwellings (135).

3 EXISTING SERVICING INFRASTRUCTURE

The following details existing infrastructure services located within and in close proximity to the West Schofields Precinct. Existing infrastructure layout plans are based on Dial Before You Dig (DBYD) information and any relevant service provider consultation (see Appendix A). Whilst every effort has been made to identify existing infrastructure this will require a full assessment and review at time of development applications.

3.1 WATER SUPPLY

Water is currently supplied to the Site from the Rouse Hill and Minchinbury Water Supply Systems. The precinct is currently supplied via various 200/150/100mm reticulation mains from Carnarvon Road, Durham Road and Meadow Road. The existing water supply is generally a rural supply only and does not have the capacity to supply the proposed residential release. There is also a 200mm main in Victory Road which was only designed to serve the existing Colebee development.

Sydney Water has advised that a new 450mm trunk watermain along South St should be delivered by Roads and Maritime Services (RMS) as part of the road widening in 2018/19. Once this main is commissioned, the West Schofields “Part” Precinct will be supplied from the Minchinbury Water Supply System. The remainder of the West Schofields precinct (“Balance” Precinct) will remain supplied via the Rouse Hill system for at least the short term.

The new 450mm trunkmain along South St has been designed with capacity to service some of the proposed development within the West Schofields precinct and therefore may be available for connection when commissioned.

Figure 3.1 shows the existing water infrastructure within the West Schofields site including the 450mm watermain programmed to be constructed along South St.

INDICATIVE ONLY

Legend

- Existing Water Mains
- West Schofields Precinct Boundary
- West Schofields Balance Precinct
- West Schofields Part Precinct

Riverstone

Garfield Rd

DICL100

DICL300

CICL100

PE125

CICL500

Neville Rd

CICL100

OPVC100

Burfitt Rd

PE125

North St

PE100

Vine St

Carnarvon Rd

Fell Pl

CICL150

Schofields

Grange Ave

CICL250

450mm watermain to be constructed as part of road widening (2018/19)

PE180

South St

Marsden Park

Angus Rd

Durham Rd

CICL200

Meadow Rd

Jersey Rd

Richmond Rd

Townson Rd

DICL450

DICL250

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PROJECT NO. 15-004482

MAP SERIES:

PROJECT NAME: Infrastructure servicing - West Schofields Precinct

CLIENT:

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SCALE:

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Drawing Title:

West Schofields Precinct
Existing Water Services

Figure No. 3.1

Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994

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3.2 WASTEWATER

There currently are no reticulated wastewater services in the West Schofields Precinct which is mostly serviced by various onsite treatment and disposal systems. The precinct lies within the catchment of Riverstone Wastewater Treatment Plant (WWTP)

The nearest trunk sewer to the site is the existing 300mm Schofields Carrier (Section 1) and the 900 mm Riverstone Carrier which are located on the eastern side of Eastern Creek. These carriers both drain to the Riverstone WWTP.

Sydney Water recently commenced construction of a new sewage pumping station (SP1173) and rising main (450mm) to serve the Marsden Park Industrial Precinct (MPIP) and additional residential lands within the natural catchment of SP1173 including a portion of the catchment within the West Schofields “Part” Precinct (SWC, 2016) The new pumping station is likely to be completed by mid 2018.

The existing wastewater system in the study area is shown in Figure 3.2.

Legend

- Sewer Reticulation
- Sewer Trunk Main
- Sewer Rising Main
- Sewer Pumping Station
- West Schofields Precinct Boundary
- West Schofields Balance Precinct
- West Schofields Part Precinct

INDICATIVE ONLY

To Riverstone Wastewater Treatment Plant

Riverstone

Garfield Rd

Neville Rd

900mm Riverstone Carrier

Burfitt Rd

North St

Carnarvon Rd

Vine St

Fell Pl

Schofields

450mm rising main (under construction)

Grange Ave

300mm Schofields Carrier

South St

Angus Rd

Marsden Park

SPS1173

Durham Rd

Jersey Rd

Meadow Rd

Richmond Rd

Townson Rd

N

Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994

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PROJECT NO. 15-004482

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PROJECT NAME: Infrastructure servicing - West Schofields Precinct

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Drawing Title:

West Schofields Precinct Existing Sewer Services

Figure No. 3.2

3.3 ELECTRICITY

3.3.1 ENDEAVOUR

The Site is currently serviced primarily by two electrical substations. The western part of the West Schofields Precinct is supplied via the South Marsden Park Zone Substation while the eastern part is supplied via the Schofields Zone Substation. Supply is brought into the site via the existing overhead network from the substations. Property connections are generally direct from the overhead network.

3.3.2 TRANSGRID

Existing 330kV transmission lines cross the West Schofields site from the southwest corner of the site and then towards Grange Rd/South St. The transmission lines are located within a 60.96m easement primarily through private land.

Figure 3-3 shows the approximate location of the existing main electrical feeders and the transmission easement.

Legend

- AO52 Feeder (Riverstone ZS)
- SC1238 Feeder (Schofields ZS)
- SQ1142 Feeder (Marsden Park ZS)
- Transmission Easement
- West Schofields Precinct Boundary
- West Schofields Balance Precinct
- West Schofields Part Precinct

INDICATIVE ONLY

Riverstone
Garfield Rd
Neville Rd
Burfitt Rd
North St
Vine St
Fell Pl
Carnarvon Rd
Schofields
Schofields ZS
Grange Ave
South St
Angus Rd
Durham Rd
Marsden Park
HC2064
Jersey Rd
Meadow Rd
Townson Rd
Richmond Rd
South Marsden Park ZS

Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994

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PROJECT NAME:
Infrastructure servicing - West Schofields Precinct

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Drawing Title:

West Schofields Precinct
Existing Electricity Supply

Figure No.

3.3

3.4 GAS

An existing 500mm Trunk Pipeline (7000kPa) is located right through the heart of the site traversing the site from Meadow Road, Durham Road, Angus Road, Grange Ave, North St, Burffit Rd and Garfield Rd.

The existing trunk pipeline is located in an easement 24.385m wide at a depth of approximately 1.0m and is located within the same easement as the Newcastle to Sydney Oil Pipeline (see Section 3.6.1). The easement can be located by the appropriate signs along the route of the easement (see Appendix B, Photos A and B).

There is also an existing 160mm network main (210KPa) that travels along Meadow Rd, Durham Rd, Angus Rd, Carnarvon St and then through Grange Ave to supply parts of the adjacent Schofields Precinct area.

The Zone of Influence of the gas pipeline is categorised by the risk to life associated with a potential failure along the pipe. Development within the zone of influence of the pipeline is still permissible, though types of development should be limited to exclude where the occupants cannot easily or readily be evacuated in the event of a pipeline failure. Jemena would likely require a risk review of the proposed Indicative Layout Plan in the form of a Safety Management Study (SMS).

Any work near the easement or gas pipeline needs to follow the Jemena guidelines shown in Appendix A.

INDICATIVE ONLY

Legend

- Easment for 500mmm Trunk Gas Pipe (7000kPa)
- Existing 160mm Gas Main (210kPa)
- West Schofields Precinct Boundary
- West Schofields Balance Precinct
- West Schofields Part Precinct

Riverstone
Garfield Rd
Neville Rd
Burfitt Rd
North St
Vine St
Carnarvon Rd
Fell Pl
Meadow Rd
Schofields
Grange Ave
South St
Angus Rd
Marsden Park
Durham Rd
Jersey Rd
Meadow Rd
Townson Rd
Richmond Rd

N

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Drawing Title:
West Schofields Precinct
Existing Gas Services

Figure No.
3.4

Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994
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3.5 TELECOMMUNICATIONS

NBN currently has the West Schofields Precinct as part of their planned rollout and the site is currently being serviced.

Figure 3.5 details the NBN indicative plan extracted from DBYD showing underground fibre optic and telecommunication owned by NBN in the West Schofields area.

INDICATIVE ONLY

Precinct

- West Schofields Balance Precinct
- West Schofields Part Precinct
- West Schofields Precinct Boundary

- Fibre Optic Assets In Service: Cable/Duct/Trench
- Fibre Optic Assets Designed/ Constructed: Cable/Duct/Trench

Riverstone
Garfield Rd
Carlton St
Denmark Rd
Creek St
Neville Rd
Burfitt Rd
North St
Vine St
Fell Pl
Carnarvon Rd
Schofields
Grange Ave
South St
Marsden Park
Angus R
Durha Rd
Meadow Rd
Jersey Rd
Richmond Rd
Townson Rd

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PROJECT NO. 15-004482
MAP SERIES:

PROJECT NAME: Infrastructure servicing - West Schofields Precinct
CLIENT:

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SCALE:

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Drawing Title:

West Schofields Precinct
Existing NBN Fibre Optic Assets

Figure No.
3.5

Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994

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3.6 NEWCASTLE TO SYDNEY PIPELINE

As noted in Section 3.4, the existing gas pipeline easement which runs through the West Schofields precinct shares its easement with the Newcastle to Sydney oil pipeline. The two pipelines share a common trench approximately 1 metre apart. Discussions with Caltex have indicated that the oil pipeline is a 350mm high pressure line (maximum operating pressure of 10 MPa) at a varying depth of between 0.9m – 1.2m. The pipelines shares the same zone of influence as the Jemena pipeline and as such would be considered in any risk review undertaken as part of Jemena's SMS.

INDICATIVE ONLY

Legend

- Easement for Newcastle to Sydney Oil Pipeline
- West Schofields Precinct Boundary
- West Schofields Balance Precinct
- West Schofields Part Precinct

Riverstone
Garfield Rd
Neville Rd
Burfitt Rd
North St
Vine St
Fell Pl
Carnarvon Rd
Schofields
Grange Ave
South St
Marsden Park
Angus R
Durha Rd
Meadow Rd
Jersey Rd
Richmond Rd
Townson Rd

Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994

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PROJECT NO. 15-004482
MAP SERIES:

PROJECT NAME: Infrastructure servicing - West Schofields Precinct
CLIENT:

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SCALE:

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www.calibreconsulting.co

Drawing Title:

West Schofields Precinct
Existing Caltex Oil Pipeline

Figure No.

3.6

4 ULTIMATE SERVICING INFRASTRUCTURE

All proposed locations/alignments and sizes of infrastructure (eg water and wastewater pipelines, pumping station facilities, connection points etc) shown and discussed in this report have been identified by Calibre solely and are indicative only. All locations/alignments of proposed infrastructure are subject to future detailed planning and design by each of the relevant Authorities (eg Sydney Water, Endeavour) including consultation with impacted landowners.

Uncommitted spare system capacity identified within this report is only assumed to be available for connection at the time of this study being carried out. This spare capacity is not reserved by the relevant Authorities (eg Sydney Water, Endeavour) for any particular development and may be utilised by other developments in the meantime.

4.1 WATER

4.1.1 WATER SUPPLY PLANNING AND DESIGN CRITERIA

The planning and design criteria used to forecast future water demands are generally taken from the Water Supply Code of Australia, Sydney Water Edition, WSA 02 – 2002 and the *North West Priority Growth Area – Western Precincts, Options Report (SWC,2017).*

Design demands assume rainwater tanks are provided for non-potable water uses, with top-up to the rainwater tanks provided from the drinking water supply.

Table C.1 (Appendix C) summarises the planning criteria that have been adopted for this study. Both the water demands and planning criteria identified in this report are preliminary only and will need to be reassessed as part of individual development applications to Sydney Water.

4.1.2 WATER DEMAND

In order to plan for future infrastructure requirements for the West Schofields Precinct, an estimate of the projected maximum day demand is required. Projected ultimate maximum day water demands for the West Schofields precinct are shown in Table 4.1 and are based on the design criteria shown in Table C.1 and the development yields in Table 2.1.

Table 4-1: Maximum Day Demands for West Schofields Precinct

Development Category	Maximum Day Demand (MLD)						
	CSR (Stage 1)	*CSR (Stages 2,3 & 4)*	*Remainder East*	*Remainder West*	*Total (Part)*	*Balance*	*Total*
Existing Residential	0.00	0.00	0.04	0.04	0.08	0.08	0.08
Low Density Residential	0.58	1.91	1.42	0.24	4.15	2.20	6.35
Medium Density Residential	0.00	0.23	0.21	0.24	0.68	0.00	0.68
Town Centre	0.00	0.00	0.00	0.10	0.10	0.00	0.10
Environmental Living	0.00	0.00	0.00	0.03	0.03	0.21	0.24`
TOTAL RESIDENTIAL	**0.58**	**2.14**	**1.67**	**0.65**	**5.0**	**2.5**	**7.5**
Commercial/Business	*0.00*	*0.00*	*0.00*	*0.09*	0.09	0	0.09
School	*0.00*	*0.00*	*0.00*	*0.00*	0.00	0.09	0.09
TOTAL NON-RESIDENTIAL	**0**	**0.0**	**0**	**0.09**	**0.09**	**0.09**	**0.2**
TOTAL	***0.6***	***2.1***	***1.7***	***0.7***	***5.1***	***2.6***	***7.7***

The maximum day demands shown in Table 4.1 are slightly lower than the demands estimated by Sydney Water in their options report (SWC, 2017) due to a more accurate breakdown on residential type (ie medium density housing) being available at the time of this infrastructure report being prepared. It is not expected that this reduction in demand will have a significant impact on the sizing of the trunk infrastructure proposed by Sydney Water in their options assessment report.

4.1.3 PREFERRED SERVICING STRATEGY

The ultimate water supply servicing strategy for the West Schofields precinct described in this report is consistent with Sydney Water's "*North West Priority Growth Area – Western Precincts, Water and Wastewater Options Assessment Report* (SWC, 2017)" and which is valid at date of issue.

The preferred servicing strategy to service the West Schofields precinct is via the Minchinbury Supply Zone. Sydney Water has advised that there is sufficient existing storage capacity within the Minchinbury Supply Zone to ultimately supply West Schofields precinct. However, new trunk mains will be required to be extended from the existing system to service the precinct. Additionally, smaller lead-in mains and reticulation will also be required.

As noted in Section 3.1 Sydney Water has advised that the proposed 450mm along South St is programmed to be delivered in 2018/19. Once this main is commissioned it could provide a connection point to the new development for both the 'Part' and 'Balance" precincts.

An indicative trunk watermain network layout (>= 200mm) to service the West Schofields Precinct is shown in Figure 4.1. The alignment of these watermains are proposed to be located within existing and future roads within the development site and therefore are subject to the final road alignment adopted for the site.

Legend

- Existing Water Mains
- West Schofields Precinct Boundary
- West Schofields Balance Precinct
- West Schofields Part Precinct
- Proposed 200mm watermain
- Proposed 300mm watermain
- Proposed 375mm watermain
- Proposed 450mm watermain (2018/19)

INDICATIVE ONLY

Riverstone
Garfield Rd
Neville Rd
Burfitt Rd
North St
Vine St
Carnarvon Rd
Fell Pl
Schofields
Marsden Park
South St
Angus R
Durham Rd
Jersey Rd
Meadow Rd
Townson Rd
Richmond Rd

ISS	BY	CHK	DATE	DETAILS
01	TP	_	27/07/17	DRAFT

DRAWING NO: L03017.407 PWEXITINGAV4
PROJECT NO. 15-004482
MAP SERIES:

PROJECT NAME: Infrastructure servicing - West Schofields Precinct
CLIENT:

0 62.5 125 250 m
1:11,302
SCALE:

calibre CONSULTING www.calibreconsulting.co

Drawing Title:
West Schofields Precinct
Proposed Water Supply Network (as of Feb 2018)

Figure No. 4.1

Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994
H:\17\17-000114 - West Schofields Precinct - ISTS UD\06_Model\GIS\ShapeData\PWexitingAV4.mxd

4.1.4 STAGING OF WATER INFRASTRUCTURE

4.1.4.1 "PART" PRECINCT

The "Part" Precinct should be supplied with drinking water via the 450mm watermains along South St (proposed) and Richmond Rd (existing asset). As shown in Figure 4.1, a new 300mm trunkmain is likely to be constructed through the "Part" Precinct to ultimately link both of the 450mm watermains together. This 300mm watermain (length of 3km) is likely to be constructed in stages and the final alignment will depend on development staging and the final street layout. As initial development is anticipated to commence in Stage 1 CSR during 2019, the initial connection is likely to be from the existing 450mm main in Richmond Rd. This will likely require a new 300mm watermain to be constructed along Townson Rd and into the initial development area. As a result of the current planning position and associated funding routes, Sydney Water has advised that it has no committed timeframe for delivery of this 300mm watermain and is likely to be constructed after 2019. Therefore, this main may need to be constructed and funded upfront by the developer to enable servicing of the initial development front by 2019. Connection to the future 450mm watermain in South St will be required as development proceeds within the northern section of the "Part" Precinct. Additional 200mm (indicatively shown in Figure 4.1) and smaller watermains (100mm and 150mm) will be required to be constructed within the development site. Final sizing of all mains and alignment within the site will be determined by hydraulic modelling.

Table 4.2 shows the key catchment information for those dwellings being supplied with drinking water within the "Part" Precinct including infrastructure required (>= 200mm) and the estimated costs for servicing.

Table 4-2: Water Supply to "Part" Precinct

Water Supply to "Part" Precinct		
Item	**Value**	**Comment**
Residential dwellings	2847	Based on latest data provided by DP&E.
Non- Residential	Business/Commercial Centre	2.3 ha of Business/Commercial
Average Demand (MLD)	2.1	Based on 202 l/capita/day
Maximum Day Demand (MLD)	5.2	Based on 517 l/capita/day
3km of 300mm 2.8km of 200mm	$8.4m[1]	Infrastructure to be delivered in stages. No committed date for delivery by Sydney Water but likely to be no earlier than 2021.
Reticulation mains	$4000 per lot	Generally 150/225mm in size and to be delivered by the developer.

Note: 1. See Appendix D for details of cost estimates. All cost estimates have been calculated by Calibre and are based on Calibre's assumptions and demand data

4.1.4.2 "BALANCE" PRECINCT

The "Balance" Precinct should be supplied with drinking water via the potential 450mm watermain along South St. As shown in Figure 4.1, a new 375mm trunkmain (approx. length of 1.7km) is proposed to be constructed through the "Balance" Precinct along Carnarvon Rd and will link to the existing watermain in Garfield Rd. The 375mm watermain is likely to be constructed in stages. The majority of the remainder of the site will be supplied from 100/150mm reticulation mains with only a small length (~ 1.3km) of additional 200mm likely to be required. Final sizing of all mains and alignment within the site will be determined by hydraulic modelling.

Table 4.3 shows the key catchment information for those dwellings being supplied with drinking water within the “Balance” Precinct including infrastructure required (>= 200mm) and the estimated costs for servicing.

Table 4-3: Water Supply to “Balance” Precinct

Water Supply to “Balance” Precinct		
Item	**Value**	**Comment**
Residential dwellings	1377	Based on latest data provided by DP&E.
Non- Residential	Proposed School	Assumed 400 pupils.
Average Demand (MLD)	1.0	Based on 202 l/capita/day
Maximum Day Demand (MLD)	2.5	Based on 517 l/capita/day
1.7km of 375mm 1.3km of 200mm	$6.0m	Infrastructure to be delivered in stages. No committed date for delivery by Sydney Water but likely to be after 2024 and will be subject to funding approvals.
Reticulation mains	$4000 per lot	Generally 150/225mm in size and to be delivered by the developer.

Note: 1. See Appendix D for details of cost estimates. All cost estimates have been calculated by Calibre and are based on Calibre’s assumptions and demand data

4.2 WASTEWATER

4.2.1 WASTEWATER PLANNING AND DESIGN CRITERIA

The planning and design criteria used to forecast future sewer loadings are generally taken from the Sewerage Code of Australia, Sydney Water Edition, WSA 02 – 2002 and are expressed as an Equivalent Population (EP) for a particular land use. The proposed sewers will be designed and constructed to Sydney Water’s Leak Tight Technical Specification. Table C.2 summarises the criteria adopted for this study.

Both the wastewater flows and planning criteria identified in this report are preliminary only and will need to be reassessed as part of individual development applications to Sydney Water.

4.2.2 WASTEWATER FLOW PROJECTION

The wastewater flow projections for West Schofields are based on the development yields shown in Table 2.1 and the wastewater design criteria detailed in Table C.2 (Appendix C). The estimated wastewater flows for West Schofields are detailed in Table 4.4.

Table 4-4: Wastewater flows

Development Category	Equivalent Population (EP)							ADWF (MLD)
	CSR (Stage 1)	*CSR (Stages 2 & 3)*	*Remainder East*	*Remainder West*	*Total (Part)*	*Balance*	*Total*	
Existing Residential	0	0	70	70	140	147	287	0.02
Low Density Residential	1124	3703	2762	473	8062	4263	12,325	1.85
Medium Density Residential	0	438	408	411	1257	0	1257	0.19
Town Centre	0	0	0	201	201	0	201	0.03
Environmental Living	0	0	0	63	63	410	473	0.07
TOTAL RESIDENTIAL	**1124**	**4141**	**3240**	**1218**	**9723**	**4820**	**14,543**	**2.15**
Commercial/Business	*0*	*0*	*0*	*173*	173	0	173	0.02
School	0	0	0	0	0	80	80	0.01
TOTAL NON-RESIDENTIAL	**0**	**0**	**0**	**173**	**173**	**80**	**253**	**0.03**
TOTAL	***1124***	***4141***	***3240***	***1391***	***9896***	***4900***	***14,796***	***2.2***

The average day wastewater flows shown in Table 4.6 are slightly lower than the flows estimated by Sydney Water in their options report (SWC, 2017) due to a more accurate breakdown on residential type (ie medium and high density housing) being available at the time of this infrastructure report being prepared. Preliminary sizing of assets identified in this report based on the lower flows shown in Table 4.4 indicate that this reduction in wastewater flow does not have a significant impact on the sizing of the proposed trunk infrastructure.

4.2.3 PREFERRED SERVICING STRATEGY

In June 2017, Sydney Water approved the "*North West Priority Growth Area – Western Precincts, Water and Wastewater Options Assessment Report*" (SWC, 2017) and which is valid at date of issue. The purpose of the study was to review, identify opportunities, confirm the sizing, timing and approximate location of trunk infrastructure identified in the previously approved water and wastewater servicing strategy (prepared in 2012) based on the recent development growth information. The information provided for ultimate wastewater servicing of West Schofields in this section, including revised pipe sizes, is consistent with the outcomes of the latest approved servicing report provided by Sydney Water.

The West Schofields precinct area is proposed to be ultimately transferred to the existing Riverstone Wastewater Treatment Plant (WWTP) by three different ways.

- Transfer to existing SPS 1173
- Transfer to existing Riverstone Carrier
- Transfer to future SPS "B"

Figure 4.2 shows the indicative ultimate catchment areas based on the three servicing solutions.

INDICATIVE ONLY

Legend

- Existing Sewer Mains
- Future Sewer Mains
- Existing Sewer Pumping Station
- Future Sewer Pumping Station
- Potential Interim Pumpout location

Wastewater Catchments

- Dwellings to drain to existing Riverstone Carrier
- Dwellings to drain to future SPS "B"
- Dwellings to drain to SPS 1173

Riverstone

To Riverstone Wastewater Treatment Plant

Approximate location of future connection point to existing Riverstone Carrier

900mm Riverstone Carrier

West Schofields Carrier Section 1
Diameter = 450mm
Length = 710m

West Schofields Carrier Section 2
Diameter = 375mm
Length = 950m

300mm Schofields Carrier

2 x 450mm rising main
(1 x 450mm currently under construction)

SPS 1173 (under construction)

CSR Line 1
Diameter = 300mm
Length = 1400m

Ridgeline

Remainder West Line 1
Diameter = 225mm
Length = 800m

Proposed location of Interim Pumpout (if required)

West Schofields Precinct Boundary

Neville Rd
Burfitt Rd
North
Vine St
Fern Pl
Garfield Rd
Grange Ave
South St
Angus R
Durha Rd
Jersey Rd
Meadow Rd
Richmond Rd
Townson Rd

Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994

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ISS	BY	CHK	DATE	DETAILS
01	TP	_	09/10/17	DRAFT

DRAWING NO: L03017.407 32WWEXITING_AV5_OBO
PROJECT NO. 15-004482
MAP SERIES:
PROJECT NAME: Infrastructure servicing - West Schofields Precinct
CLIENT:
0 62.5 125 250 m
1:11,302
SCALE:

calibre

Drawing Title:
West Schofields Precinct
Indicative Wastewater Servicing **Strategy (as of Feb 2018)**

Figure No. 4.2

The final servicing catchment areas and the final alignment of the proposed trunk infrastructure shown in Figure 4.2 are indicative only and will be determined during detailed planning including consultation with the affected landowners.

Sydney Water has advised that Riverstone WWTP is currently being upgraded and should have sufficient treatment capacity to cater for the projected flows from West Schofields.

4.2.4 STAGING OF WASTEWATER INFRASTRUCTURE

As shown in Figure 4.2, the West Schofields precinct area is proposed to be ultimately transferred to the existing Riverstone Wastewater Treatment Plant (WWTP) by three different ways.

4.2.4.1 TRANSFER TO EXISTING SPS 1173

Lots within this catchment (known as Remainder West) will be transferred by gravity to the pumping station (SPS 1173) currently being constructed by Sydney Water. This pumping station and associated 450mm rising main are anticipated to be commissioned by mid 2018. Lead-in wastewater mains will be required in the future to transfer flows from this catchment to SPS 1173.

Table 4.5 shows the key catchment information for those dwellings draining to SPS 1173 within the West Schofields Precinct including infrastructure required and the estimated costs for servicing. Any lots identified in this report to be transferred to SPS 1173 will be subject to future Sydney Water reviews and confirmation during time of application to connect.

Table 4-5: Transfer to SPS "1173" Catchment

Transfer to SPS 1173 Catchment		
Item	**Value**	**Comment**
Residential dwellings	359	Based on latest data provided by DP&E.
Non- Residential	Business/Commercial centre	2.3 Ha
EP	1391	Based on typical Sydney Water design criteria.
ADWF (l/s)	2.1	Assumes 150 l/EP/day.
PDWF (l/s)	5.7	Based on the Sewerage Code of Australia, Sydney Water Edition.
DWF (l/s)	16.7	Based on the Sewerage Code of Australia, Sydney Water Edition.
SPS 1173 & 450mm pressure main	Delivered by SWC	Currently being constructed by Sydney Water and due to be completed by 2018. This pumping station mainly services the Marsden Park Industrial Precinct but some capacity has been allocated to the Part Precinct.
Remainder West Line 1 – 800m of 225mm	$1.2m[1]	Lead in main required to be constructed in the future to service catchment and to connect to SPS 1173.
Reticulation mains	$6000 per lot	Generally 150/225mm in size and to be delivered by the developer.
Total Cost (excl reticulation)	~$1.2m	

Note: 1. See Appendix D for details of cost estimates. All cost estimates have been calculated by Calibre and are based on Calibre's assumptions and flow data

4.2.4.2 TRANSFER TO EXISTING RIVERSTONE CARRIER

This catchment area will be transferred by gravity to the existing 900mm Riverstone Carrier. This existing carrier has sufficient capacity to accept the proposed flows from West Schofields (SWC, 2017)

Significant new infrastructure is required to service this catchment area as shown in Figure 4.2. This includes over 3km of a new 300/375/450mm wastewater trunk main and additional lead-in mains. As a result of the current planning position and associated funding routes, Sydney Water has advised that it has no committed timeframe for delivery of this trunk main and would unlikely be constructed until 2021 at the earliest (subject to funding approval).

Sydney Water identified delivery risks (SWC, 2017) with the construction of the portion of the sewer main across Eastern Creek. The design and constructability of this part of the proposed trunk main can only be confirmed after detailed survey and geotechnical assessment of the creek crossing has been carried out. If a gravity connection to the existing Riverstone Carrier is not viable then a pumped solution to either Riverstone Carrier or SPS 1173, or gravity flow to the future SPS "B" are possible alternatives.

Table 4.6 shows the key catchment information for those dwellings draining to the Riverstone Carrier within the West Schofields Precinct including trunk infrastructure required and the estimated costs for servicing. Any lots identified in this report to be transferred to Riverstone Carrier will be subject to future Sydney Water reviews and confirmation during time of application to connect.

Table 4-6: Transfer to "Riverstone Carrier" Catchment

Transfer to Riverstone Carrier Catchment		
Item	**Value**	**Comment**
Residential dwellings	3225	Based on latest data provided by DP&E.
Non- Residential	1 school	400 students assumed for proposed school.
EP	11,686	Based on typical Sydney Water design criteria.
ADWF (l/s)	20.2	Assumes 150 l/EP/day.
PDWF (l/s)	40	Based on the Sewerage Code of Australia, Sydney Water Edition.
DWF (l/s)	120	Based on the Sewerage Code of Australia, Sydney Water Edition.
West Schofields Carrier Sections 1 & 2 – 1660m of 375/450mm	$10.4m[1]	Sydney Water has no committed delivery date for this infrastructure but unlikely to be earlier than 2021.
CSR Line 1 – 1400m of 300mm	$2.1m[1]	Sydney Water has no committed delivery date for this infrastructure but unlikely to be earlier than 2021.
Reticulation mains	$6000 per lot	Generally 150/225mm in size and to be delivered by the developer as development progresses.
Total Cost (excl reticulation)	~$12.5m	

Note: 1. See Appendix D for details of cost estimates. All cost estimates have been calculated by Calibre and are based on Calibre's assumptions and flow data

4.2.4.3 TRANSFER TO FUTURE SPS "B"

Flows within this catchment could be transferred by gravity to a future pumping station (SPS "B"). As a result of the current planning position and associated funding routes, Sydney Water has advised that it has no committed timeframe for delivery of this pumping station and would unlikely be constructed until 2024 at the earliest (subject to funding approval). This pumping station could also service parts of the Marsden

Park North Precinct. Lead-in wastewater mains will also be required in the future to transfer flows from this catchment to SPS “B”.

Table 4.7 shows the key catchment information for those dwellings draining to the future SPS “B” within the West Schofields Precinct including infrastructure required and the estimated costs for servicing. Any lots identified in this report to be transferred to SPS B will be subject to future Sydney Water reviews and confirmation during time of application to connect.

Table 4-7: Transfer to SPS “B” Catchment

Transfer to SPS “B” Catchment		
Item	**Value**	**Comment**
Residential dwellings	640	Based on latest data provided by DP&E.
Non- Residential	-	
EP	1719	Based on typical Sydney Water design criteria.
ADWF (l/s)	3.0	Assumes 150 l/EP/day.
PDWF (l/s)	8.0	Based on the Sewerage Code of Australia, Sydney Water Edition.
DWF (l/s)	23.9	Based on the Sewerage Code of Australia, Sydney Water Edition.
SPS B, 450mm pressure main & 375mm carrier	Delivered by Sydney Water	As a result of the current planning position and associated funding routes, Sydney Water has made no commitment to deliver this trunk infrastructure but unlikely to be earlier than 2024. Timing likely to be driven by demand for development within Marsden Pk Precinct.
Reticulation mains	$6000 per lot	Generally 150/225mm in size and to be delivered by the developer.

Note: 1. See Appendix D for details of cost estimates. All cost estimates have been calculated by Calibre and are based on Calibre’s assumptions and flow data.

4.2.4.4 INTERIM SERVICING

Initial development within the West Schofields site is anticipated to commence in Stage 1 CSR during 2019. This initial development front is within the “Existing Riverstone Carrier Catchment” and therefore as shown in Figure 4.2 will need to be serviced by the new 300/375/450mm sewer main to be connected to the existing Riverstone Carrier via a gravity crossing across Eastern Creek or alternative. Sydney Water has made no commitment to deliver this trunk infrastructure by 2019. Additionally, if the developer were to deliver this infrastructure ahead of Sydney Water’s timeframe (likely to be 2021 at the earliest and subject to funding approval), it would require a lead time of between 24-36 months to complete the planning, design and construction of these works.

To enable development of Stage 1 CSR to proceed by 2019, may require an interim servicing solution with a lead time of approximately 12-18mths.

4.3 ELECTRICITY

The ultimate strategy for the site will see the South Marsden Park zone substation provide power to the western areas of the Site and the Schofields zone substation provide power to the eastern areas of the site as shown in Figure 4.6. To meet the ultimate load requirements for this site, an additional 3-5 feeders will need to be extended from both the Schofields and South Marsden Park zone substations.

The northern part of the site ("Balance" Precinct) will be serviced via a combination of South Marden Park substation (to supply the western part) and Schofields substation (to supply the eastern part). Both substations will require additional feeders to be extended by Endeavour Energy to the site to service the ultimate loads.

Endeavour Energy has advised (refer to Appendix A) that there will be some initial spare network capacity (approximately 250-500 dwellings) from Schofields feeder FDR SC1238 with high voltage customer (HVC 2064) closing (ie CSR). However, this spare capacity is on a 'first come, first serviced' basis and so this capacity may be utilised by adjacent developments outside of West Schofields Precinct. Assuming that the spare capacity is utilized by the initial development within West Schofields, the initial new feeder/s from the Schofields zone substation will be required by 2021.

4.4 GAS

Natural Gas is available in the vicinity and Jemena may be able to supply this proposal. In consideration of their shareholders' interests and under NSW regulation, Jemena Gas Networks (NSW) Ltd is required to ensure that any connection to the natural gas distribution system is commercially viable.

Jemena have advised (refer to Appendix A) that the nearest existing suitable gas main available for connection for the West Schofields site is located at the corner of Grange Ave and Carnarvon Rd (see Figure 3.4). The 160mm pressure main (210 kPa) has sufficient capacity to service the precinct at this time. Additional capacity to the precinct is available (if required) in an existing high pressure steel main located on the north east corner of South St and Richmond Rd.

Jemena also advised that in order to enhance the viability of gas supply to the site the developers should allow for the provision of all trenching required throughout the site at no cost to Jemena.

4.5 TELECOMMUNICATIONS

The installation of telecommunication lines to the new development area within West Schofields Precinct will be demand driven. Once the Site has been rezoned and developments commence, developers must lodge an application with the provider (NBN/Telstra). The provider will then bring in sufficient cabling through the main ducts to service the new development. New lead-in ducts should be installed during construction of new public roads within the Site or where upgrades to the existing roads are being carried out.

Legend

- Future feeder to be sourced from Schofields ZS
- Future feeder to be sourced from south Marsden Pk ZS
- West Schofields Balance Precinct
- West Schofields Part Precinct

INDICATIVE ONLY

Riverstone

Schofields

Marsden Park

GARFIELD RD W

VERON RD

RICHMOND RD

DARLING ST

Coordinate System: GDA 1994 MGA Zone 56 Datum: GDA 1994

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ISS	BY	CHK	DATE	DETAILS
01	TP	_	07/09/17	DRAFT

DRAWING NO: L03017.407 4.6_WWEXITING_V1

PROJECT NO. 15-004482

MAP SERIES:

PROJECT NAME: Infrastructure servicing - West Schofields Precinct

CLIENT:

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SCALE:

calibre

Drawing Title:

West Schofields Precinct
Proposed Ultimate Electricity Strategy

Figure No.

4.3

5 REFERENCES

Calibre Consulting 2016, *West Schofields Part Precinct, Infrastructure Servicing Study*, Prepared for the Department of Planning and Environment on behalf of CSR Limited.

Mott McDonald 2016, *Infrastructure Precinct Planning Report, Vineyard Precinct*, Department of Planning and Environment.

Sydney Water, *Interim Operating Plan, Draft Guidelines for temporary pump out systems*.

Sydney Water 2016, *Sewage Pumping Station SPS1173, South Street Marsden Park, Needs Specification*. Final Revision.

Sydney Water 2017, *North West Priority Growth Area – Western Precincts, Water & Wastewater Options Assessment, Options Report*.

Water Services Association of Australia 2009, *Sewerage Code of Australia,* Sydney Water Edition, WSA 02 – 2002

Water Services Association of Australia 2014, *Water Supply Code of Australia*, Sydney Water Edition, WSA 02 – 2002

Jemena, Guideline to Designing, Constructing and Operating around existing AS2885 Natural Gas Pipelines, Revision no. 8, Nov 2016

APPENDICES

APPENDIX A - SERVICE PROVIDER CORRESPONDENCE

13 July 2017

Endeavour Energy Ref: ENL2831 – 2017/02455/001

Calibre Consulting (NSW) Pty Ltd
Level 2/2 Burbank Place
BAULKHAM HILLS
NSW 2153

Attention: Mark Obuchowski

ENL2831 – SUPPLYENQUIRY | WEST SCHOFILEDS PRECINCT DEVELOPMENT, SCHOFIELDS

Dear Mark,

Thank you for your enquiry regarding the proposed West Schofields Precinct Development. This enquiry has been registered under our reference numbers – ENL2831. Please quote this number for all future correspondence.

Endeavour Energy acknowledges that proposed West Schofields Precinct Development will comprise of over 4,550 residential dwellings and a small commercial area with 2ha to be developed over 25 years.

Frist residential dwelling are anticipated in 2017/2018 and School Development with 800 students and Town Centre will be established in 2023.

The proposed growth projection (in residential dwellings – low density) for the West Schofields Precinct is provided as the following summary table:

Growth Scenario	2017/18	2022/23	2027/28	2032/33	2037/38	2041/42
High	50	1080	2130	3680	4680	5460
Medium	50	100	2050	3050	400	4500
Low	50	920	1870	2570	3520	3640

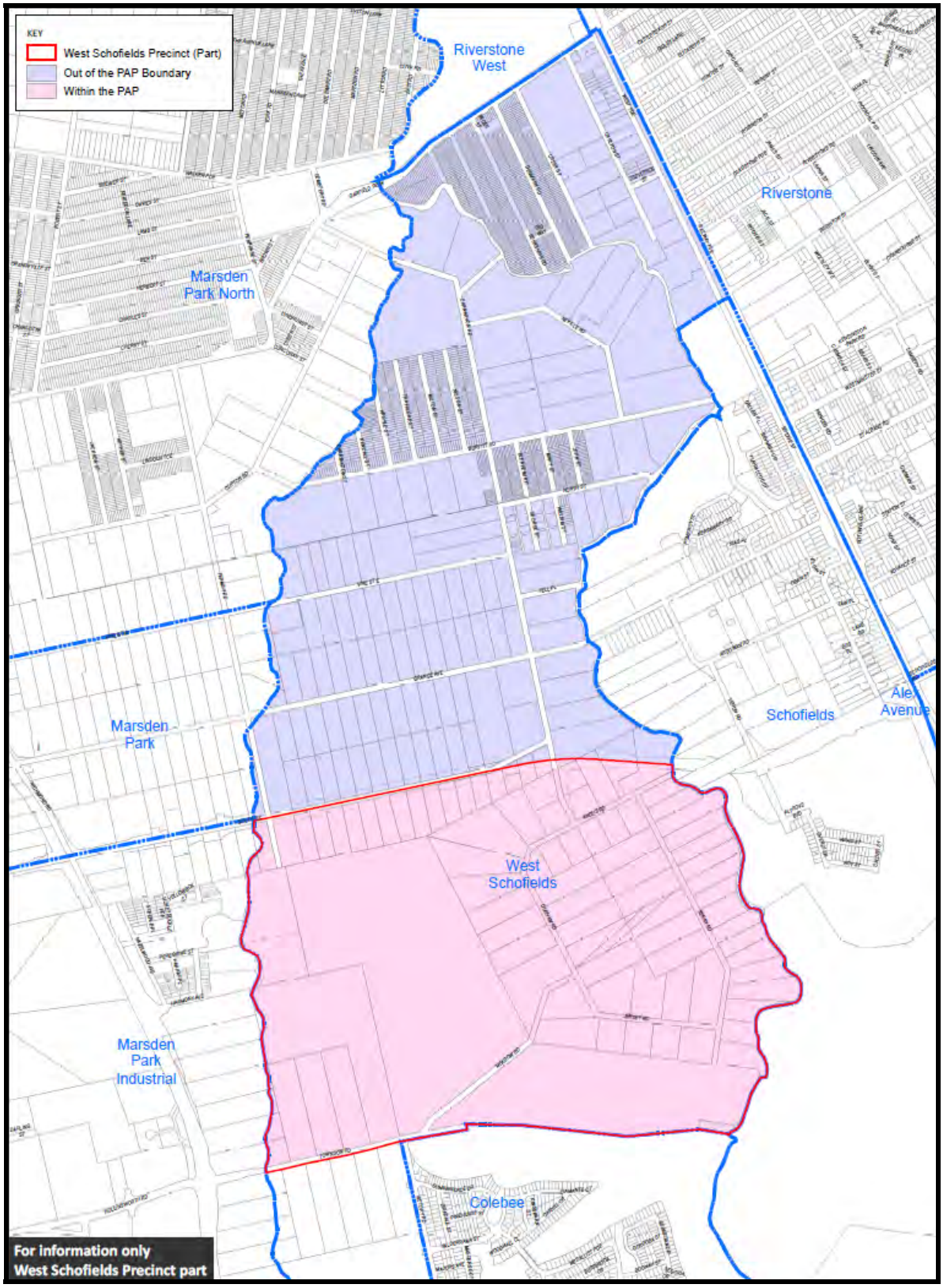
Load Assessment

Endeavour Energy EE assessed load breakdown as the following table (based on the mixture of units and houses).

Growth Scenario	2017/18	2022/23	2027/28	2032/33	2037/38	2041/42
High	0.2	5.2	9.5	15.9	20.1	23.3
Medium	0.2	4.7	9.1	13.2	22.6	19.5
Low	0.2	4.6	8.3	11.2	15.2	15.7

Remark:
1. *Load are measured in MVA*
2. *From 2022/23, the loads of commercial and school development are added*

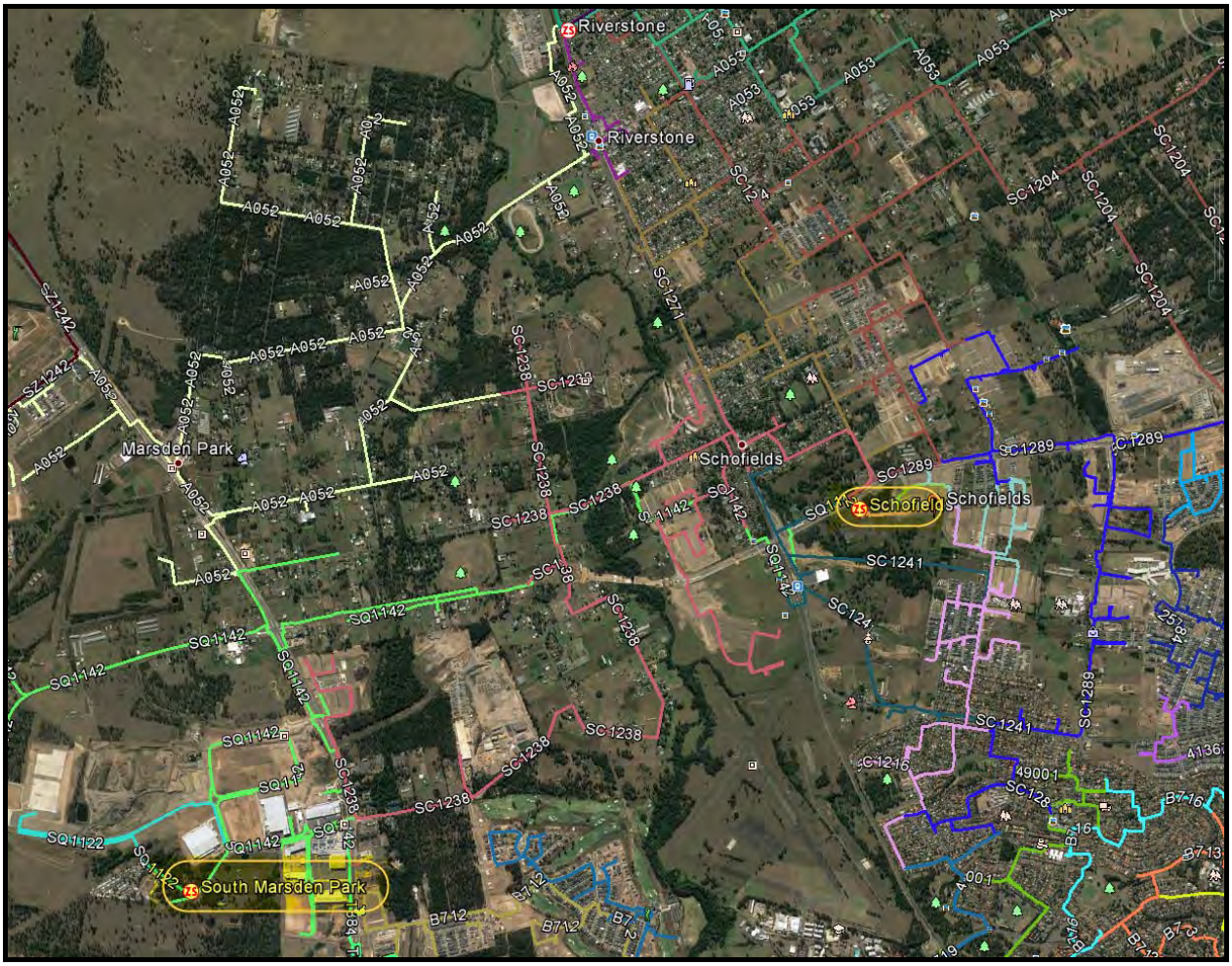
West Schofields Development Precinct (including areas in blue and pink)



The subject site is known as "West Schofields Development Precinct" and is located in the Blacktown local government area, in the North West Priority Growth Area. The site is bounded by Garfield Road to the North, Eastern Creek to the East, Bells Creek to the West and Townsend Road to the South.

Supply Requirments

Preliminary analysis indicates that presently some initial network capacity may be available from Schofields ZS feeder SC1238 with HVC 2064 (CSR) closing to supply pink areas, however nearby developments in Schofields may also use this capacity as those developments progress; in addition Riverstone ZS feeder A052 could have minimum capacity to supply northern sections of the blue areas but it is expected that capacity at Riverstone ZS is quickly being reserved for surrounding developments.



Therefore the ultimate load for this development will require a total of 3-5 feeders to be developed from Schofields ZS and South Marsden Park ZS. West Schofields Precinct locates within the western region of Schofields ZS and within the eastern region of South Marsden Park ZS.

Actually available capacity will be determined at the time of and application of load but the most likely supply arrangement will be:

1. Some initial capacity (1-2 MVA) available from existing Schofields FDR SC1238
2. New HV feeders are required from Schofields ZS and South Marsden Park ZS as development progresses

In order to program this connection, I recommend you to submit an application for Connection of Load and engage the services of a Level 3 ASP to prepare and provide an electrical design to Endeavour Energy in the form of a Proposed Metho of Supply. This activity is customer funded contestable work and you will need to pay for it.

Hope this assists for the meantime and this advice provided is in response to an enquiry only and does not constitute a formal method of supply. An application must be submitted and subsequent designs have been certified or approvals granted will Endeavour Energy reserve capacity on the network.

Should you have any questions regarding this response to your request for technical review, please contact me.

Yours faithfully,

David HO

David Ho
Contestable Works Project Manager
Network Connections

☎ Direct: (02) 9853 7901

✉ Email: david.ho@endeavourenergy.com.au

Jemena Limited
ABN 95 052 167 405

06/06/2017

Calibre Consulting Pty Ltd
PO Box 8300
Baulkham Hills BC,
N.S.W. 2153

Greg Knight
Network Development Manager
PO Box 8212
Tumbi Umbi NSW 2261
M: 0402 060 241
E: greg.knight@jemena.com.au
www.jemena.com.au

Att: Mr. Mark Obuchowski

Dear Mark:

RE: West Schofields-Infrastructure Planning

Natural Gas is available in the vicinity and could be extended to supply this proposal.

Our policy is to extend gas mains to all developments wherever possible, depending upon economic viability.

In consideration of our shareholders' interests and under NSW regulation, Jemena Gas Networks (NSW) Ltd is required to ensure that any extension of the natural gas distribution system is commercially viable and therefore must assess each request for supply on an individual basis.

Upon the provision of the final approved layout and gas Load configurations for the development a full economic evaluation can be undertaken to determine the availability of natural gas to the site.

A contribution may be required to assist in the economic viability of the proposal.

To assist in the planning of supply to the development

- I can confirm that the nearest suitable gas main is located on the corner of Grange Avenue and Carnarvon Road, this main has adequate capacity to service this proposal at this time. Jemena also has a high pressure steel main located on the North East Corner of South Street and Richmond Road which could be used to upgrade capacity into this precinct if and when required.
- To enable a thorough economic evaluation to be undertaken we will require an accurate breakdown of the dwelling and any commercial loads proposed for the site once all approvals and zonings are in place.
- In order to enhance the viability of gas supply to the site the developer should allow for the provision of all trenching required throughout the site at no cost to Jemena.

Jemena Gas Networks looks forward to providing the many benefits of Natural Gas to this proposal; if you could provide planning approval advice and the relevant drawings to me as soon as they are available I can arrange for a full supply assessment to be undertaken.

Thank you for your enquiry. If further information or assistance is required, please do not hesitate to contact me on 0402 060 241.

Yours faithfully

Greg Knight

Greg Knight
Network Development Manager

GUIDELINE

GUIDELINE TO DESIGNING, CONSTRUCTING AND OPERATING AROUND EXISTING AS2885 NATURAL GAS PIPELINES

GAS-960-GL-PL-001

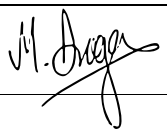
Revision Number: 8
Revision Date: 4/11/2016

AUTHORISATION

REVIEWED BY

Name	Job Title	Signature	Date
James Wu	Engineering Support Manager - Pipelines		04/11/16

Approved by

Name	Job Title	Signature	Date
Mark Dragar	Asset Manager - Pipelines		04/11/16

INTERNAL

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DOCUMENT HISTORY

Revision	Date	Author	Description of Changes
0	4/11/2016	R. JEYARAJAH	New Jemena Template and general changes. Addition of Feedback Form, and supersede all other Jemena encroachment guidelines

OWNING FUNCTIONAL GROUP & DEPARTMENT / TEAM

Asset Management : Asset Strategy Gas : Pipelines

REVIEW DETAILS

Review Period:	As required
Next Review Due:	As required

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1 INTRODUCTION

1.1 PURPOSE

This document has been developed to provide general guidelines to assist the Third Party in their design/construction proposal prior to submitting it to Jemena for review.

This document does **NOT** authorise the Third Party to carry out any construction activities unless the design/construction proposal has been reviewed, assessed and accepted by Jemena.

Jemena Pipelines are licensed under the legislative provisions of each State. The Legislations contain a number of requirements including the:

- Approval from the relevant statutory authority for any modification to the assets as a result of the encroachment.
- Where required separate easements for third party services crossing Jemena Pipelines, and
- Approvals from the easement licence holder for works within the easement.

Jemena aims to continuously improve the guidelines it provides to help avoid delays or additional work or costs being incurred. The Feedback Form located in Appendix A of this guideline can be used to provide suggestions/or questions for continuous improvement.

1.2 DEFINITION

Term	Definition
Easement	A corridor for Jemena Pipelines that are laid in land other than road reserve (Private property) require an easement. The easement terms and conditions are listed in the current Jemena 88B document, to obtain the 88B document refer to Jemena Land Services.
Encroachment	Any design or construction activity and changes in operating condition that may impact on the integrity of the pipeline; Also see Standard and Non-Standard Encroachment
Encroachment Management Study (EMS)	The process that identifies threats to the pipeline system and applies controls to them, and (if necessary) undertakes assessment and treatment of any risks to ensure that residual risk is reduced to an acceptable level. This will include conducting workshops that will include relevant Stakeholders from the Third Party, Jemena lands, Service Delivery and Asset Management.
Jemena Pipeline (AS2885 pipeline)	A Jemena owned/operated natural gas pipeline that operates above 1050 kPa.
Jemena Representative	Responsible for providing site instructions to the Third Party as part of ensuring the safety and integrity of the Jemena Pipeline.

Term	Definition
Non-Standard Encroachment	An encroachment that does not meet the requirements set out in Section 6 of this Guideline.
Road Reserves	Road reserve is measured from boundary to boundary which includes the footpath, stormwater drains, roadways, medium strips, bus lanes and cycleway.
Shall	Designates a mandatory action
Standard Encroachment	An encroachment that meets the requirements set out in Section 5 of this Guideline.
Third Party	Developer, Builder, Owner, Contractor or Customer planning or conducting works in the vicinity of Jemena Pipelines.

1.3 REFERENCE DOCUMENT S

- AS2885.1 Pipelines - Gas and liquid petroleum-Design and construction
- Jemena Excavation Procedure document number; GAS PR 0005
- Jemena Backfilling Procedure
- Jemena Pipeline Survey Specification Procedure.

1.4 CONTACT DETAILS

1.4.1 FAULTS AND EMERGENCIES

For faults and emergencies only:

- Eastern Gas Pipeline (VIC/NSW) **1800 620 492**
- Queensland Gas Pipeline (QLD) **1800 177 008**
- Jemena Gas Network (NSW) / ActewAGL Distribution (NSW/ACT) **131 909**

1.4.2 JEMENA SERVICE DELIVERY

The Contact numbers to book a Jemena Representative are as follows:

1. NSW Jemena Gas Network **1300 665 380**;
2. Eastern Gas Pipeline (VIC/NSW) **(02) 9867 7700** ;
3. Queensland Gas Pipeline (QLD) **(07) 3498 7500**
4. ActewAGL Distribution **1300 503 237**

2 DUTY OF CARE FOR WORKING AROUND JEMENA PIPELINES

Working next to high pressure gas pipelines is extremely dangerous. You should always exercise due care and caution when working near any gas infrastructure. In addition to your general duty of care, there may be other obligations under relevant state legislations which require you to maintain safe practices.

Due care shall be taken at all time not to damage the Jemena pipeline or the protective coating covering the pipelines.

Any damage to Jemena Pipelines, their protective coating or other assets shall be reported immediately to Jemena (see SECTION 1.4.1 for contact numbers).

3 APPROVAL PROCESS

3.1 JEMENA LANDS TEAM:

The Third Party shall contact the Jemena Lands Team on Land.Services@jemena.com.au.

Jemena Lands Team will register the new enquiry and will advise the Third Party of the next steps based on the proposal.

3.2 SITE MEETING:

The purpose of the site meeting with the Lands Coordinator and a Jemena Representative is to:

- Identify the location of the Jemena Pipeline **(refer to Section 5.2.2)**;
- Discuss and review (where applicable) the design/construction scope of work.

Jemena Lands Coordinator and a Jemena Representative, will decide if the proposed design/work is a **STANDARD ENCROACHMENT (refer to Section 5)** or a **NON STANDARD ENCROACHMENT (refer to Section 6)**.

If the site meeting determines that the proposed design/work is a **STANDARD ENCROACHMENT**, a discussion and an agreement of the next step will be undertaken to ensure a Jemena Representative will be available to oversee that the works are undertaken as per Section 5.

If the proposed design/construction is a **NON STANDARD ENCROACHMENT**, Jemena Lands Coordinator will escalate the proposed design/construction.

3.3 JEMENA PIPELINE ENGINEER ENGAGEMENT:

The pipeline engineer will review the proposed design/construction package **(refer to Section 4)** and provide any drawing mark-ups or comments on the methodology to ensure that there are sufficient controls to ensure the integrity of the Jemena asset. Where the proposed design/construction package is acceptable, the Jemena engineer will provide a dated digital acceptance stamp on reviewed drawings.

In some cases, the Pipeline Engineer may elect to conduct an Encroachment Management Study (EMS) with the relevant stakeholders (Third Party and Jemena) to ensure that the threats from the

proposed design/construction are considered and effective controls are put in place. Any action items from the EMS will be communicated to the third party in a formal written response. Any additional controls identified shall be incorporated in the design/construction documents and re-submitted to Jemena for approval by the Third Party.

3.4 COMMERCIAL

Commercial agreement may be required if there is a permanent crossing that leads to restriction of access to Jemena pipeline or modification. If so, this will be discussed and negotiated with the Lands Team.

Where a Commercial Agreement is required, the agreement shall be in place prior to any design acceptance and construction occurring.

4 DESIGN AND CONSTRUCTION PACKAGE

The Third Party shall provide the Design/Construction Package to Jemena for review and acceptance.

The package shall include but not be limited to the following:

- Due Dates or Project Program;
- Scope/Description of the project impacting on the Jemena Pipeline/s;
- Site Layout: Site Layout drawings shall include the following:
    - The location/address of the proposed work.
    - Site Access Designated Area including Jemena pipeline location and depth of cover (confirmed by positive identification) relative to the works
    - Sheds: The Third Party shall not install sheds directly over pipeline or within the easement without obtaining Jemena approval.
    - Temporary Stockpile: The Third Party shall not stockpile any heavy material directly over the pipeline, temporary Stockpile should be kept away from the pipeline to a distance equivalent to pipeline depth of cover plus 1 m.
- Design: depending on the proposed design/work, the drawings shall include the following **(refer to Section 5 or 6):**
    - Plan drawing: show the location of the Jemena's pipeline and the new service crossing including the separation distance;
    - Cross sectional drawing: show the vertical separation distance between Jemena's pipeline and the new service.
    - Details of Cathodic Protection where applicable for the new service
- Construction **(refer to Section 5):**
    - Construction alignment sheet (if applicable);
    - Construction methodology: Specify the construction activities, what equipment and how it will be used around the Jemena Pipeline
    - Plant and Equipment Specifications including:
        - Size of the plant, equipment or machinery that will be used within the Jemena Easement or where there is no easement, within a 10 m distance;
        - Load per axle where the vehicles will be crossing the Jemena pipeline;
        - Wheels configuration or track dimensions where the vehicle will be crossing the Jemena pipeline

The design documents required in this Section shall take into account the requirements outlined within this document, along with any other controls that may be required by Jemena.

5 STANDARD ENCROACHMENT

This section describes the minimum design and construction guidelines for utility crossings (trenched /trenchless installations), vertical drilling, road work maintenance, changes to surface levels and vehicle crossings in the vicinity of the Jemena Pipelines.

For activities complying with the requirements in this Section, the design and construction packages shall be as per **Section 4**. Where the proposed design/construction does not meet the requirements in this Section, the Third Party shall comply with the additional documentation requirements outlined in **Section 6**.

5.1 DESIGN

The most effective means of reducing the risks of working around gas infrastructure is to plan works in locations where the gas infrastructure is not located, or locations where the impact can be minimised. Where this is not possible, risk can be minimised through accurate locating and maximising clearances during the design phase.

Safety in design should be paramount, with due consideration of safe methods for the construction of the works and the ability to apply effective controls for these activities.

5.1.1 SEPARATION DISTANCE FOR NEW SERVICE

Electrical assets encroaching on Jemena Pipeline are considered **NON STANDARD ENCROACHMENT (refer to Section 6) and have additional requirements to the separation requirements outlined in Section 5.**

5.1.1.1 Trenching (open cut)

The separation distance between a new service crossing a Jemena pipeline is as follows:

- **Major utility services** vertical separation to the nearest surface of the Jemena Pipeline:
  - **Crossing over** - minimum 500 mm
  - **Crossing under** – minimum 1000 mm

All services crossing above Jemena Pipelines are to be marked with buried gas warning marker tape at the bottom of the service trench.

All services crossing below Jemena Pipelines shall have a Jemena Pipeline Marker installed within 1 m of the crossing point.

The requirement for any service (pipe or cable) to be installed parallel to the Jemena Pipeline is as follows:

- Where there is a **Jemena easement**, the service shall be located **outside of the Jemena easement.**
- Where there is **no Jemena easement**, the service shall be installed with a **minimum horizontal clearance of 1000 mm** between the two nearest surfaces (Jemena Pipeline and new service).

5.1.1.2 Vertical Drill

Where Jemena Pipeline has an easement, all vertical augering, including drilling for any geotechnical investigation shall be outside the easement.

Where Jemena Pipeline does not have an easement: the minimum separation distance to Jemena Pipeline shall be a minimum of **5 m** for any vertical augering, including drilling for any geotechnical investigations.

5.1.1.3 Trenchless Installations

The minimum separation distance for trenchless installations (including Horizontal Direction Drill (HDD), Micro Tunnelling (Laser Bore), or horizontal bore) shall be **3 m**.

For trenchless crossings of Jemena Pipelines:

- The Jemena Pipeline shall be **fully excavated at least 1 m in all directions** to ensure the drill will cross the pipeline safely with sufficient clearance; and
- A visual window in the form of a **slot/witness trench** 2-3m away from the pipeline on the drill approach side shall be provided. The slot/witness trench should have a depth equivalent to the Jemena pipeline depth (positively identified) plus 1 m.

5.1.2 EXISTING ROAD WORK MAINTENANCE

The minimum cover including the reduction of cover for road maintenance shall be minimum **1.2 m** to the top of the pipe. And the maximum finish level to the top of the pipe is **3 m.**

5.1.2.1 Changes to ground levels or surface conditions

Ground levels within the easement shall not be altered without written permission from Jemena.

Any proposed alterations to the finished surface level, width or surfacing of any street or road (sealed/unsealed) reserve shall not be altered without written agreement from Jemena.

5.1.3 VEHICLE CROSSING AND CONSTRUCTION LOADINGS OVER JEMENA PIPELINES

The acceptable load/axle for construction vehicle or plant crossing over the Jemena Pipelines is limited to **8 Tonnes/axle**, the minimum depth of Jemena Pipeline shall be **1.2 m** at the crossing point. The crossing should be at right angles to the pipeline alignment.

Where soil conditions exhibit poor compaction and load bearing characteristics, such as swamp areas or wet soil conditions, equipment is not permitted to cross the pipeline irrespective of weight without written approval from Jemena.

Temporary Stockpile is not allowed within Jemena easement. Where there is no Jemena easement, temporary stockpile should be kept away from the pipeline at a minimum distance equivalent to the pipeline depth of cover plus one meter.

5.2 CONSTRUCTION PARAMETERS

5.2.1 GENERAL

All construction personnel shall be made aware of the presence of gas infrastructure at the daily pre-start meetings and toolbox meetings, with due consideration given to the gas infrastructure within the relevant Job Safety Assessment.

Gas Marker sign posts shall not be disturbed, relocated, removed or altered without the prior written approval from Jemena.

5.2.2 LOCATING JEMENA'S PIPELINES

Jemena Pipeline locations shall be positively identified (potholing) in the presence of a Jemena Representative (see Section 1.4.2 for contact details) prior to any drilling or excavation that may impact Jemena's buried pipelines.

Potholing can be carried out by HydroVac or AirVac as per Jemena's Pipeline Excavation Procedure GAS PR 0005. **Water jetting at high pressures has the potential to damage buried assets**. Care should be taken if water jetting and the Third Party shall ensure that the water pressure will comply with the approved water pressure range depending on the type of Jemena Pipeline coating as per below:

Pipe material	**Maximum allowable water pressure, psig**	
	Rotating nozzle	**Fixed nozzle**
Nylon	2000	1500
PE	2500	2500
Uncoated steel pipe	3000	3000
PE coated steel pipe (yellow jacket)	2000	2000
Fusion bonded epoxy (FBE) coated steel	2000	2000
Coal Tar Enamel coated steel	1000	1000
Petroleum tape coated steel	1000	1000
Tek-Rap coated steel	1000	1000
Coated steel pipe (unknown coating)	1000	1000

5.2.3 EXCAVATORS AND EXCAVATION PROCEDURE

The biggest acceptable size of excavator that can be used during trenching (open cut) is 20 Tonnes fitted with general purpose bucket (blade bucket toothless bucket, mud bucket).

The excavation **SHALL** comply with Jemena's excavation procedure GAS PR 005. The requirement for a Jemena Representative during excavation will be advised by Jemena based on the Construction Methodology, typically Jemena supervision is required for the following:.

- Any excavation within the easement or crossing the easement
- For road reserves within 2 m or crossing the Jemena Pipeline

5.2.4 BACKFILLING MATERIAL

The general backfilling material surrounding the Jemena pipeline (**minimum 150 mm around the pipeline**) shall be:

- Free of shell, stones and other deleterious material,
- Have a particle size not exceeding 1mm,
- Have a water extract pH value in the range of 6-8

- Sand bags are NOT allowed to be used as permanent bedding
- Recycled material is not to be used even if it meets the above specifications.

5.2.5 STABILISED SAND

If the Third Party needs to use stabilised sand, the stabilised sand shall not exceed a ratio of **14:1 (sand: cement)**.

5.2.6 COMPACTION OVER JEMENA PIPELINE

Compaction over Jemena Pipelines is limited to static rollers only.

- Where **cover exceeds 1.2 m**, compactors weighing **up to 10 tonnes** may be used over the pipeline.
- Between **0.6m and 1.2m cover**, compactor weight shall be **limited to 8 tonnes**.
- **Below 0.6m** cover, only a **handheld mechanical tamper** is allowed to be used.

The use of vibrating equipment is restricted in the vicinity of the Jemena Pipelines. Without prior approval, **vibrating compaction equipment is not to be operated within 20 m of the pipeline**, and handheld jackhammers are not to be operated within 5 m of the pipeline.

5.2.7 VIBRATION

Vibrations from any equipment or processes including vibrating compaction equipment, jack hammers, rock hammers, seismic measuring processes, etc. **are not to exceed peak particle velocity readings of 20 mm/second** at the nearest surface of the buried pipeline.

In the event that such vibrating equipment is to be used close to the pipeline or in blasting operations, suitable trials are to be conducted prior to proceeding with the proposed development to ensure that the stipulated peak particle velocities will not be exceeded.

Suitable vibration monitoring equipment is to be used to record the tests and works as they progress in accordance with agreed procedures with Jemena.

5.2.8 BLASTING

Blasting is **not allowed within 500 m** of Jemena Pipelines without prior written approval from Jemena.

5.2.9 PROLONGED JEMENA PIPELINE EXPOSURE

If the Jemena Pipeline is to be exposed for more than one day, suitable barricades and steel plates to be installed to ensure the security of the exposed Jemena Pipeline from accidental (construction or vehicle impact) or deliberate damage (vandalism).

Damage to Jemena Pipeline due to sagging shall be prevented. For **any unsupported span of pipe exceeding 6 m**, written approval from Jemena will be required.

5.2.10 JEMENA PROTECTION MEASURES - POST CONSTRUCTION

All existing Jemena Pipeline's protection measures including but not limited to concrete slabs, marker posts, marker tape and Cathodic Protection Systems shall be retained, any protection measure that was temporarily removed with Jemena's approval as part of construction is to be reinstated to its original condition post construction.

6 NON STANDARD ENCROACHMENT

Where the proposed design/construction does not meet the requirements outlined in **Section 5**, the following additional documentation requirements shall be met. Based on the proposed methodology, the Jemena Engineer may deem that an EMS is required. The third party shall actively participate in the EMS and complete any action items before design and construction acceptance.

6.1 DESIGN PARAMETERS

6.1.1 VERTICAL DRILL

If Third Party cannot achieve the **STANDARD ENCROACHMENT** requirement, the Third Party shall provide Jemena the following information in the design package in addition to the minimum requirements set out in **Section 4**:

- The methodology of drilling activity, such as hammering, rotating, etc.;
- Findings of any Geotechnical assessment of formation being drilled to determine if ground settlement/heaving is likely and monitoring methodology to be used during works; and
- Demonstrate recommended physical mitigation measures.

6.1.2 TRENCHLESS CROSSING

If a trenchless crossing activity is proposed to be carried out near Jemena Pipelines is less than the minimum recommended distances in **Section 5.1.1.3**, the following documents (in addition to minimum requirements in **Section 4**) shall be provided by the Third Party to Jemena for review:

Trenchless installation details including:

- Drill path profile showing Separation distance between the new service and the existing Jemena pipeline.
- The location and setup of the launch and receive pits where they are located within the Jemena Easement, where there is no easement, if located within 10 m;
- Drill head control, accuracy and monitoring methodology;
- Geotechnical assessment of formation being drilled to determine if ground settlement/heaving is likely and monitoring methodology to be used during works;
- Contingencies in the event of frac-out where drilling fluids are used; and
- Demonstrate recommended physical mitigation measures.

6.1.3 NEW/UPGRADED ROAD CROSSINGS

The following specific design requirements will be required for road crossings:

- Minimum cover of 1200mm from the finished surface of the road or the invert of the drains to the top of the pipeline.
- Road alignment shall cross the pipeline at or close to a right angle.
- Road alignment shall not be parallel to and above the pipeline
- Where permanent protection measures are proposed, see Section 6**.1.6**

6.1.4 ELECTRICAL UTILITY INSTALLATION

For **High Voltage Electrical installation**, defined as **voltage above 1000 VAC and 1500 VDC**, the Electricity Asset Owner or representative shall perform an electrical hazards study on the Jemena steel Pipeline in accordance to the latest version of AS4853 (Electrical Hazards on Metallic Pipelines).

The study shall be completed by a certified practitioner. The types of electrical hazards that need to be covered are as follows:

- Low frequency induction (LFI);
- Earth potential rise (EPR);
- EPR due to lightning current;
- Capacitive coupling on the pipeline due to adjacent high voltage power lines; and
- Accidental contact of pipeline with other electrical systems.

This report shall be submitted to Jemena for acceptance prior to implementing any design. The report should clearly state the standards it refers to, e.g. AS 4853:2012, details of the proposed electrical infrastructure, the hazards that have been assessed, the assessment, findings and Jemena's pipe details (diameter, length, and distance to nearest pipeline facility where contact by personnel is expected, such as Cathodic Protection Test Points).

For **Low Voltage Electrical installation** defined as voltage **below 1000 VAC and 1500 VDC**, the Electricity Owner or representative shall perform an electrical hazards study on the Jemena steel Pipeline in accordance to AS/NZ 5601 and AS 3000 by a certified practitioner.

6.1.5 BLASTING

If blasting activity is the proposed work, the following information shall be included in the design:

- The blasting distance from the pipeline;
- Depth of the blast;
- Shot size (kg);
- Shot sequence and delay; and
- Shot strength.
- Information on Peak Particle Velocity (PPV) and measures to be in place during blasting to monitor PPV (**refer to Section 5.2.7**)

6.1.6 NEW PERMANENT STRUCTURAL PROTECTION INSTALLATIONS OVER JEMENA PIPELINE

If the depth of the cover of Jemena Pipeline is Less than 1.2m or more than 3m, and the Third Party is proposing to design and install a new permanent structure on the top of Jemena Pipeline to provide protection from external loads or damage, the Third Party shall provide the following in the design package:

- The slab design drawing (plan and cross section);
- How the slab will be supported, i.e. vertical piers or similar
- Geotechnical investigations
- Design calculations; and
- Certification from the Structural Engineer certifying the adequacy of the design in ensuring the pipeline is isolated from excessive loading

The permanent structure shall be submitted to Jemena for review and acceptance.

7 ENVIRONMENTAL

The Third Party shall consider the following environmental requirements:

- Any tree planting within the vicinity of the Jemena Pipeline shall be reviewed and approved by Jemena. The proposed tree planting shall include the plan drawing showing the Layout of the

trees with respect to Jemena pipeline, and type of the trees that will be planted. Expected size of trees and shrubs at maturity demonstrating the location with respect to an easement, proximity of roots to a pipeline and placement of root barrier measures

- Clearing & grubbing, soil recovery management plans where work is carried in rehabilitated areas;
- Operations management plan, describing site layout, materials management and logistics/supply, traffic movements in/near gas mains area;
- Weed Management plan to ensure weeds, diseases are not imported/exported from site including vehicle cleaning process;
- Groundwater & construction water management plan, treatment & disposal means, including existing groundwater, water for hydro testing needed;
- Soil, erosion management plans;
- Area rehabilitation plan to ensure vegetation is reinstated consistent with local area;
- Management of local stakeholders;
- Information on type and source of soils/fill to be imported, to ensure material is suitable for use & not contaminated;
- Mitigation measures for air, noise, vibration, dust, erosion management issues on site
- Soil mechanics properties of fills to be imported, friction angle, calculation of soil pressures and mitigation measures for mains protection where surcharge may occur. Include design of protective slab, shoring and retaining walls to be proposed;
- Noise & Vibration management plan for works carried out near sensitive receivers or where vibration generating equipment is used.
- Check local authorities if excavation is to be performed within 50 m of a waterway. This activity may require state regulatory permission or advice.

8 AS-BUILT DRAWINGS

8.1 STANDARD ENCROACHMENTS

On completion of new **individual residential services**, a Jemena Representative shall provide As Built drawings in a site sketch including:

- Address
- Plan view;
- Cross section view;
- GPS coordinates.

On completion of new **major services** or changes to existing services, such as water and sewer mains that either parallel or cross a Jemena Pipeline, the following information shall be provided in hard copy and electronic medium format as agreed with Jemena:

- “As Built” drawings of the service in the vicinity of the Jemena Pipeline
- Obvert level of services crossing under, and invert level of services crossing over Jemena Pipelines
- Separation distance between new service and Jemena Pipeline
- Coordinates of the services on GDA datum.
- The location of each feature crossing the pipeline is to be accurate to ±100 mm.
- As-Built survey is an engineering survey, and may be undertaken by qualified Engineering Surveyors. A Registered Surveyor shall supervise all engineering surveys.

9 APPENDIX A – FEEDBACK FORM

Third Party Feedback Form

Please complete this form with your feedback and return to Land.Services@jemena.com.au

Publication Information					
Title:	GAS-960-GL-PL-001 Guideline to designing, constructing and operating around AS 2885 Pipelines	**Revision:**	8	**Issue Date:**	7/11/2016

Proposed Change Information			
Page No:		**Paragraph No:**	
Description of Change:			
Reason for Change:			

Your Information			
Name:		**Phone:**	
Email:			
Address:			
Signature:		**Date:**	

APPENDIX B - PHOTOS

Photo A	Photo B
	
Description: Typical signpost found along the existing gas and oil mains easement within West Schofields. **Location:** Near the intersection of Carnarvon Rd and Angus Rd, Schofields. **UBD Reference:** 147 J4	**Description:** Photo showing easement corridor for the existing gas/oil pipeline through West Schofields Precinct. **Location:** North St, Schofields. Approximately 100m east of Carnarvon Rd (looking south). **UBD Reference:** 127 H15

APPENDIX C - WATER AND WASTEWATER PLANNING CRITERIA

Table C.1 - Water Planning Criteria

Item	Design criteria	Units	Requirements
Residential Occupancy	Occupancy Rate	capita/dwelling	Low density residential: 3.5
			Medium density residential: 3.0
			High density residential: 2.5
Max Day Demand	Residential	L/capita/d	517
	Non-residential	kL/Nha/d	41
Ave Day Demand	Residential	L/capita/d	202
Pressure	Minimum Pressure	m	>20 (desirable)
			>15 (minimum)
			>12 for un-boosted area
			>3 for trunk mains not supplying customers
	Maximum Pressure	m	< 50 (desirable)
			< 60 (maximum, subject to economic evaluation)
Pipelines	Reticulation Mains and Lead-in mains		Sized for max hour demand
	Target Head Losses	m/km	5 (mains ≤ DN150)
			3 (mains ≥ DN200)
	Minimum Pipe Size	mm	DN100 (low density residential)
			DN150 (industrial and commercial)

Table C.2 - Wastewater Planning Criteria

Item	Description	Units	Criteria
Single Dwelling Residential	EP	EP/dwelling	3.5
Med. Density Residential	EP	EP/dwelling	3.0
High Density Residential	EP	EP/dwelling	2.5
Commercial	EP	EP/ha	75
School	EP	EP/student	0.2
Future Design Flow (Greenfield Growth Areas)	Average Dry Weather Flow (ADWF)	L/s	ADWF = 0.00015x EP Based on 150L/EP/day for new system for greenfield areas
	Wet Weather	L/s	For new sewer system 2% I/I over 20 years (3xPDWF) for low infiltration sewer
Pipeline Design			
Gravity main	Minimum diameter	mm	150
Rising main	Minimum velocity	m/s	0.75
Rising main	Target velocity	m/s	1.2 – 1.8
Rising main	Maximum velocity	m/s	2.5

APPENDIX D - COST ESTIMATES (WATER AND WASTEWATER)

General Notes:

- All cost estimates are 'order of cost' only (+- 35%)
- Unit rates, direct costs and indirect costs based on general Sydney Water estimates for delivery of similar infrastructure as identified in this report.
- Cost of siphon crossing Eastern Creek based on cost estimate achieved for similar syphon crossing by Yarra Valley Water in 2017.
- Pumpout costs based on similar scheme currently in operation.

Cost Estimating Sheet

Project: West Schofields Precinct

Job Name: Water Services to Part Precinct

Date: 30-Aug-17

Item No.	Year	Item Description	Scope Item	Direct Costs	Indirect Costs	Client Costs	Total Project Cost
1.1	2019	Watermain to Service Stages 1&2	1370m of 300mm (PVC)	$1,640,000	$1,162,000	$374,000	$3,176,000
1.2	2019	Watermain to Service Stages 1&3	340m of 200mm (PVC)	$97,000	$68,600	$69,000	$234,600
						Project Cost (2019)	$3,410,600
2.1	2021+	Watermain to Service Stage 3	600m of 300mm (PVC)	$317,000	$197,200	$112,500	$626,700
2.2	2021+	Watermain to Service Stage 3	1630m of 300mm (PVC)	$388,000	$274,700	$126,600	$789,300
						Project Cost (2021)	$1,416,000
3.1	2021+	Watermains to Remainder of Precinct	1060m of 300mm (PVC)	$1,270,000	$899,000	$301,000	$2,470,000
3.2	2021+	Watermains to Remainder of Precinct	810m of 200mm (PVC)	$590,000	$410,000	$166,000	$1,166,000
						Project Cost (2021+)	$3,636,000
						Total Project Cost	**$8,462,600**

Cost Estimating Sheet

Project: West Schofields Precinct

Job Name: Water Services to Balance Precinct

Date: 30-Aug-17

Item No.	Year	Item Description	Scope Item	Direct Costs	Indirect Costs	Client Costs	Total Project Cost
1.1	2024+	Watermain to Service Balance Precinct	1700m of 375mm (PVC)	$2,387,000	$1,689,000	$521,000	$4,597,000
1.2	2024+	Watermain to Service Balance Precinct	13000m of 200mm (PVC)	$731,000	$517,000	$194,000	$1,442,000
						Project Cost (2024+)	$6,039,000
							$0
						Total Project Cost	**$6,039,000**

Cost Estimating Sheet

Project: West Schofields Precinct

Job Name: Ultimate Wastewater - Transfer to SPS 1173

Date: 30-Aug-17

Item No.	Year	Item Description	Scope Item	Direct Costs	Indirect Costs	Client Costs	Total Project Cost
1.1	2021+	Remainder West Line 1	800m of 225mm (PVC)	$514,000	$522,000	$198,000	$1,234,000
						Project Cost (2019)	$1,234,000
						Total Project Cost	**$1,234,000**

Cost Estimating Sheet

Project: West Schofields Precinct

Job Name: Ultimate Wastewater - Transfer to Riverstone Carrier

Date: 30-Aug-17

Item No.	Year	Item Description	Scope Item	Direct Costs	Indirect Costs	Client Costs	Total Project Cost
1.1	2019	West Schofields Carrier Sect 1	710m of 450mm (GRP)	$2,600,000	$2,975,000	$1,093,000	$6,668,000
1.2	2019	West Schofields Carrier Sect 2	950m of 375mm (GRP)	$1,510,000	$1,740,000	$489,000	$3,739,000
1.3	2019	CSR Line 1	1400m of 300mm (PVC)	$833,000	$963,000	$257,000	$2,053,000
						Project Cost (2019)	$12,460,000
						Total Project Cost	**$12,460,000**