

Sydney Water generally uses a conversion factor of 0.0021 to convert Average Dry Weather Flow from Equivalent Population (180L/day/EP).

Table 6 Estimated Average Dry Weather Flow (ADWF)

Name	Unit	EP per unit	EP	ADWF (L/s)
Residential	3400 dwellings	3 average	10,200	21.42
Retail	3 ha	75	225	0.47
Open Space	41.6* ha	20	832	1.74
Education, research and development	44 ha	75	3,300	6.93
Total				30.56

4.2.3 Sewerage Service

Lead-in

A new sewer lead-in is required to connect the development site to Sydney Water's sewer network. The lead-in would connect to the Mamre Road Carrier to the site boundary. Sydney Water would classify the lead-in as a carrier since it would pass through other properties along the route to Sydney Science Park. The lead-in would be classified as major works and Sydney Water may fully fund these works. This is discussed later in the report.

The elevation difference between the proposed Mamre Road carrier connection point and the lowest areas at the north eastern point of the site 15m. The sewer lead-in grade will be approximately 0.4%. This is a minimal grade by Sydney Water standards. The lead-in service may therefore need to be oversized to improve the capacity of the line. This needs to be confirmed by detailed sewer modelling.

The lead-in sewer would connect to the Mamre Road Carrier near the intersection of Luddenham Road and Mamre Road, 5km from the site .

A single lead-in versus a branched lead-in main needs to be considered. There are multiple catchments within the development area separated by ridges. The internal reticulation will need to be designed to suite the topography. This will determine whether the lead-in will be a single or branched main. The next section of the report discusses the internal reticulation design.

A single lead-in will need to be sized for the ultimate development, whereas a branched lead-in can be sized according to the development staging. The upfront cost to construct the lead-in main and sewer modelling results will influence the decision whether a single or branched lead-in main is constructed.

It is anticipated the design and construction of the lead-in service can take more than two years. It is therefore recommended to commence the planning and concept design as early as 2014 to meet the 2016 development program.

It is not known whether amplification of the Mamre Road carrier or the St Mary's Treatment Plant is required. Detailed sewer modelling will confirm these requirements.

Internal Reticulation

J. Wyndham Prince has assessed the topography of the site and identified two major sewer catchments within the site: Blaxland Creek and South Creek. The current master plan aligns with the South Creek catchment. Sub catchments within the main catchment are separated by ridges of higher grounds, refer to **Appendix C**.

An internal gravity sewer system is considered to be adequate to service the proposed subdivision. The site topography is undulating with various depressions and ridges. Existing surface levels within catchments vary in height by up to 15m. The lowest surface level within the development area is AHD 45m, the highest is around AHD 80m. To overcome the undulations in the site, deep sewers can be constructed through the ridges to drain the low lying areas from one sub-catchment through to the lead-in main.

Alternatives are possible to avoid the construction of deep sewers, such as:

- Local pumping stations and rising mains could be constructed within individual sub-catchments to pump the waste water to higher ground so the sewer can drain to the lead-in main. The cost to construct a pumping station may not be financially viable. Individual pumping station cost around \$2.2M each. More than one pumping station may be needed in this servicing strategy.
- The lead-in sewer main could branch out to service individual sub-catchments. Detailed modelling would need to confirm if this is a better design solution. This would overcome the challenge to drain the sewer through or over the ridges between catchments.
- Site regrading will be necessary to achieve large level lots suitable for employment development. Regrading the site may change the existing surface levels by up to 5 to 10m. Levelling the development area will assist the design of the gravity sewer design.

The suggested sewer layout to service the site is to:

- construct a branched lead-in main. Separate lead-in lines would enter the site along the northern boundary, the low points within the sub-catchments. **Plates 6** outlines the low points along the northern boundary. A possible route for the lead-in line/s is shown in **Plate 7**).
- Regrade the site to provide large level lots suitable for employment development to assist the design of a gravity sewer network within the site. This will also improve the saleability of the employment lots.

If a sub-catchment cannot not serviced directly by a lead-in main, deep sewer trunk lines should be constructed to drain the sub-catchment to the nearest lead-in line.

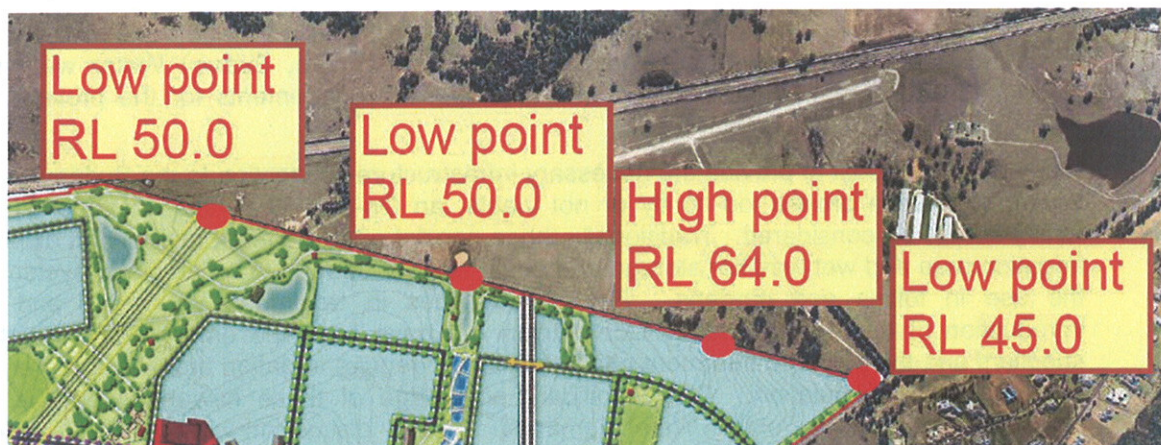


Plate 6 Low/high points of development

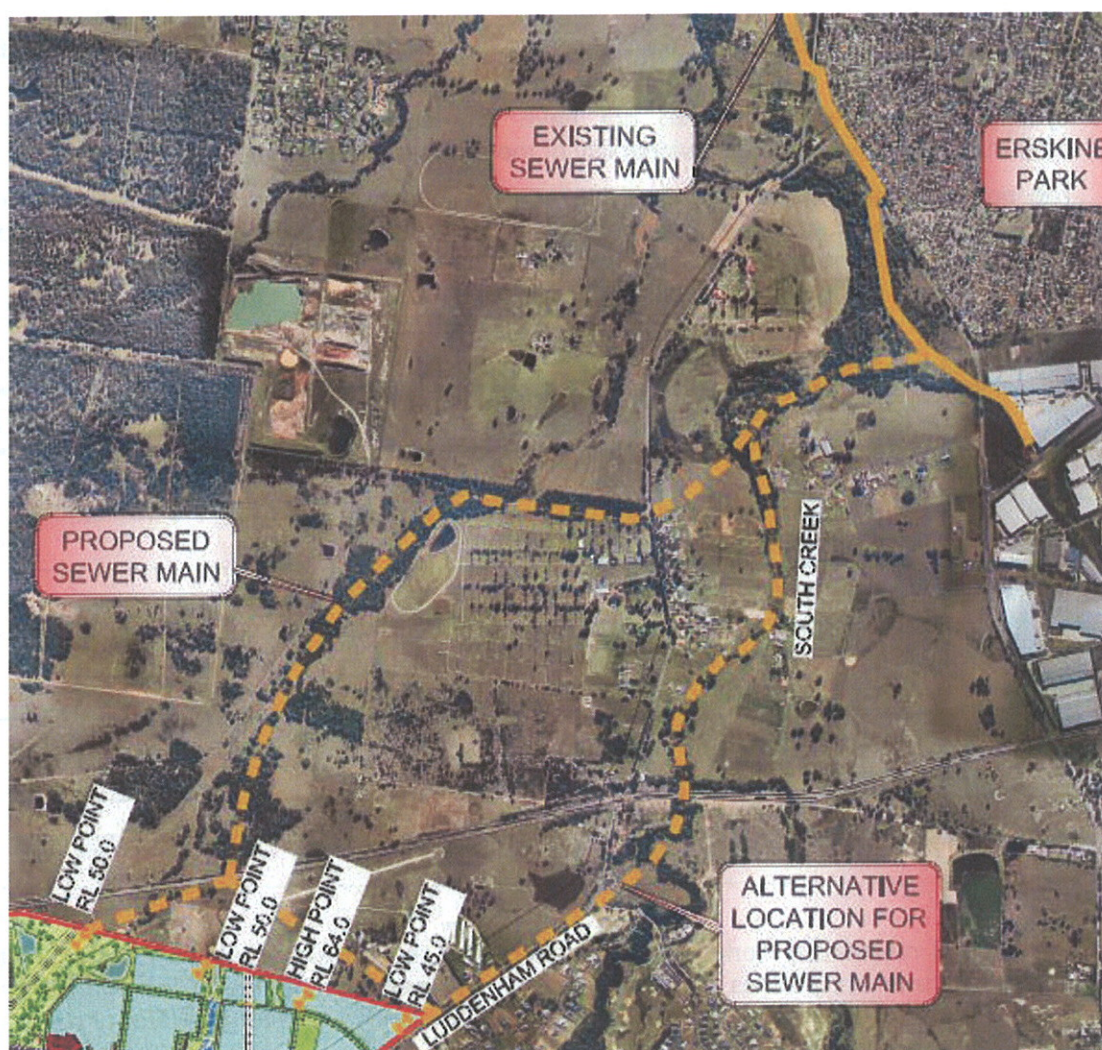


Plate 7 Possible sewer lead-in alignments

The suggested servicing strategies discussed in this report need to be verified by sewer modelling and detailed sewer network analysis. Furthermore, Sydney Water will issue Notices of Requirements which will outline the specific requirements for the provision of sewer infrastructure to service the site.

Ultimately, if the cost to provide the necessary infrastructure connection to the Sydney Water sewerage system proves too costly or not viable, an On-Site Sewerage Treatment Plant (STP) should be considered. Traditionally those consist of a treatment facility with disposal irrigation area and wet weather storage and could also include the recycled water system for the use in toilets and gardens. Recent advances in treatment technology and the introduction of the Water Industry Competition Act have seen the emergence new utility suppliers and the package treatment plans that do not require irrigation areas, but do rely on recycled water reticulation. One significant advantage of these newer systems is the significant reduction in Potable Water demands. Further discussion will occur with various operators / utility suppliers to achieve a cost effective and efficient outcome.

4.2.4 Sewer Funding

Sydney Water advised they do not have any current plans to upgrade the sewer infrastructure to improve the serviceability of the proposed development.

The possible major infrastructure works required to service the site are listed in **Table 7** along with an estimated cost of each item. Under the current procurement policies, Sydney Water would fund major infrastructure works. An application to Sydney Water is necessary to confirm the value of funding if these works are constructed.

Table 7 Estimated Sewer Lead-in cost

Item Description	Cost (excl GST)
Sewer lead-in: - Assume 1050mm diameter main; 8.8km long branched line; construction rate \$1,790 p/m.	\$ 15,752,000
Mamre Road Carrier Amplification: - Assume second carrier main from Mamre Rd and Luddenham Road intersection to St Marys treatment plant; 450mm diameter main; 13km in length; construction rate \$920 p/m.	\$ 11,960,000
Local sewer pumping station: - One pumping station.	\$ 2,200,000
Sewer rising main	\$ 1,365,000

The internal reticulation works would be funded by the developer. Under Sydney Water's current procurement policies, Sydney Water would fund the upsizing of the internal sewer mains. Future funding of any works would need to be verified by Sydney Water at the time of the development works.

4.3 POTABLE WATER SUPPLY

4.3.1 Potable Water Supply

Sydney Water's water infrastructure surrounding the site does not have the capacity to service the proposed development. The proposed development can however be serviced by water by constructing a connection to Sydney Water's water network.

Bulk Water Supply

The closest bulk water supply is the Orchard Hills Water Treatment Plant on The Chase Road in Orchard Hills, 4.5km from the site. The site is within the Orchard Hills water supply zone.

Sydney Water's Warragamba pipeline runs along the northern boundary of the site. These mains cannot be used to service developments of any description. These mains are solely for the purpose to transporting bulk water supply.

Reservoirs

There are several reservoirs operated by Sydney Water surrounding the site, as shown in **Appendix D**. The closest reservoir to the site is the Bringelly Reservoir located at the Orchard Hills Water Treatment Plant. Other local reservoirs include the Erskine Park Reservoir and Cecil Park Reservoir. It is envisaged the water supply for the development would be supplied from the Bringelly Reservoir.

Lead-in Water Main

A water main extension, along The Northern Road from the Bringelly Reservoirs can be constructed to connect the proposed development site to Sydney Water's water supply network.

To improve the capacity of Sydney Water's water supply network, a new surface reservoir could be constructed closer to the site. A suitable location for a new reservoir is a site presently owned by Sydney Water on The Northern Road at Luddenham.

Detailed Planning and Design

The detailed planning phase to plan the water supply network for the development may take up to 6 months while the detailed design and approval phase may take an additional 12 months to complete. It is recommended to commence the planning and concept works as soon as possible to meet the development program.

Procurement of the new surface reservoir may take two years. Therefore it is recommended to commence the negotiation with Sydney Water as early as 2014 in order to meet the development program for 2016.

4.3.2 Potable Water Demand Estimate

A preliminary maximum demand calculation for a single reticulation system has been carried out in accordance with Water Supply Code of Australia (2009 issue) (Sydney Water Version).

Table 8 Estimated Potable Water Demand for Sydney Science Park

Name	Unit	Max day demand rate (KL/ha/day)	Total max day Usage (KL/day)	Ratio max hr/max day	Total max hr Usage (KL/hr)
Residential (detached, terrace and townhouse)	3400 dwellings	0.8 KL/dwelling/day	2720	2	226
Retail	3 ha	63	205	2	16
Open Space *	41.6 ha	7	292	1.5	19
Education, research and development	44 ha	40	1760	2	147
Total			4977		408

The Mixed Use/Residential precinct will be a combination of high rise, medium rise and low rise buildings. The demand calculation assumes 65% of the residential precinct has fewer than 30 dwellings per hectare and the remaining 35% has between 30-60 dwellings per hectare.

The open space total area is 83.2 ha, including all the channels, basins and stormwater treatment areas, playing field and landscape buffer. It's assumed 50% of the open space area requires potable water for maintenance purposes.

The estimated maximum daily demand calculated is 4,977 kL, and the maximum hourly demand is 408 kL.

4.3.3 Potable Water Delivery

Trunk Main

A 450mm diameter trunk main extension from the Bringelly Reservoirs to the site may be adequate to service the site. The trunk main alignment would be along The Northern Road; the shortest route to the site is via Gates Road otherwise the trunk main alignment would traverse along Elizabeth Drive and Luddenham Road.

Reservoir

Sydney Water generally requires the reservoir size to equal the volume of water consumed in an 8 to 24 hr peak demand period. The estimated size of a new reservoir will be between 3.3ML to 12.4ML. This report considers a 5ML reservoir.

The existing ground levels, at the potential new reservoir site adjacent to The Northern Road at Luddenham, is AHD 90m. This site is generally higher than the proposed development.

It is anticipated any area within the development above AHD 80m will require a booster pump service. There are two isolated areas on the western side of the site higher than AHD 80m. These areas are however not included in the current rezoning proposal and the booster pump is not considered necessary for the proposed master plan.

Booster Pumps

It may be possible and cost effective to service the site directly from the Bringelly Reservoirs utilising a booster pump at the reservoirs instead of constructing a new service reservoir. This option should be considered in the Detailed Planning Process.

Reticulation Network

The minimum internal water main reticulation in industrial and commercial developments is 150mm. It is likely that this type of development will have 150mm and up to 375mm diameter internal watermain.

4.3.4 Potable Water Funding

Sydney Water has advised that they do not have any current plans to upgrade the water infrastructure to improve the serviceability of the proposed development. The developer will need to enter into a commercial agreement with Sydney Water to investigate, design and construct the water trunk main infrastructure and any amplification works requested by Sydney Water.

An application to Sydney Water would be necessary to confirm what works will be funded by Sydney Water. Under the current procurement policies, Sydney Water may fund the trunk main works, and possibly a new reservoir or booster pumping station especially if these works are categorised as major infrastructure works.

The estimate cost to construct the major water infrastructure works is shown **Table 9**.

Table 9 Estimated Potable Water Lead-in cost

Name	Cost (excl GST)
Transfer Booster Pump at Bringelly	\$500,000
Trunk Main: - Assume a 450mm diameter pipe from Bringelly Treatment Plant to new reservoir; 5.5km in length; construction rate \$750 p/m	\$4,125,000
New Reservoir:	\$3,000,000

Name	Cost (excl GST)
- Assume a surface reservoir; 5ML capacity	
Lead-in trunk main: - Assume a 450mm diameter main from the new reservoir to the development site; 3.5km in length; construction rate \$750 p/m)	\$2,625,000

The internal water reticulation works would be funded by the developer with the exception of upsizing works, which Sydney Water currently funds under their procurement policies. Future funding of any works would need to be verified by Sydney Water at the time of the development works.

5 GAS INFRASTRUCTURE

The site is currently not serviced by natural gas and there are no gas services surrounding the site.

The site can be serviced by natural gas by connecting to the nearest high pressure gas main located 4km from the site, in Elizabeth Drive near the intersection with Martin Road. Jemena advised they will allow a connection to their gas network at this location.

An extension of the high pressure main is necessary to provide a gas supply to the proposed development. The length of the extension is 7.7km along Elizabeth Drive and Luddenham Road. The extension is likely to be a 150mm diameter steel main, as advised by Jemena.

Following a formal request for gas supply, Jemena will issue a gas supply offer confirming a design for the gas lead-in and reticulation network, and funding requirements.

Jemena would manage and coordinate the design and construct the extension works and internal reticulation works.

A concept sketch showing the existing and proposed gas main extension is included in **Appendix E**.

5.1 Gas Infrastructure Funding

Jemena will most likely undertake an internal business case study to identify if they will fund the gas main extension. Initial advice suggests the developer / landowner will pay for these works. This decision may change at the time of a gas application.

The anticipated cost of the gas main extension works is \$5.5M.

The internal reticulation works are usually paid for by Jemena.

6 TELECOMMUNICATIONS

NBN Co. state fibre optic infrastructure will be installed into new developments of 100 premises (dwellings/units) or more released over a three year period. It is assumed NBN Co. will service the Sydney Science Park development.

Fibre optic infrastructure will be delivered to the area as part of National Broadband Network (NBN) roll out, a Federal Government initiative to deliver high speed broadband network. NBN Co. is a company established to design, construct and operate the NBN.

NBN Co. advised that they need a minimum of 9 months for planning and delivery of a lead-in service. An ideal situation would be to have lead-in constructed prior to commencement of Stage 1 civil work.

To confirm NBN Co. will service the site, it will be necessary to register the development with NBN Co. as early as possible. Registration can be completed online at on the NBN website <http://www.nbnco.com.au/industry/new-developments.html>. All new developments requesting fibre from NBN Co. will be assessed to determine if they are within NBN Co.'s long-term fibre footprint. Information on NBN Co.'s proposed fibre footprint is available on the NBN Co. website. Registration of the development with NBN requires the submission of the Masterplan.

NBN Co. will assess the application for service and issue a Developer's Agreement to confirm the serving requirements for the site.

The nearest NBN services are located in Glenmore Ridge 6km from the site via Gates Road or 13km via Elizabeth Drive and Luddenham Road. The current NBN rollout map for the Luddenham Area is shown in Plate 9.

The Luddenham area is not on the NBN roll out map for the next three years and the first stage of development is scheduled for completion by June 2016. Considering this timing, it is assumed the development will be connected to the NBN network via The Northern Road.

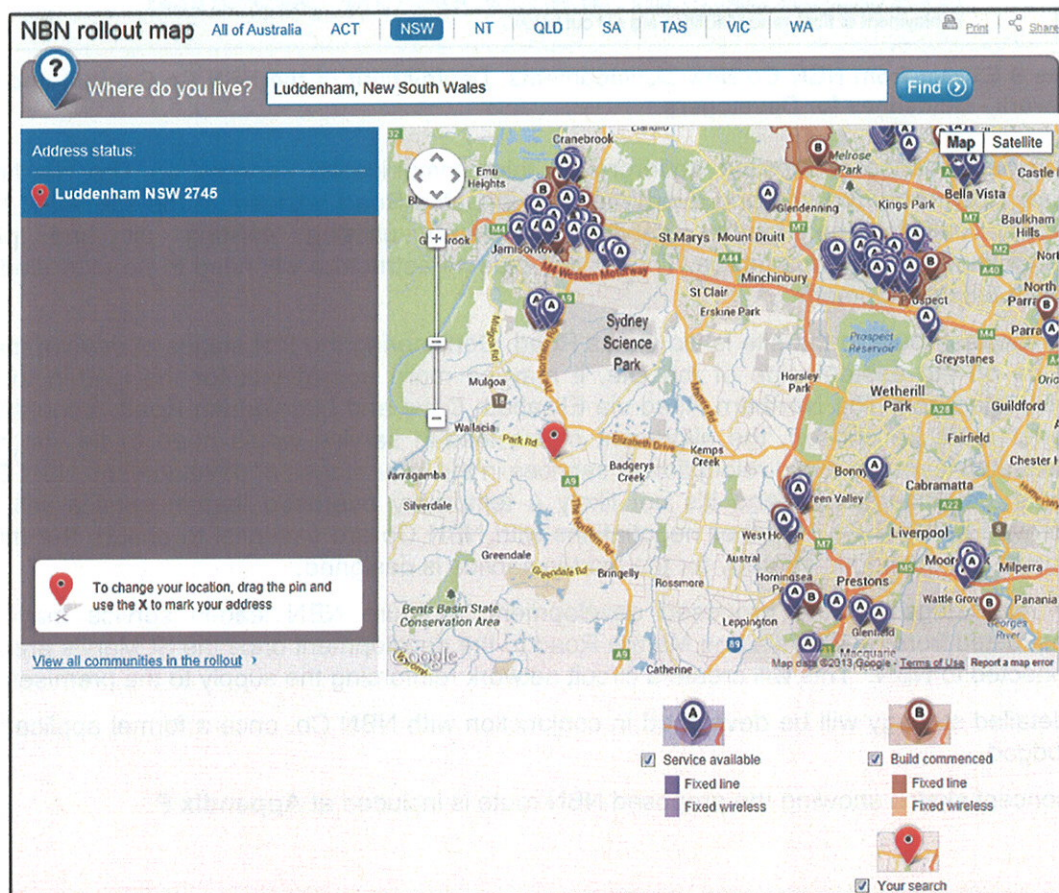


Plate 8 Extract from NBN Co New Developments: NBN Rollout Map December 2013

The fibre to premises network for new connections is outlined in **Plate 10**.

4 FTTP Network Overview

The NBN Co New Development Fibre to the Premises (FTTP) network is designed to provide fibre connectivity to premises, including New Development projects.

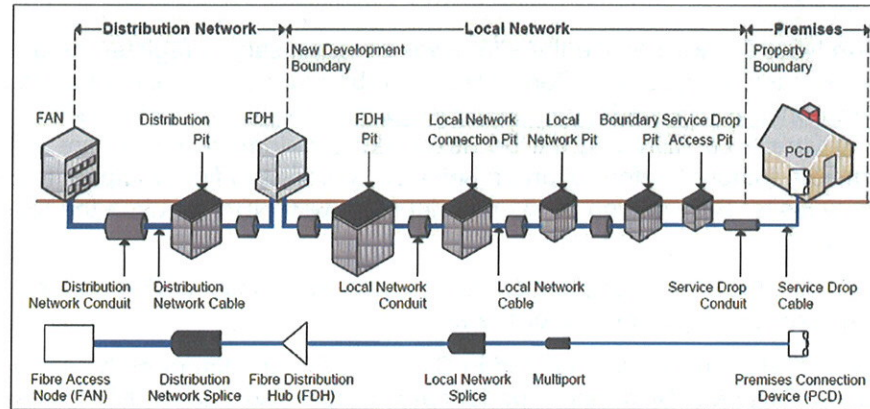


Figure 1 – Fibre to the Premises Network

The FTTP network is divided into hierarchical components which assist in the planning, design, and implementation of the FTTP network.

Network components shown in Figure 1 (above) that are relevant to New Development project deployment of fibre ready facilities are set out below.

Plate 9 Extract from NBN Co New Developments: Deployment of the NBN Co Conduit and Pit Network - Guidelines for Developers

There is evidence of existing underground telecommunication services on The Northern Road, 1.8km from the site and overhead lines in Gates Road adjacent to the site. NBN Co. typically installs the lead-in service (backhaul) utilising existing pit and pipe telecommunication infrastructure. The pit and pipe infrastructure will need to be extended to service the development.

The shortest route to the site is via Gates Road. Considering the first stages of development will be on the eastern side of the site, it may be more appropriate for the lead-in to be constructed from The Northern Road via Elizabeth Drive and Luddenham Road. Should the shorter route be chosen, the alignment of the lead-in service would need to tie into the Masterplan layout to avoid relocation of services in the later stages of development. NBN Co. assets are underground and it's not likely a temporary overhead lead-in service will be approved by NBN Co. Further negotiations with NBN Co are essential to ensure the most efficient and economic strategy for the lead-in service is designed.

For later stages of the proposed development, a future NBN lead-in service may be constructed from St Marys along Mamre Road to the development once the St Mary's area is connected to NBN. This will create a circuit network reinforcing the supply to the premises.

A detailed strategy will be developed in conjunction with NBN Co. once a formal application is lodged.

A concept sketch showing the proposed NBN route is included at **Appendix F**.

6.1 Telecommunication Funding

The current responsibilities stated by NBN Co. are as follows.

Developers:

- Install pit and pipe infrastructure or pathways (as appropriate) to NBN Co. specifications and standards; and
- Transfer ownership of pit and pipe infrastructure to NBN Co before fibre can be installed.

NBN Co.:

- install fibre infrastructure to each premises or multi-dwelling unit connecting all approved stages in the estate to the NBN;
- provide a connection from the new development to the NBN (i.e. 'backhaul'); and
- work to switch on the network in the new estate to align with the first service connection date required for the first resident moving in.

7 CONCLUSION

All service reviews undertaken in this report indicate the proposed development can be serviced: In summary:

Electrical Supply	Stage 1 can be serviced by two local zone substations. A new zone substation to amplify the existing electrical infrastructure is required to adequately service the remaining stages of the development.
Sewer	A new lead-in service is required to connect the site to Sydney Water's sewer network.
Water	A new water trunk main needs to be constructed to connect the site to Sydney Waters water supply network. A new reservoir or booster pumping station is required to amplify the existing water supply network to provide adequate supply and pressure to the development.
Gas	A gas main extension is required to connect the site to the gas network.
Telecommunications	New lead-in services are required to connect the site to the NBN network.

Limitations of this report.

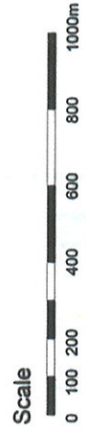
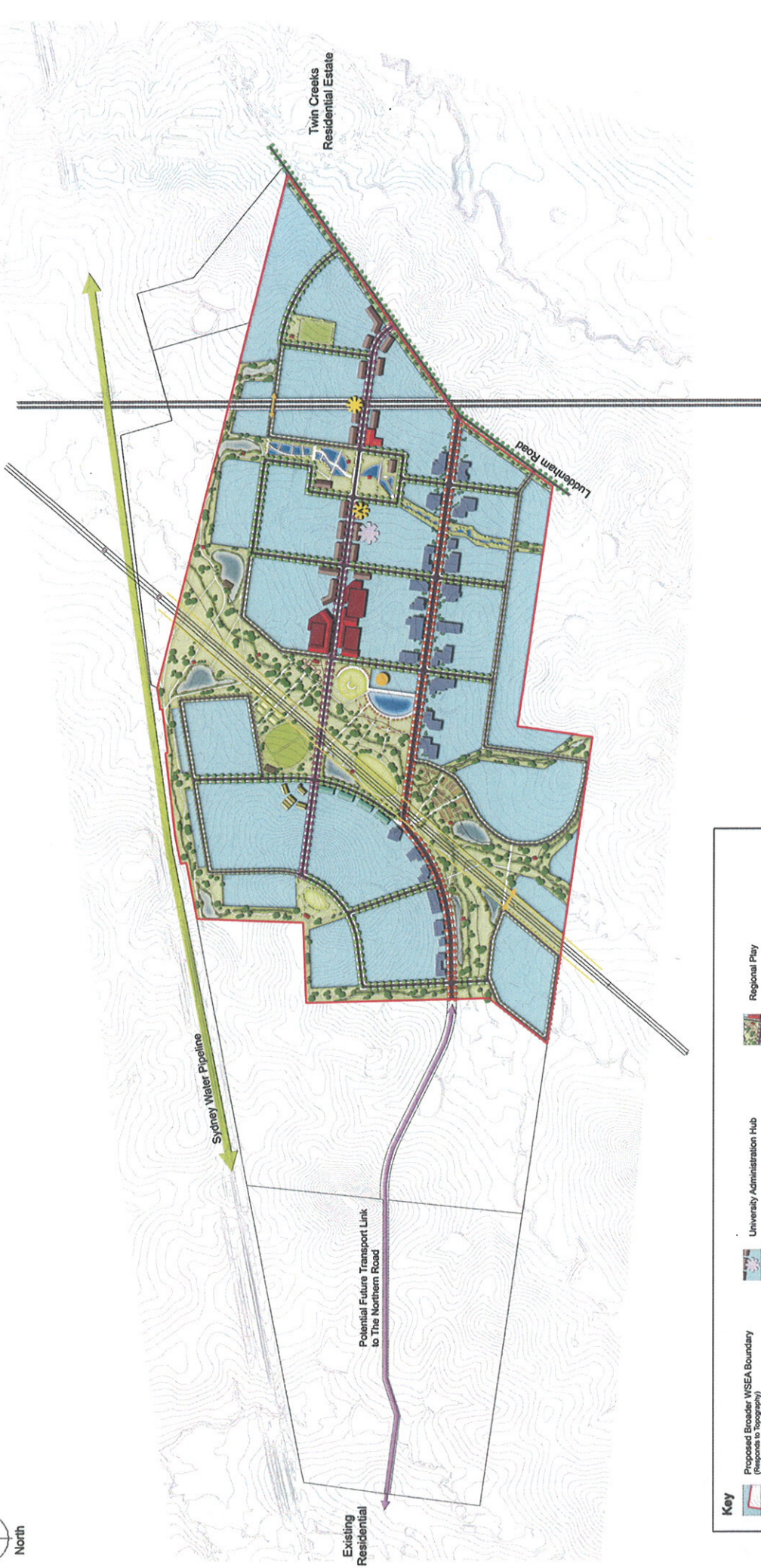
This report outlines the possible ways to service the proposed development. The derived outcomes are based on the current and available information from the service Authorities and J. Wyndham Prince's knowledge of the area.

The servicing of the site should be verified with each service Authority by submitting the relevant applications and completing the detailed planning and design processes required by each authority.

APPENDIX A – Lot Layout

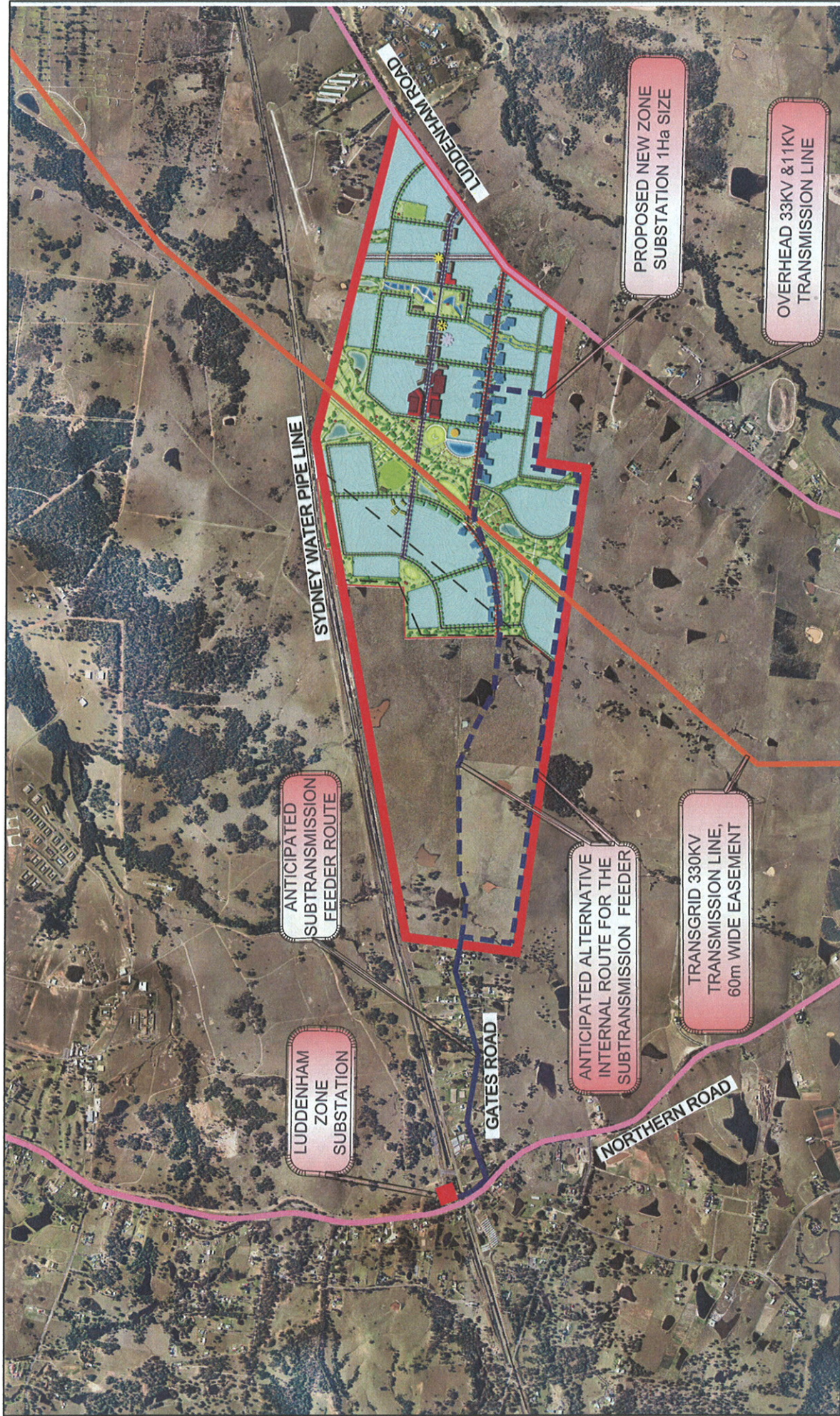
1. Registered Lot and Deposited Plan Numbers
2. Proposed master plan

J. Wyndham Prince Pty Ltd
Consulting Civil Infrastructure Engineers & Project Managers



Key			

APPENDIX B – power supply



J. WYNDHAM PRINCE

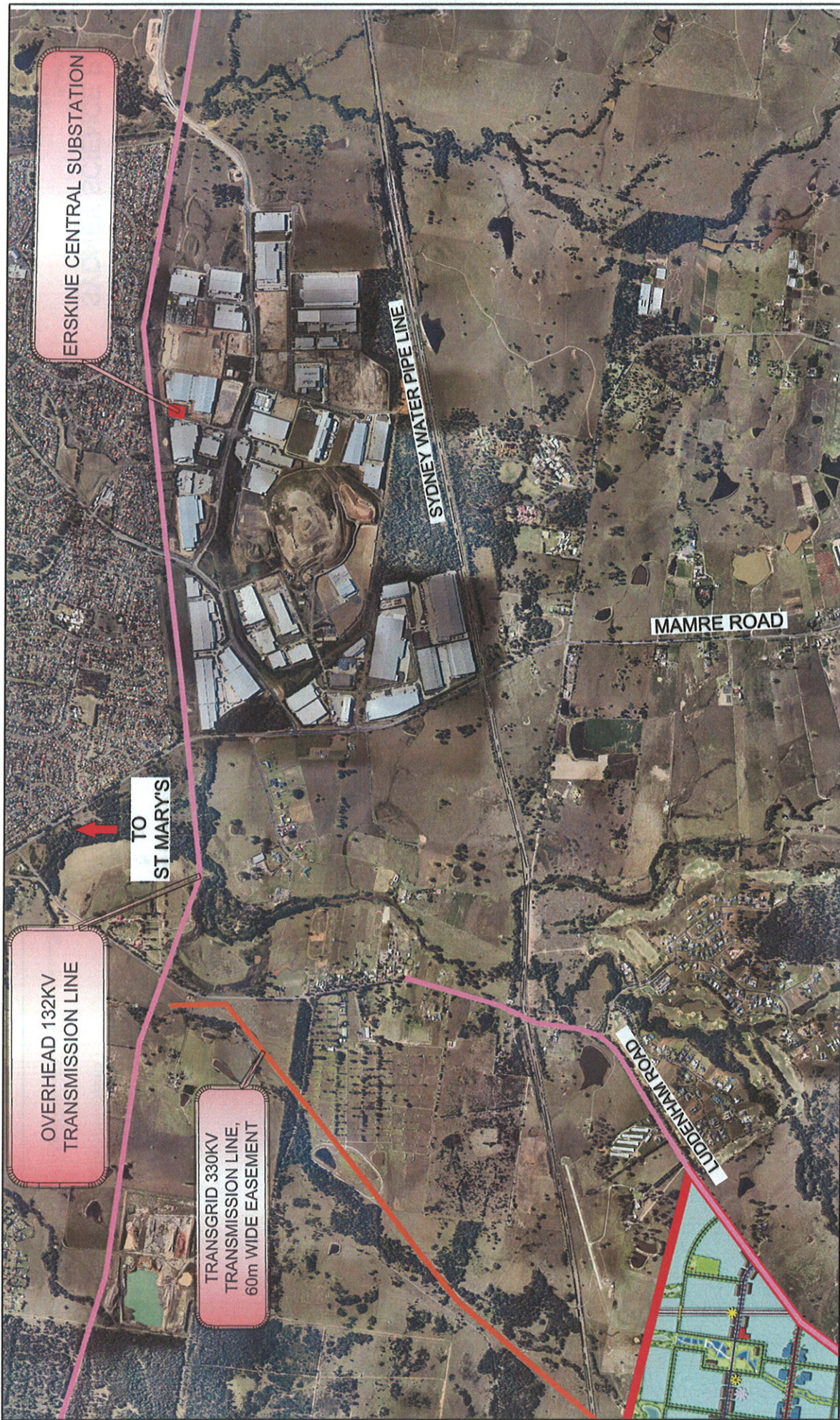
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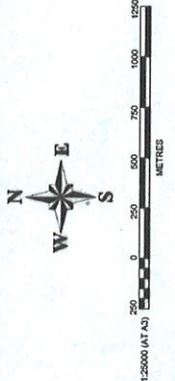
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SYDNEY SCIENCE PARK
POWER SUPPLY
PLAN LAYOUT

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POWER SUPPLY
PLAN LAYOUT
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