Draft Western Sydney Aerotropolis Constraints and Land Capability Assessment

Draft Utilities Audit

Western Sydney Planning Partnership

October 2020

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1 Executive Summary

The purpose of this report is to identify existing servicing infrastructure within the Western Sydney Aerotropolis (the Aerotropolis) and review the capacity constraints of existing utility services, to determine the implications on potential growth and considerations for the future utilities assessment (by others). Utility networks beyond the Aerotropolis boundary have been considered in this audit, due to the nature of utility services. Summaries for the Aerotropolis region are as follows (individual precinct summaries are provided in Section 4 of this report):

- Potable Water and Recycled Water

Sydney Water's existing water supply is serviced by regional reservoirs within four major water supply zones (Cecil Park, Warragamba, Leppington and Raby) and does not include water recycling treating facilities or the current use of recycled water. The majority of the precincts within the Western Sydney Aerotropolis are serviced by the Cecil Park system and future servicing can be supported by this system with augmentation. Large portions of the Agribusiness Precinct currently have no servicing and are serviced by onsite water harvesting or water tanks, any growth in these areas would require significant infrastructure to expand Sydney Water's network. There is limited capacity to accommodate future demand in the existing network. Sydney Water have planned for a staged development and upgrade of trunk water assets and new centralised reservoirs to accommodate growth in the Aerotropolis.

Along the Aerotropolis' northern boundary is the Warragamba Pipeline, transferring bulk (raw) water from the Warragamba Dam to the Prospect Reservoir then onto Prospect Water Filtration Plant. WaterNSW's Warragamba Pipeline is likely to be augmented or upgraded to suit future growth in demand for bulk water supply to the greater Sydney Area in the longer term, however there are no immediate plans to upgrade these pipelines. Due to restrictions as per the Bulk Water Supply Agreement, potable water servicing the Aerotropolis is from Sydney Water's Prospect Water Filtration Plant and therefore will be provided by Sydney Water as opposed to WaterNSW.

- Wastewater

There is no Sydney Water wastewater infrastructure within the Aerotropolis. At a regional level, there is insufficient residual capacity to accommodate future growth and demand. Sydney Water's planned infrastructure solution includes the Advanced Water Recycling Centre in Upper South Creek and up to 11 separate sewer pumping stations to service the Aerotropolis. These works are expected to begin rollout from 2024/25 as the Airport is commissioned and development begins to take place. There is a potential servicing gap in the interim between 2020 and 2025. Sydney Water are aware of this servicing limitation and are exploring interim wastewater servicing options that can integrate with the future permanent network to limit redundant works. New mains are proposed along South Creek and Cosgroves Creek to service initial development in the Northern Gateway, Aerotropolis Core, and northern portion of the Agribusiness Precinct.

- Gas

Gas is being supplied into Aerotropolis by two Jemena Trunk Regulating Stations located at Horsley Park and West Hoxton. The secondary and medium pressure mains are sparsely distributed around the Aerotropolis due to the existing low intensity land use which is unlikely to be sufficient to cater for the projected future growth in gas demand. The list of planned utility infrastructure upgrades includes a network of secondary mains to be extended to the Aerotropolis servicing the Aerotropolis Core, Western Sydney International (Nancy-Bird Walton) Airport, Badgerys Creek and Northern Gateway.

- Fuel

There is currently no fuel pipeline in the Aerotropolis but it is understood that long term planning for the Airport will consider the need for a fuel connection.

- Electricity

Endeavour Energy and TransGrid have a network of bulk supply points, zone substations and transmission lines in the region to service the primary agriculture land use for the Aerotropolis and other regions. Although TransGrid's assets are located within the Aerotropolis, their primary function is bulk supply for other regions. Long-term forecasts and planning strategies indicate that the existing capacity cannot support future growth without augmentation or additional infrastructure. The planned utilities include a new build supply point, several new zone substations and switching stations and feeders to support the additional 900MW growth expected in the WSPGA. Relocation of existing electrical services within the Western Sydney International (Nancy-Bird Walton) Airport footprint and nearby is also underway as part of the Stage 1 Airport works. There is some residual capacity in some zone substations such as the Kemps Creek, Bringelly and Luddenham Zone Substations but would only support very minor growth. A 330kV transmission line traverses the Agribusiness and Northern Gateway precincts and has a 60m wide easement that is not likely to be relocated or undergrounded. As such, future land use planning should consider the implications of this easement on developable areas.

- Telecommunications

A number of telecommunication towers exist around the Aerotropolis with recent towers upgraded by NBN Co for the Fixed Wireless rollout. This is currently providing partial fixed line and wireless NBN services to rural landholdings. 3G and 4G mobile coverage is present throughout the Aerotropolis with partial existing 5G mobile coverage. Rollout plans for the various service providers are staged to match the location and pace of development in the Aerotropolis.

The Aerotropolis is currently supported with telecommunications through pole mounted wires and in some isolated locations, conduits. Whilst the Aerotropolis is completely serviced, new growth would require infrastructure upgrades such as additional telecommunication towers to support the new industries and further optical fibre would likely to be rolled out. The rollout of telecommunications is not seen as a roadblock to delivery (or limiting to growth) however the rise of data centres and data intensive industries would need to be considered in the proposed servicing strategy.

- Stormwater

Liverpool City Council and Penrith City Council have provided data for the existing stormwater network within the Aerotropolis. Existing stormwater infrastructure is generally restricted to rural road culverts and occasional bridges. No additional trunk stormwater facilities are present and all dams are farms dams owned by the respective landowners. The existing stormwater network is expected to be sized for the current rural catchments and limited capacity for significant future development and modification of catchments. Significant stormwater pit and pipe upgrades and development of water quality and quantity treatment measures are required to accommodate future development in addition to upgrading infrastructure to be climate change resilient. Landside water quality and detention basins are required to support growth in the future, but it is understood that Sydney Water are presently undertaking a study to determine this requirement and land take.

Overall, there is very limited existing utilities infrastructure across the Aerotropolis, which is consistent with the historical rural and agricultural land use in the region. More broadly to the Precincts there is also very limited capacity in the established networks to support the expected growth which further compounds the lack of servicing. All Agencies consulted were aware of the Aerotropolis and the limited existing servicing provision and are actively planning for future servicing. The majority of future upgrades appear to be in the early planning phases and will be updated as the Precinct Plans are developed.

2 Utilities Audit Overview

2.1 Background

The Western Sydney Aerotropolis Plan (WSAP) sets the planning framework for the Western Sydney Aerotropolis (the Aerotropolis). The WSAP draws on the collaborative work being undertaken across the three levels of government and responds to the submissions received on the Stage 1 Land Use and Infrastructure Implementation Plan (LUIIP). The WSAP will set the vision for the Aerotropolis as Greater Sydney's next global gateway with new jobs and places to learn within a cool, green and connected Parkland City. As part of the project, Western Sydney Planning Partnership (WSPP) have developed a high-level Structure Plan and land use plan for all precincts to guide precinct planning and subsequent master planning. In consultation with the Greater Sydney Commission (GSC) a draft servicing strategy will be prepared (by others) to determine the required infrastructure and sequencing to service the precincts and asses their commercial viability. Furthermore, the GSC will also recommend staging to suit this delivery strategy.

Aurecon have been engaged to provide engineering and land capability advice to support planning for the development of the Aerotropolis. The advice provided will inform the development of Precinct Plans for the following initial precinct groupings:

- Aerotropolis Core, Badgerys Creek and adjoining land in the Wianamatta-South Creek Precinct,
- Northern Gateway Precinct, and
- Agribusiness Precinct.

The Aerotropolis is a 11,200-hectare growth area surrounding the Western Sydney International (Nancy-Bird Walton) Airport (the Airport). The Aerotropolis also forms part of the GSC's Place-based Infrastructure Compact (PIC). The existing land is generally used for primary agricultural and rural purposes with intermittent areas of medium density development such as Luddenham Village. Utility infrastructure within the Aerotropolis is limited due to its agricultural and rural land use, lack of user demand and distance from existing trunk infrastructure.

2.2 Purpose

The purpose of this report is to provide a desktop review of existing services within the initial precincts of the Aerotropolis. The capacity of existing utility services will be identified, with its implications used to determine potential additional growth that can be supported without augmentation. The report also identifies the extent of the existing services and infrastructure that can be considered in future utilities assessments. Due to the nature of utilities servicing we have considered utility networks outside the Aerotropolis boundary to provide the full context. Summaries of the Aerotropolis Core, Badgerys Creek, Agribusiness, Northern Gateway and Wianamatta-South Creek Precincts have also been provided. This report covers the following:

- A desktop review of existing services within the initial Aerotropolis precincts through consultation with the service providers;
- List utilities/services – water, recycled water, wastewater, electricity, gas, telecom/NBN (including mobile), stormwater;
- The capacity of existing utility services and use limitations/implications to determine potential additional growth that can be supported without augmentation (where available from the authorities); and
- Identification of (map) the extent of the existing services and infrastructure.

The audit is to apply to the three initial precinct groupings:

- Aerotropolis Core, Badgerys Creek and adjoining areas of Wianamatta-South Creek,
- Northern Gateway, and
- Agribusiness.

It is noted that the scope of works is limited to the above precincts however, some of these precincts have very limited existing infrastructure. In the interest of completeness, in such instances, Aurecon have expanded the commentary to outside the precinct to provide a holistic understanding of the systems and networks that service the aerotropolis. Furthermore, whilst the study is aimed at existing capacities Aurecon have also commented on committed infrastructure where relevant and “in-progress” projects play an important role in this baseline assessment.

Services infrastructure and the relevant authorities included in our scope is limited to:

- Water and Sewer: Sydney Water;
- Electricity: Endeavour Energy & TransGrid;
- Gas: Jemena;
- Telecommunications: Telstra & NBN Co.; and
- Stormwater: Liverpool City Council & Penrith City Council.

The audit is limited to trunk infrastructure as minor networks have very little capacity to support growth and do not provide a good indication of development potential.

2.3 Approach

The Utilities Audit involves the following approach:

1. Undertaken Utility Authority briefings with the relevant authorities. This has included initial engagement letters and online phone calls to brief the agencies on the proposed works. These calls have explained the process of the baseline assessment the information requirements sought from agencies and response times;
2. Gathered and reviewed existing infrastructure networks (including GIS data where available);
3. Gathered and reviewed existing residual service capacities in the networks where provided by utility authorities. Where authorities were unable to provide existing residual capacities, additional commentary has been prepared to provide qualitative commentary on residual capacities from publicly available data. Provided commentary of items that may impact development land take such as existing easements (generally TransGrid);
4. Gathered and reviewed any committed infrastructure and implications for development discussed;
5. Where available or not commercially sensitive, gathered current and future utility Authority servicing strategies. It is noted that these strategies are generally not committed and therefore are flexible to support the outcomes of the Precinct Plans (nor are they likely to have considered the Precinct Plans that are under development as part of this project); and
6. (Future) Phase 2 of the works will consider an audit of the proposed servicing strategy defined by the Greater Sydney Commission (GSC). This assessment is required for the Phase 2 works and therefore no assessment is made outlining proposed servicing strategies.

The utilities assessment below transcends the individual precinct boundaries to provide a holistic picture of utilities servicing in the region as servicing networks are more regional in nature. A more targeted precinct assessment is provided in section 4 of this report outlining specific infrastructure within each precinct.

2.4 Consultation

The following key stakeholders were consulted as part of this Utilities Audit. Information was sought from each agency regarding their existing assets in the region and commentary on their residual servicing capacities for the precinct.

- Sydney Water;
- Endeavour Energy;
- Transgrid;

- Jemena;
- Water NSW;
- Telstra;
- Optus
- NBN;
- Liverpool City Council; and
- Penrith City Council.

The above list of agencies was established through Dial Before You Dig (DBYD) investigations to identify proponents in the region. Furthermore, it is noted that some agencies were unable to provide detailed assessment of existing utility capacities and provided a qualitative assessment. In addition, GIS data was unable to be sourced from some agencies, however in the interest of completeness Aurecon have sourced servicing maps from alternative sources and included these within this report but these have not been translated to GIS.

2.5 Western Sydney Airport Utilities

The nominated precincts within the Aerotropolis are proposed to utilise the synergies associated with the development of the Airport. The Commonwealth Department of Infrastructure, Transport, Regional Development and Communications (DITRC) funded airport will be delivered by Western Sydney Airport. The Stage 1 EIS released in December 2016 show the utility demands for the permanent long-term Airport as well as interim (Stage 1) arrangements. A summary is provided below for context, and whilst delivery dates are not provided, it is understood that these services will be in place for the opening of the Airport in 2026. No further documentation is available to show commercial discussions between DIRTC and the utility authorities or the final servicing strategy. It is understood that some efficiencies may have been explored to collocate utilities for the Airport and other developments surrounding the Airport. Elizabeth Drive is flagged as a major thoroughfare for future services.

The interim (Stage 1) Airport development indicatively shows several potential Airport servicing strategies from the various utility authorities within the region. There has also been consideration of the permanent long-term Airport arrangement for the various nominated reticulation alignments. This includes:

- Provision for onsite storage of water suitable for the supplying Aviation Rescue and Fire Fighting Services (ARFFS);
- Provision of an onsite recycled water treatment plant for the irrigation or other greywater purposes;
- Provision of onsite wastewater treatment facilities or trunk mains to leverage potential future regional infrastructure;
- Multiple options for 132kV electrical transmission line alignments to service the Airport;
- 210kPa gas main from Elizabeth Drive to provide a connection point for the Airport;
- Two underground fibre optic telecommunication lines for Airport with connect points potentially from The Northern Road and Elizabeth Drive; and
- Potential requirement for an underground jet fuel pumping system to service the Airport aviation fuel demand.

Various existing services have been also nominated to be relocated or adjusted as part of the Stage 1 Airport works. These include:

- Relocation of 3.2km of existing TranGrid overhead transmission line;
- Potential relocation of existing Jemena assets. Extent of gas relocation works to be confirmed by Jemena at a later date;
- Undergrounding of existing Endeavour Energy overhead high voltage lines on Elizabeth Drive, Luddenham;

- Relocation of the existing Sydney Water potable water main along Badgerys Creek Road to service the Airport; and
- Relocation of the existing services along The Northern Road to suit the new road alignment. This includes Sydney Water potable water main.

3 Utilities Baseline Service Assessment

The following utilities baseline assessment is broken into service categories and relevant agencies for clarity. This assessment examines the broader region as large swathes of the Aerotropolis have no utility servicing within the Aerotropolis, therefore to understand the constraints this report examines the regional impacts.

3.1 Potable Water and Recycled Water

3.1.1 Sydney Water

Existing Utilities

The western portion of the Aerotropolis is largely currently unserved for potable and recycled water. The vast majority of existing properties are predominantly rural and agricultural land with sporadic more established businesses. The Aerotropolis is largely serviced by minor reticulation suited to the current rural land holdings and agricultural production. The Aerotropolis' existing water supply is serviced by regional reservoirs within four major water supply zones covering the precinct. Existing service provision in the region consists of predominately of 100-200mm mains in each of the Aerotropolis precincts with limited augmentation capacity for future growth due to their existing size. On a bulk servicing level water is predominately supplied from Sydney Water's Prospect reservoir and filtration plant and will continue service the region into the future. Significant investment would be required to support new development and meet the projected population and economic growth of the region due to the lack of existing trunk infrastructure locally.

There is currently no recycled water reticulation service within the Aerotropolis. This is likely due to there being no commercially viable customers in the region and without the support of recycled water treatment facilities at sewerage treatment plants (and their distance from the Aerotropolis) this will have hampered any rollout to date. Recycled water should be considered to offset potable water use and promote circular economies for the Aerotropolis should a viable source be created. Sydney Water are planning to provide a recycled water scheme with the creation of the Upper South Creek Advanced Water Recycling Centre (AWRC) to meet the demands that makes it commercially viable.

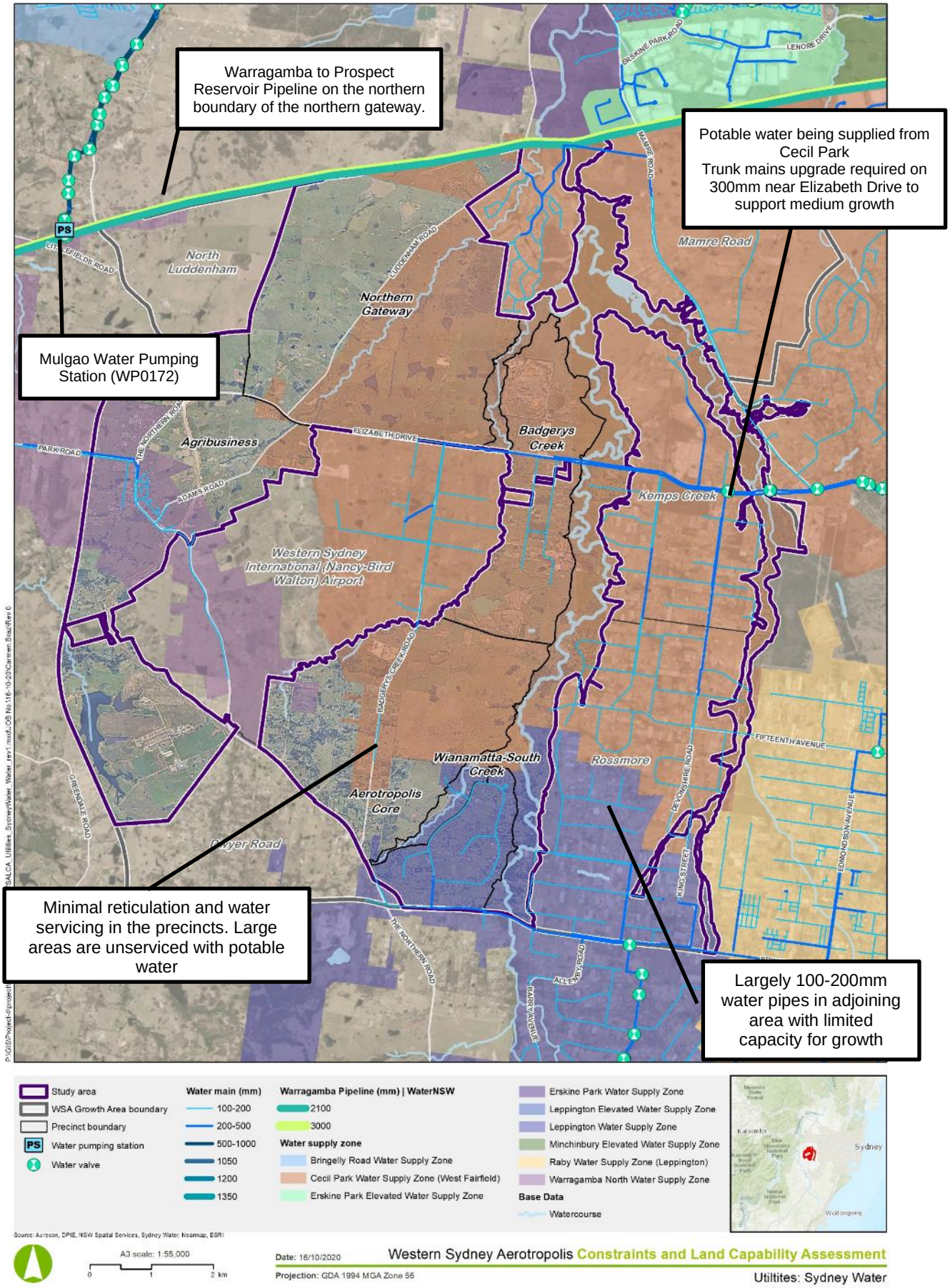


Figure 1: Existing Potable Water Network and Service Catchments

The Aerotropolis is serviced by four major water supply servicing zones as identified in Figure 1 above being:

- Cecil Park (part of Prospect South delivery system) – this zone currently delivers majority of the potable water to the existing land holdings in the Aerotropolis.
- Warragamba – which services the Luddenham area along the Northern Road. This servicing region is not as extensive as the Cecil Park supply zone but can act as an alternative supply source in the future for short term growth however, existing capacity is limited.
- Leppington (part of Macarthur delivery system) - Recent upgrades have allowed higher elevation regions of Leppington and the surrounds to be serviced, this zone services Leppington, Catherine Fields North, Rossmore and the southern portion of the Aerotropolis Core.
- Raby (part of Macarthur delivery system). – Raby services the Austral and Leppington North regions and is not expected to service the initial Aerotropolis Release Precincts.

Figure 1 also highlights the areas of Agribusiness and Northern Gateway precincts that currently have no access to piped water supply, existing properties in this area are supplied from tank water or utilising farm dams. All new infrastructure would be required to service these areas with any new development intensification. It is understood that the majority of the Aerotropolis is likely to be serviced predominantly by the Cecil Park System with augmentations and additional reservoirs created locally, this system provides the greatest servicing potential (albeit requiring augmentation) which is currently being assessed by Sydney Water.

Existing and short-term developments in Austral and Leppington North can be leveraged off for potable water from the Cecil Park, Leppington and Raby reservoirs, however a significant shortfall exists for the Aerotropolis and Sydney Water have indicated that there is both little residual supply in the water network along Elizabeth Drive and without augmentation on a bulk level there would be limited capacity to supply development regionally for the next 15 years.

The primary challenges for servicing being the distance to existing trunk infrastructure and available capacity of the existing infrastructure in the precincts. In addition, water treatment facilities may require augmentation and headworks to support the new growth and therefore are capital intensive.

The majority of the region is currently serviced from the Cecil Park Reservoir and supplies up to 300mm mains along Elizabeth Drive. The Cecil Park supply zone, fed from the Prospect Reservoir, is likely to see the greatest short to medium term increase due to future release areas around Mamre Road and Eastern Creek. The Aerotropolis Core Precinct supply is connected to the Macarthur delivery system from Leppington and the Agribusiness Precinct and will need to be serviced in sequence.

The Agribusiness Precinct has the greatest challenge with respect to water servicing as the vast majority of the precinct is unserviced and a considerable distance from existing reservoirs. Future strategies could consider decentralised networks in these areas.

New mains are currently under construction along the upgraded The Northern Road and will provide some additional supply to the Aerotropolis Core in the initial stages which is supplied from the recently upgraded Oran Park Reservoir.

Elevated Supply Zones

The existing reservoirs in the region provide sufficient supply and capacity to the current rural consumers however, should servicing expand to the unserviced regions of the Aerotropolis then not only will new trunk infrastructure (supply mains) be required, additional reservoirs or high lift pumps would also be required to service the western portions of the Aerotropolis which are located at higher elevations. This is due to the limited servicing ability of existing infrastructure and as a result of head loss experienced over the long reticulation distances from existing reservoirs and areas of the aerotropolis being elevated higher than the existing reservoirs.

Table 1 below highlights the elevations of existing reservoirs. Figure 2 shows the elevation heat map of the precincts up to 120m AHD. As illustrated elevated parts of the Agribusiness and Aerotropolis Core precincts may be challenging to service from existing reservoirs without supply augmentation (pumps or new reservoirs). Existing infrastructure may allow for some initial smaller rezoning. However, supply will become limited by the existing main capacities and elevations in the initial release years without intervention.

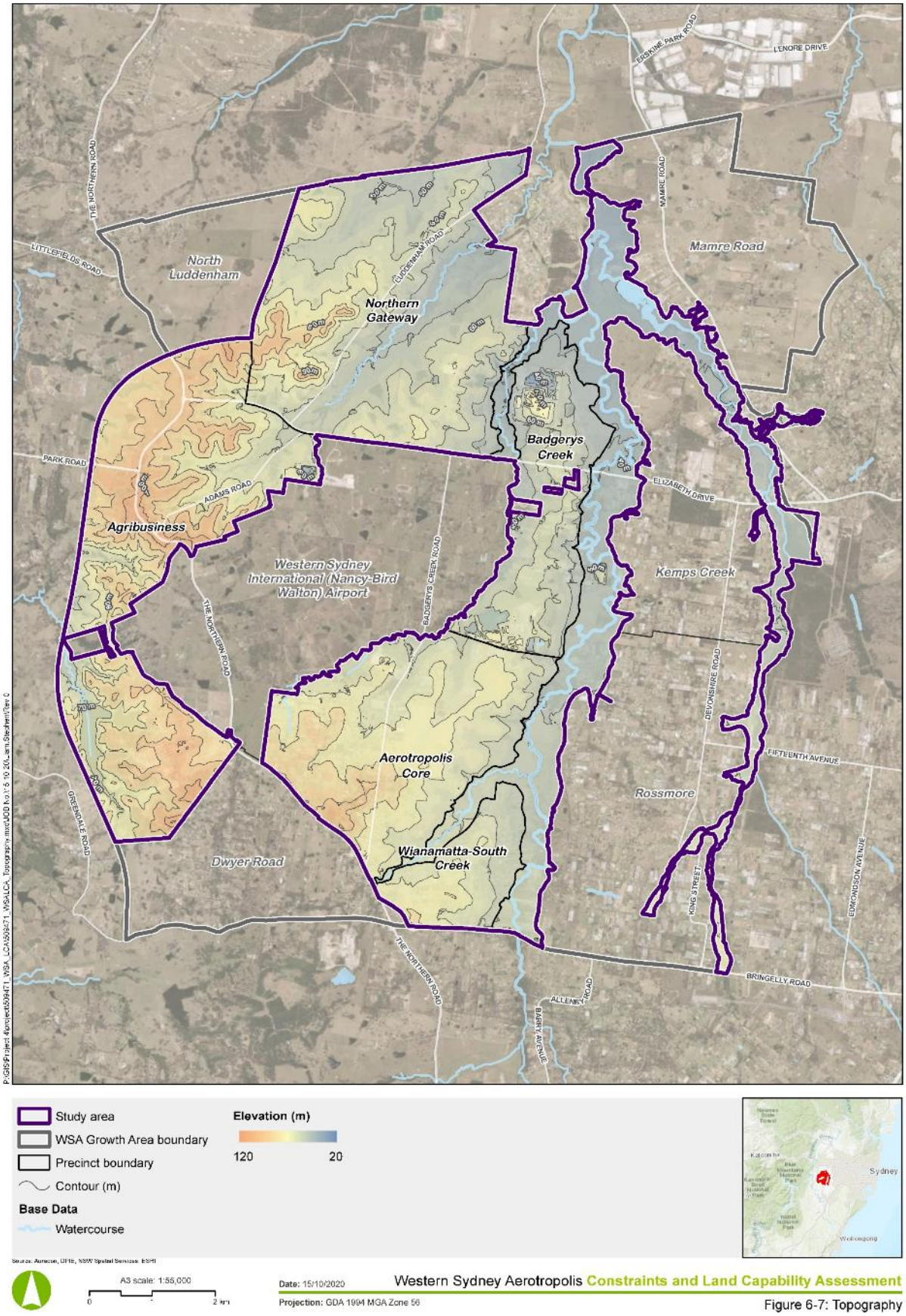


Figure 2: Terrain Elevation map

Current and Residual Capacity

The Aerotropolis is likely to be serviced from the selection of existing reservoirs below as well as additional future reservoirs. As indicated in the below table the existing Cecil Park Reservoir is significantly larger than the remaining reservoirs that also service the Aerotropolis at Warragamba and Leppington and further reinforces the Cecil Park Reservoir as the major source supply for the region.

Table 1: Reservoir Capacities

Item	Unique Name	Current Capacity	Full-Services Levels
Prospect Hill	WS0096	41.9 ML	115 AHD
Prospect Hill Elevated	WS0095	2.2 ML	138 AHD
Prospect Surface	WS0463	4 ML	137.5 AHD
Warragamba	**WS0129/WS0248**	**3.2 ML**	**381 AHD**
Warragamba North	WS0328	5 ML	163 AHD
Cecil Park	**WS0165/WS0336**	**39.5 ML**	**158 AHD**
Leppington	**WS0315**	**15 ML**	**143 AHD**
Leppington Elevated	**WS0344**	**0.6 ML**	**156 AHD**
Erskine Park	WS0321	60 ML	92 AHD
Erskine Park Elevated	WS0361	3.2 ML	110 AHD
Raby	WS0100/WS0164	12 ML	143 AHD
Carnes Hill	WS0264	20 ML	105.5 AHD
Silverdale	WS0329	7 ML	221 AHD

Sydney Water have provided a qualitative high-level assessment of the network and its residual servicing capacity. Due to the complexities of the network operations and timing constraints, Sydney Water will be confirming residual capacities in the existing reservoirs at a later date. Significant regional growth in population, dwellings and employment has been forecasted in major development sites around the Aerotropolis. Sydney Water have recognised the need for infrastructure investment mainly within the Cecil Park and Leppington water supply zones. The existing network was described to have underlying constraints leading to areas of low water pressure. There is also an urgent requirement for additional storage capacity to accommodate the rezoning within the Austral Precinct which neighbours the Aerotropolis. It is understood that there is limited residual capacity in the existing network for any initial short-term growth within the Aerotropolis. Sydney Water is expediting short-term infrastructure upgrades to address other network constraints and neighbouring demand increase. Furthermore, Sydney water are currently planning and delivering additional upgrade works to match the growth rollout in the Aerotropolis however, these works are in their initial planning phase and based on consolidated growth intelligence. Servicing capacities are not yet known but will incorporate the Aerotropolis Precinct Plans as they are developed.

Sydney Water have also identified that the high cost of servicing Western Sydney relative to the number of new connections will be a key issue moving forward. Greenfield developments typically require new capital investment and higher levels of treatment and are therefore more expensive to service when compared to infill developments. In addition, there is limited opportunity to leverage off the existing system due to the distance and available capacities of these systems. Innovative decentralised water supply solutions may be feasible as interim measures or alternatives and will be explored as part of the precinct planning process. Sydney Water are currently determining an interim servicing strategy that will help address short term immediate development that occurs prior to the larger servicing infrastructure that is proposed to coincide with the opening of the Airport in 2025/6. Whilst not confirmed by Sydney Water, possible decentralised systems could include:

- Wastewater recycling systems to supply non-drinking water demands in the precinct;
- Harvesting stormwater runoff from open spaces and rooftops for water usage; and
- Extracting groundwater for drinking and irrigation purposes.

Additionally, staging of development to locate development in close proximity to Sydney Water's servicing sequence is a potential opportunity to logically "seed" development in the area. This would involve initial release areas being centred around Elizabeth Drive, the southern portion of The Northern Road and Luddenham.

Planned/Committed Utilities

The existing potable water reticulation in the Aerotropolis is designed towards servicing the rural population of the area. The current infrastructure is insufficient to support significant growth in the region as there is limited residual capacity. Existing infrastructure would require augmentation/upsizing to cater for future loads and the general transformation of land use from rural to residential, commercial and industrial land uses. Sydney Water are aware of the current network limitations and hence upgrades are in progress for a staged delivery of trunk water assets from 2021. Recently completed works include:

- The South West Growth Centre (SWGC) South Western Front Water Trunk Main Package 1A: providing new drinking water infrastructure in the area; and
- SWGC South Western Front Drinking Water Package 2A: providing new drinking water infrastructure in the area.

Between 2020 – 2022, Sydney Water will be investing $1.3B on infrastructure projects in the Aerotropolis. The committed and planned water upgrades for the Aerotropolis initial precincts include the following:

- Trunk drinking water assets are being constructed to provide 10ML of water for the Airport. The expected completion is in 2022.
- A new 450mm Water Main along Luddenham Road is also in its early planning phases and will service Science Park and is expected to support initial growth in the Northern Gateway.
- New drinking water services to cater for future developments in Austral, Leppington and Leppington North. The works include new reservoir and pumping station at the Liverpool Reservoir, which is due for completion in 2022. Additionally, a new pressure main to transfer water supply from Liverpool reservoir to the existing Cecil Park reservoir is under construction and is to be completed in the same year. Water trunk mains supplying Austral and Leppington is to be delivered in stages by 2025.
- As part of the Oran Park extension, a 600mm main will be extended from The Northern Road to Aerotropolis Core with expected delivery in 2020.

Longer term, the Aerotropolis Reservoir on Elizabeth Drive between the Agribusiness and Northern Gateway precincts is proposed. Construction works are anticipated in 2030. Sydney Water and GSC are currently planning trunk water upgrades to match development growth.

Cecil Park is the major supply zone of the region. Forecasts for the area have significantly increased since the 2017 GSIP (Growth Servicing Investment Plans) and has triggered major capacity upgrades. As these new assets are built, the corresponding water supply zone servicing areas are likely to be adjusted to accommodate and will provide servicing to the unserviced portions of the Aerotropolis.

These works, along with reticulation amplifications, are expected to support initial growth at the airport, Aerotropolis Core Precinct and potentially the Northern Gateway precincts. An additional $300 million in upgrade works are also expected before 2026 to accommodate Aerotropolis precincts. Sydney Water's drinking water servicing plan is shown below in Figure 3.

Re-using and recycling water is central to this approach by supplementing potable water consumption in applications such as industrial, agricultural, firefighting and construction. This requires significant upfront investment to distribute the recycled water from the AWRC as there are no recycled water schemes in the region and as such there is no existing reticulation infrastructure available. Implementation of the recycled water scheme will reduce the overall demand on potable drinking water in the Aerotropolis and the corresponding requirement for infrastructure upgrades and additional infrastructure. Sydney Water are planning on developing a resource recovery plant in the Upper South Creek as per the *Reimagining water in western Sydney - Western Sydney Regional Master Plan*. However, the recycled water aspect of the AWRC is still under assessment and development by Sydney Water.

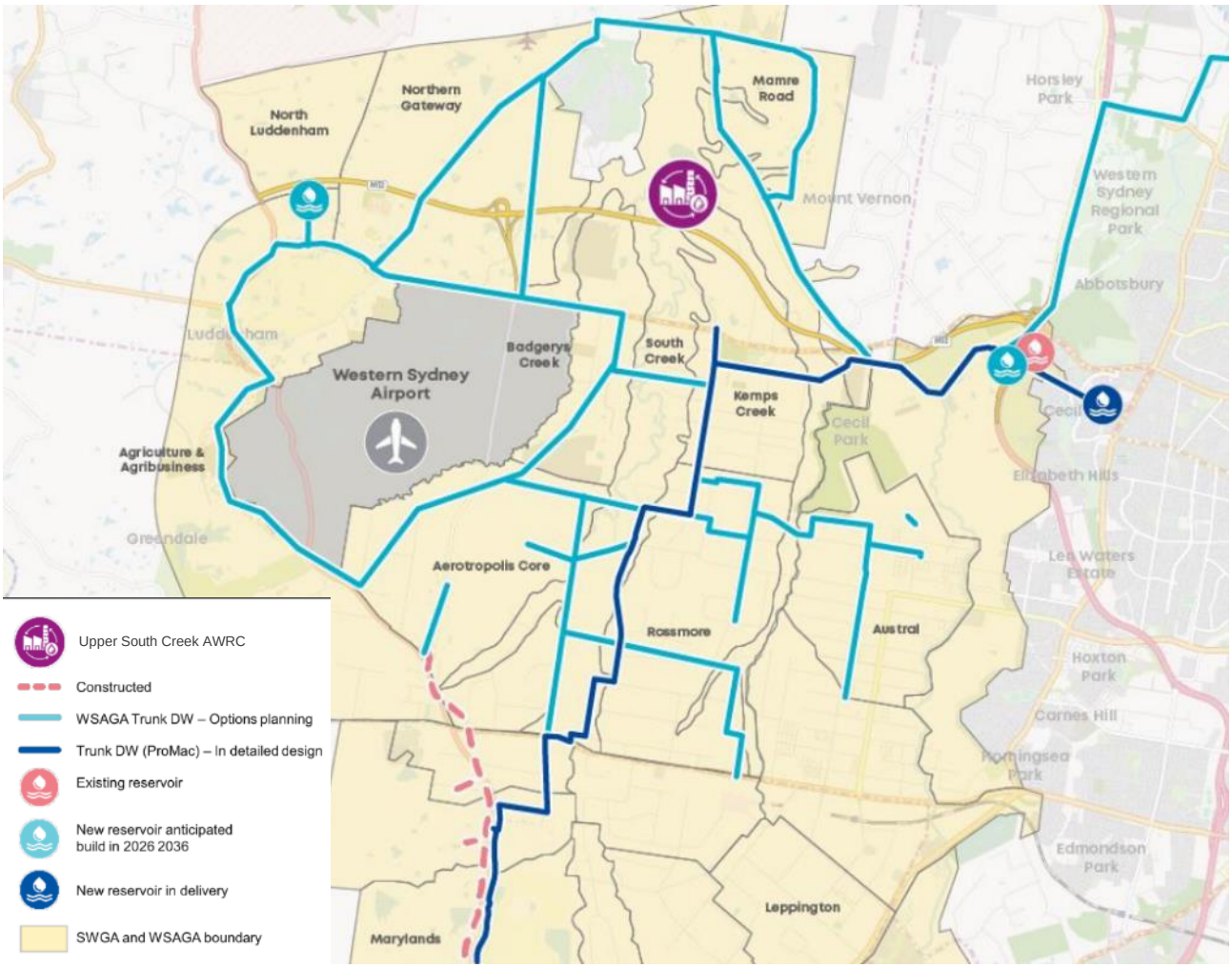


Figure 3: Sydney Water Western Sydney Aerotropolis Indicative Drinking Water Servicing Infrastructure Plan

Future Strategy

Western Sydney's population is forecast to double by 2056 reaching a total population of 1.5 million where a majority this growth will occur in currently rural or semi-rural areas. This will require a shift in current land-use planning to maximise integrated water cycle management principles.

Further to the infrastructure in Figure 3, there are a series of planning and strategy studies prepared by Sydney Water including the SWGC Drinking Water Services Study. The two additional key areas of potable water service upgrades have been identified to cater for increased growth and demand in Western Sydney. These include:

1. Austral, Leppington and Leppington North

Figure 4 shows the staged construction of water trunk mains within the road reserve of the Austral, Leppington and Leppington North growth areas to be delivered by 2025 with some mains currently under construction. The mains will connect to Cecil Park Reservoir via the major trunk lines either along Elizabeth Drive and/ or through Western Sydney Parklands to Liverpool Reservoir via an alternative trunk main. These infrastructure upgrades are planned to service Austral, Leppington and Mamre Road Precincts in the long-term. It will also support the Aerotropolis as part of the potable water network in conjunction with the proposed Aerotropolis reservoir on Elizabeth Drive and an additional reservoir at Cecil Park. Nevertheless, there is a potential short to medium term opportunity to utilise surplus capacity from the committed upgrades to support early staged development of the Badgerys Creek post 2025. This opportunity will need to be further discussed and explored by Sydney Water as it would be limited by the capacity of the existing rural mains in Badgerys Creek until such as they are also upgraded.

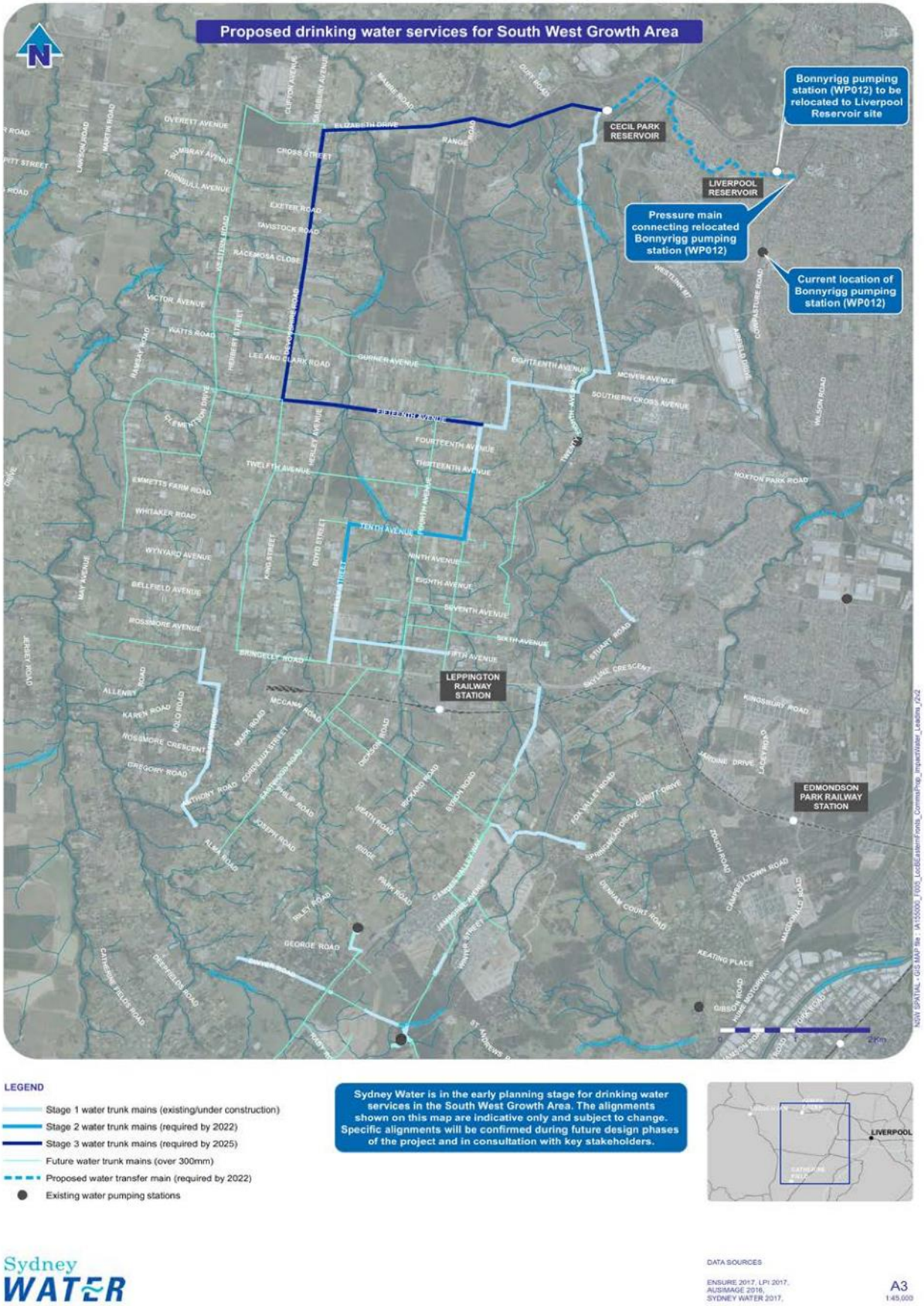


Figure 4: Potable Water Upgrade Plan for Austral, Leppington and Leppington North Growth Areas

2. Cecil Hills and Cecil Park

The proposed plans within this growth area include a pressured transfer main (DN750) proposed to connect Liverpool Reservoir to the existing Cecil Park Reservoir and the relocation of the Bonnyrigg Pumping Station (WP012) by 2022 which will bolster bulk supply to the region. The proposed alignment will cross existing TransGrid easements, M7 motorway and the WaterNSW Upper Canal.

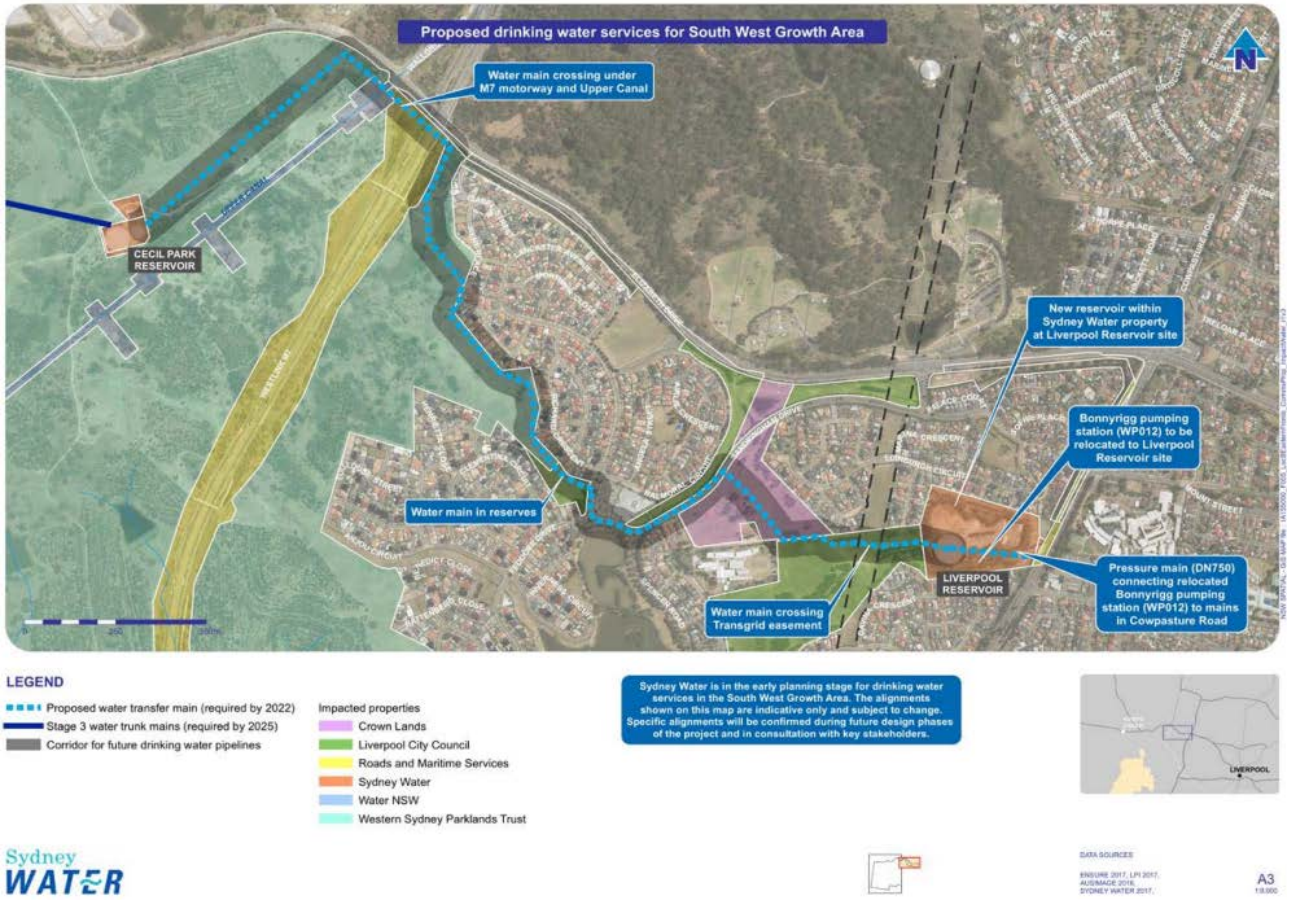


Figure 5: Potable Water Upgrade Plan for Cecil Hills and Cecil Park Growth Areas

The recent release of *Reimagining water in western Sydney - Western Sydney Regional Master Plan* helps guide Sydney Water's next steps in planning and delivering for the region. It sets a new direction for servicing and finds that an adaptable and integrated water cycle management approach delivers the greatest economic value for the region over a conventional servicing approach. The Master Plan considers four pathways and evaluates the environmental, customer and community benefits in the form of a Cost Benefit Analysis (CBA).

The Water Cycle City which aims for more recycled water for non-drinking purposes and increased focus on local retention / reuse of stormwater as compared to the traditional drained city pathway was deemed to deliver the greatest economic value at the least cost to realise the Parkland City vision. The pathway is also the most readily deliverable pathway in the current regulatory and socio-economic setting.

The additional benefits of investing in integrated water cycle servicing is derived from the liveability and amenity outcomes associated with greener and bluer urban environment. Additional financial, environmental and sustainability benefits are also associated with the use of locally recycled water for agricultural, industrial, irrigation and other applications within the Aerotropolis. These benefits mature at 2056.

3.1.2 Water NSW

Existing Utilities

WaterNSW operates the State's surface and groundwater resources delivering bulk supplies of water from Warragamba Dam to Prospect Reservoir, through twin above ground Warragamba Pipelines. For the Aerotropolis, the bulk water demand for the region is likely to be sourced from the Prospect Reservoir with the balance to be supplied from Warragamba and Leppington Reservoirs.

The Warragamba to Prospect Pipelines corridor is bulk water infrastructure owned by WaterNSW. The Warragamba Pipelines corridor forms the Aerotropolis' northern boundary and is a controlled area declared under the *Water NSW Act 2014.* It connects Warragamba Dam to the Prospect Water Filtration Plant (WFP) and Prospect Reservoir. Sydney Water has responsibility to convey Greater Sydney's drinking water from the Prospect WFP.

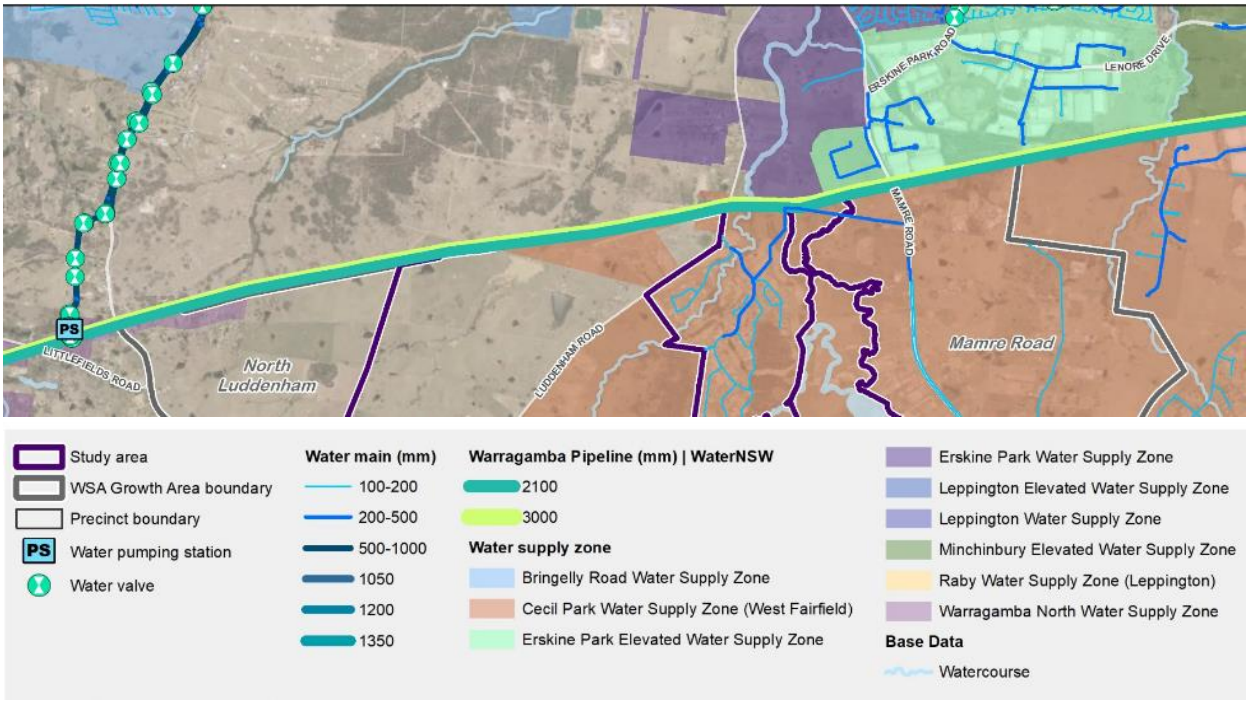


Figure 6: Existing WaterNSW asset plan

Current and Residual Capacity

The Warragamba to Prospect Pipeline is considered a bulk (raw) water pipeline which transfers raw water to Prospect reservoir and Sydney Water's Water Filtration Plant. It has restrictions on supply and capacity as per the Bulk Water Supply Agreement with Sydney Water. As a result, no direct connection can be made from the Warragamba Pipeline to directly service the Aerotropolis and therefore the pipeline's current residual capacity is not considered applicable to this existing utilities audit. The future land use planning should view the WaterNSW pipelines as a geographic constraint to ensure their protection and should not consider the pipeline as a source supply constraint or potential connection source. Bulk potable water servicing will be from Sydney Water's Water Filtration Plant at Prospect and therefore be provided by Sydney Water.

Planned/Committed Utilities

As Greater Sydney's demand for potable water increases, WaterNSW's infrastructure upgrades would augment or replace the pipelines to suit. Long-term construction and maintenance works are scheduled over the next 10 years within the controlled area of the Warragamba to Prospect Pipeline however, there are no immediate plans to upgrade these pipelines.

3.2 Wastewater

3.2.1 Sydney Water

Existing Utilities

There are no existing wastewater services / assets in the Aerotropolis Core, Northern Gateway, Badgerys Creek and Agribusiness precincts. Sewer is currently treated via onsite disposal systems within each rural and agricultural landing holding. Significant new investment and environmental approvals are needed for the establishment of new wastewater facilities in the various precincts. The closest treatment plants are located at Liverpool, Wallacia, West Camden and St Marys, all of which present a significant distance to cover when considering providing new piped infrastructure.

The closest wastewater reticulation exists near Austral, Leppington (in the east) and near Minchinbury towards the north east of the Aerotropolis boundary as can be seen in Figure 7 below. These systems pump wastewater to either Liverpool or West Camden Water Filtration plant. These systems have an inter-connection to the Malabar Wastewater Treatment Plant in south-eastern Sydney; however, both these systems are reaching capacity and currently do not have capacity to support rezoned (but undeveloped) land let alone land that is not yet rezoned. Sydney Water are developing strategies to transfer wastewater to a new sewerage treatment facility to be built by 2026 in the Upper South Creek catchment area (discussed further below). The residual capacities in the Liverpool system are expected to service growth in Austral and Leppington North. It is not expected that the Liverpool system will service the Aerotropolis initial release precincts.

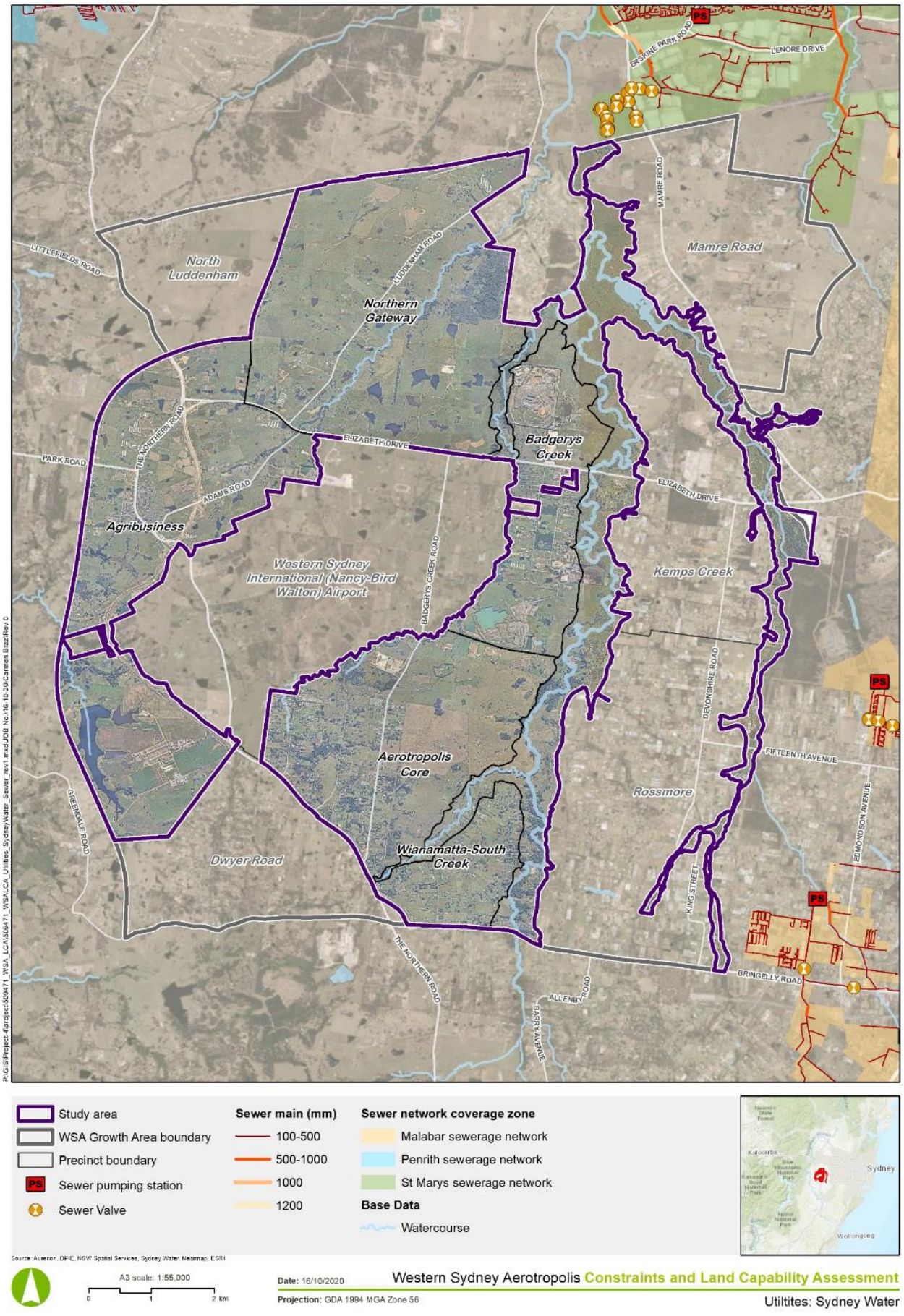


Figure 7: Existing Wastewater Network within and surrounding the Aerotropolis

Planned/Committed Utilities

Sydney Water are proposing that the Aerotropolis and other initial precincts would ultimately be serviced by the new Upper South Creek Advanced Water Recycling Centre (AWRC). The AWRC facility would be an innovative and integrated facility which would process incoming wastewater from the Airport, surrounding Aerotropolis industrial areas and homes in the Aerotropolis precincts. The AWRC will produce recycled water suitable for agricultural irrigation purposes in the Agribusiness Precinct, for Aviation Rescue and Fire Fighting (ARFF) Services and other industrial and domestic greywater applications while co-digesting waste for energy generation purposes. The excess water from the facility which cannot be recycled or reused will be treated and then discharged into the Nepean River. The AWRC is due for completion in 2025 with an estimated construction cost of $400-500 million. The creation of the AWRC not only supports circular green economies but will unlock the region for growth.

Given that the AWRC delivery is proposed to match and compliment the new Airport and any surrounding initial development based on the delivery assumption of 2025, there is a potential gap in servicing provision between 2020 and commissioning of the AWRC. Sydney Water are aware of this servicing gap and are currently exploring interim servicing solutions. Preliminary contingency concepts have been considered by Sydney Water for sewer interim operating procedures such as holding and pump-out options, alternative transfers or decentralised systems. However, these strategies are currently being planned and have not yet been formalised or committed. Sydney Water have indicated that the intent is that any interim solution should ideally be able to connect into the future long-term strategy to limit abortive/temporary works.

Sydney Water have also prepared plans for additional wastewater services to cater areas that are without wastewater services such as part of Austral, Luddenham and Leppington (shown below in Figure 8) however this does not activate the Stage 1 LUIIP. The proposed long-term wastewater infrastructure strategy includes up to 11 additional sewer pumping stations and additional pressure and gravity mains to transfer flows across the Aerotropolis connecting to the new AWRC. The initial mains flagged by Sydney Water include a new trunk main and pump station along South Creek which will service the Western portion of the Aerotropolis Core and Badgerys Creek Precincts as well a new main along Cosgroves Creek which runs through the Northern portion of the Agribusiness precinct and the Northern Gateway. Sydney water are still undertaking the planning of these mains, but it is understood that they will be sized to accommodate the ultimate growth within their servicing catchments.

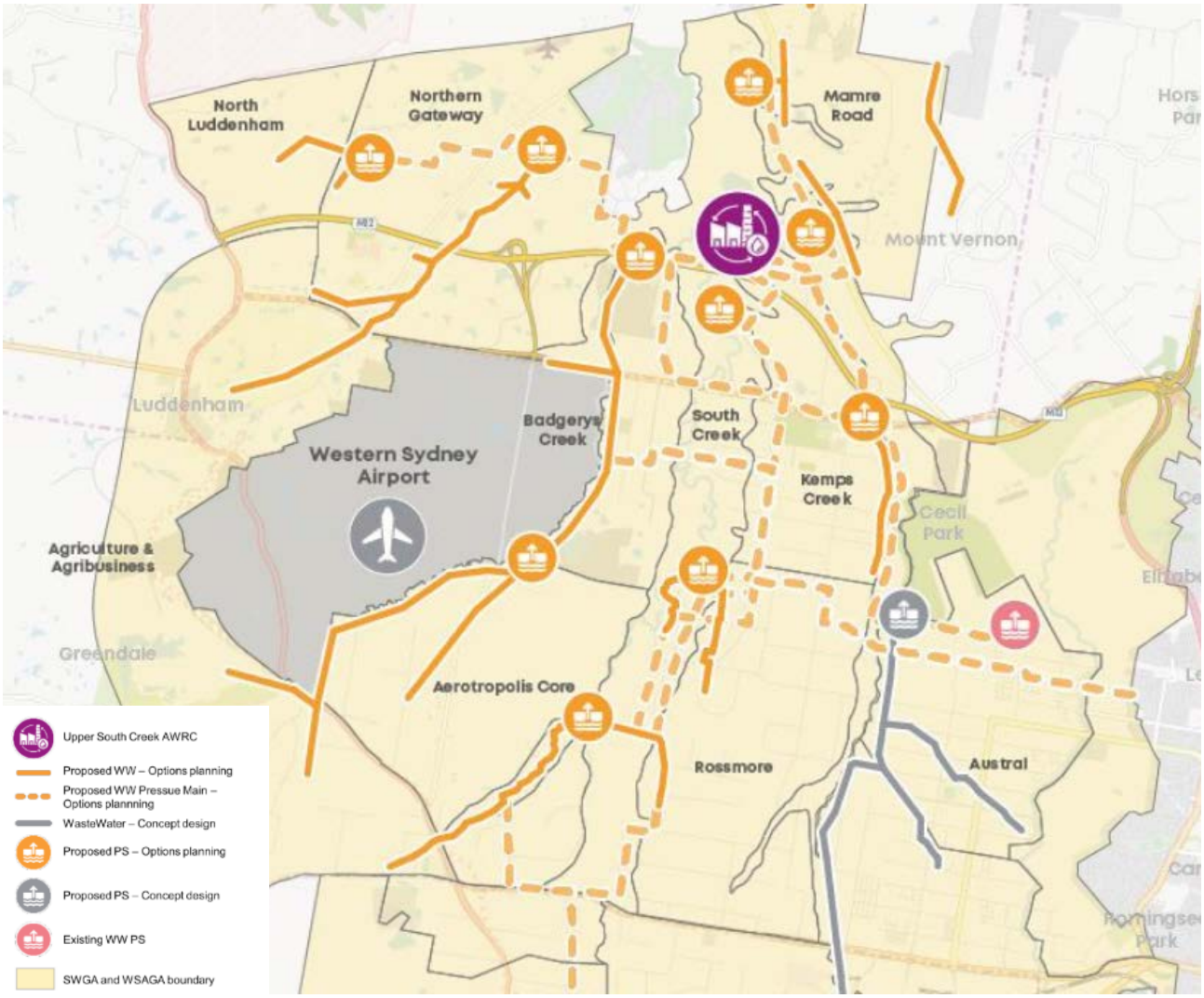


Figure 8: Proposed Aerotropolis Wastewater Network (Sydney Water)

Current and Residual Capacity

Sydney Water's object is to ensure water is retained within the catchment and utilised in an integrated and circular economy. There is limited capacity to transfer to the surrounding sewer network and nearby treatment plans such as Liverpool, Wallacia, West Camden and St Marys. It is unlikely to sufficiently service the proposed development of the Aerotropolis and corresponding forecasted demand for wastewater utilities and it is not Sydney Water's intended approach to increase adjoining network capacity to service the Aerotropolis. Wastewater infrastructure upgrades are proposed to cater for the Aerotropolis such as Upper South Creek AWRC and potentially up to 11 additional local pumping stations as part of the integrated and circulate economy strategy. Initial development will need to rely on interim operating procedures and other solutions until 2025 when future long-term services will be available.

3.3 Gas

3.3.1 Jemena

Existing Utilities

Jemena propose to provide gas for residential, commercial and industrial needs in the Aerotropolis. Jemena forecasts indicate population growth of 464,000 and an additional 180,000 dwellings will be constructed by 2036. Currently there is limited to no infrastructure in the region with only a few secondary mains that generally service commercial customers. Significant investment is required for the network extension to fully cater for the future growth and demand of the Aerotropolis.

Gas is being supplied into Aerotropolis by two Trunk Regulating Stations located at Horsley Park and West Hoxton. These facilities reduce the pressure from the Jemena Gas Network (JGN) Trunk pressure (6895 kPa) into the primary mains network (3500kPa). At these facilities, there are also Primary Regulating Stations (PRS), which reduce the primary main pressure down to secondary mains network (1050kPa) which feeds to the proposed Aerotropolis region.

The secondary and medium pressure mains are also sparsely distributed around the area due to the existing low intensity land use and corresponding low demand. The Aerotropolis Core and Badgerys Creek Precincts have two existing secondary mains being fed from the north along Elizabeth Drive and west along Bringelly Road. The Northern Gateway and Agribusiness precincts have no existing nearby secondary (or medium pressure) mains.

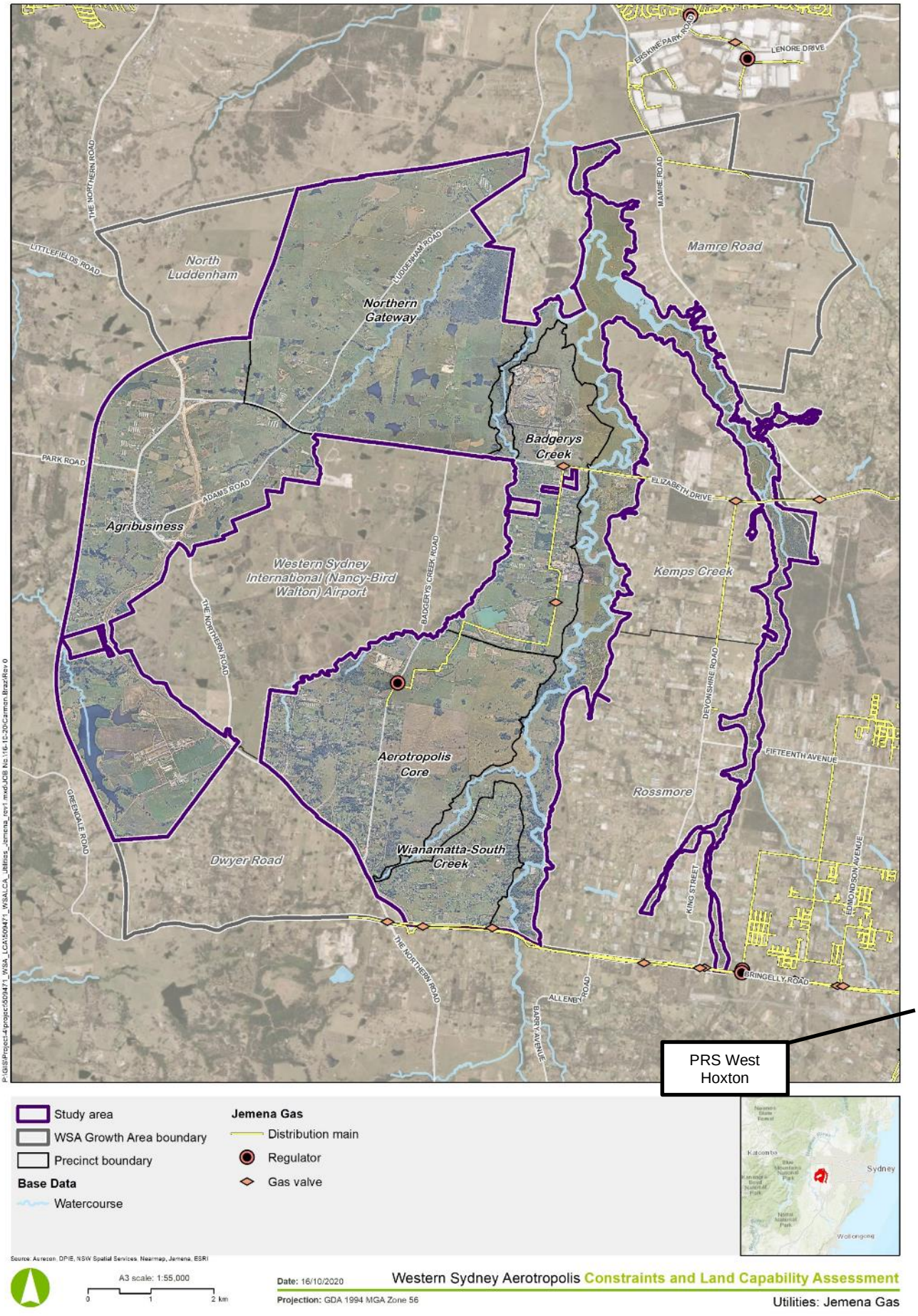


Figure 9: Existing Jemena Gas Network in the Aerotropolis and surrounding region

Planned/Committed Utilities

Jemena has identified that the largest development of new gas infrastructure is proposed in the Aerotropolis and will service the next 20 years and beyond. Significant gas demand is being anticipated with identified needs on four fronts namely the Airport, the commercial hub at Aerotropolis Core, technology centre at Sydney Science Park and Sydney Water's proposed AWRC. To cater for demand, Jemena has developed list of potential delivery options undertaking an assessment of the level of service and possible main extension routes in their Western Sydney Aerotropolis Projects – Options Analysis report (dated 20 December 2019). These options were then weighted against their Net Present Value (NPV) calculation. These projects are not currently committed and are undergoing planning by Jemena. The possible mains extensions routes required to service the Aerotropolis are indicatively depicted in Figure 10 below:

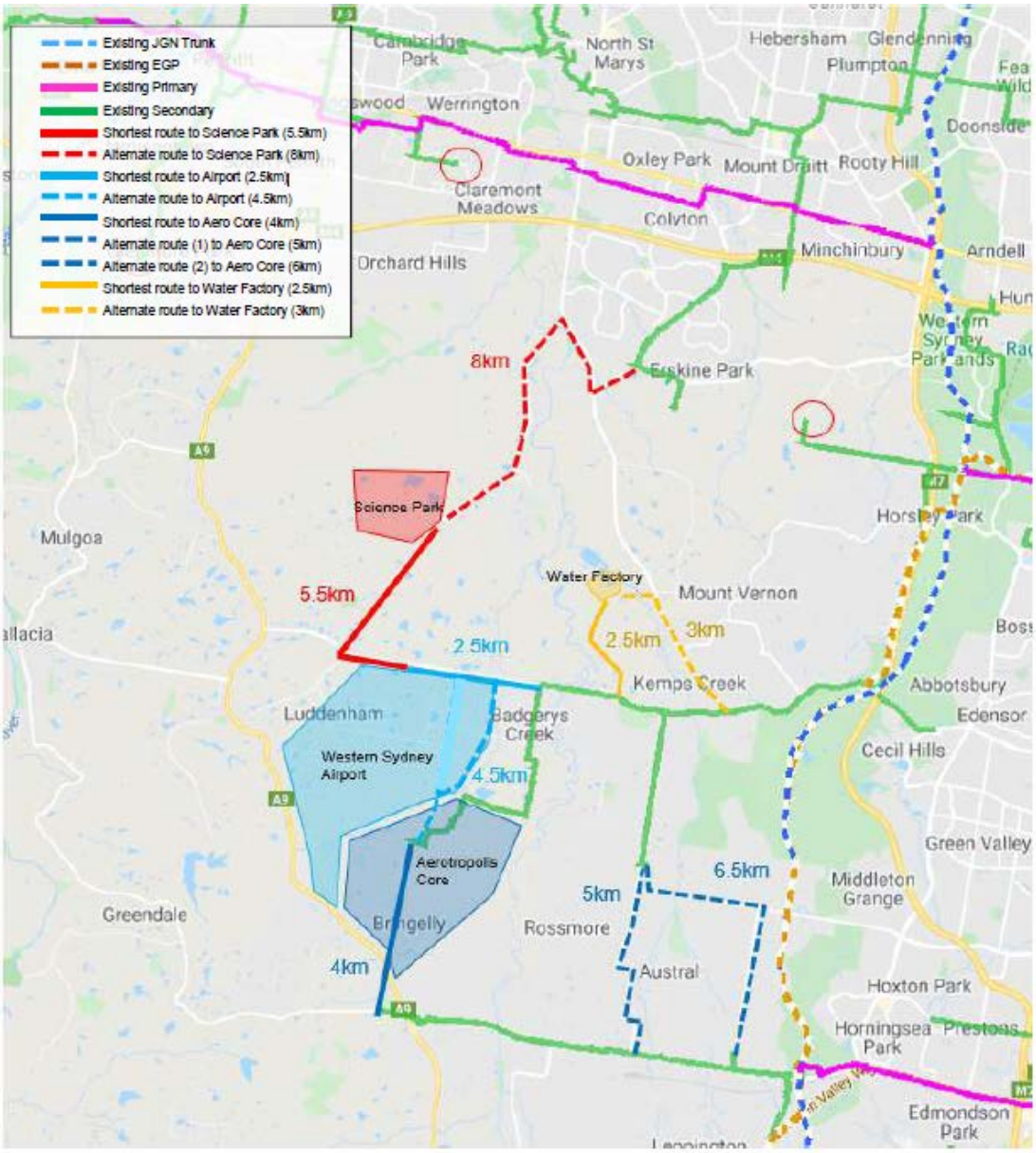


Figure 10: Possible Gas Servicing Routes (Supplemental Data from AER Access Arrangement)

The recommended option indicates augmentation capital expenditure of around $13 million and aims to provide a staged supply to the Airport and Aerotropolis between 2021 and 2024. It aims to maximise the potential synergies by aligning to other utility infrastructure where possible, such as along Luddenham Road to the Sydney Science Park and Badgerys Creek Road to the Aerotropolis Core Precinct. The following items are included in the preferred servicing option:

- Construct 2.5km of 250 mm secondary steel main (ST) main to the Airport and an additional 5.5km of 150mm ST to Sydney Science Park by 2022. The additional secondary mains network along Elizabeth Drive and Luddenham Road would supply the Airport and the Northern Gateway Precinct.

- Extend existing secondary network in Bringelly by 4km (250mm ST) to Aerotropolis Core Precinct by 2022.
- Lay 2.5km of 150mm ST to South Creek AWRC by December 2024.
- Construction of Secondary Regulating Sets (SRS) and medium pressure networks to supply residential and light commercial areas around the Northern Gateway Precinct and the Aerotropolis Core Precinct by 2026.

The Australian Energy Regulator (AER) have acknowledged the requirement for investment into infrastructure augmentation, upgrades and extensions given the forecasted demand in their draft decision for Jemena 2020-25 Capital Expenditure Proposal and indicated their commitment to servicing in the region (as a non-essential service). All Aerotropolis projects have subsequently been approved in the AER's Final Decision for Jemena 2020-25 Access Arrangement. Overall, Jemena's delivery of the proposed network infrastructure upgrades would need to be monitored and suitably aligned with regional demand growth and the performance of the current network over the next 10 years. However, the availability of gas supply is not expected to limit medium term growth. This potentially includes additional secondary regulation stations due to residential and light commercial demand from areas such as the Aerotropolis Core Precinct.

The Western Sydney Green Gas (WSGG) Project

Jemena is undertaking a 5-year trial to construct a Power to Gas facility at existing Horsley Park Trunk Regulating Station. The $15 million trial is co-funded by Jemena and the Australia Renewable Energy Agency (ARENA). The hydrogen production facility has been proposed for an initial production capacity of 100 Nm^3/h and would inject the produced hydrogen gas into the secondary gas distribution network and is likely to service the Aerotropolis as a blended natural gas/ hydrogen source. It would potentially also supply gas for bus and other vehicle refuelling and for electricity generation using a gas fuelled generator package for the local power grid.

Existing Capacity

The existing secondary gas network has capacity to service the immediate areas adjacent the existing mains and will support growth in the Aerotropolis however, additional main extensions from the existing network are required to unlock development as indicated in Figure 10. This same servicing logic applies within the Precincts with the existing network able to support initial development in the Aerotropolis Core and Badgerys Creek along the existing secondary main alignment however, network extensions are required to service the new locations around the Aerotropolis and facilitate growth in the medium term. It is understood that the existing network is not necessarily capacity constrained however the commercial viability due to the distance to service new areas of the Aerotropolis, such as the Agribusiness Precinct, may impact the staging and sequencing of infrastructure rollout. The details of the growth program were provided and Jemena have indicated that network extension works will respond to growth as it occurs. This includes the new high priority major growth locations such as the Airport, surrounding Aerotropolis, Sydney Science Park and the South Creek AWRC.

3.4 Electrical

3.4.1 Endeavour Energy

Existing Utilities

Endeavour Energy operates the distribution network generally connecting users from the bulk supply points to user premises through its distribution network which comprises of 33kV and 132kV sub-transmission and 415V, 11kV and 22kV distribution lines. The Aerotropolis currently has rural primary agriculture land use with a low overall power demand. The majority of existing assets are pole mounted rural supplies.

Currently, some Endeavour Energy infrastructure exists within or close to the precincts such as the zone substations at Bringelly, Luddenham and Kemps Creek and 11kV distribution feeders. Three bulk supply points (BSP) from where the power is supplied to the area are the Sydney West BSP near Erskine Park, Liverpool BSP at Prestons and Regentville BSP on the north west near Glenmore Park (some initial supply to the area may be available from Macarthur BSP). An overview of the trunk power infrastructure and rural overhead distribution lines can be seen in Figure 11 below.

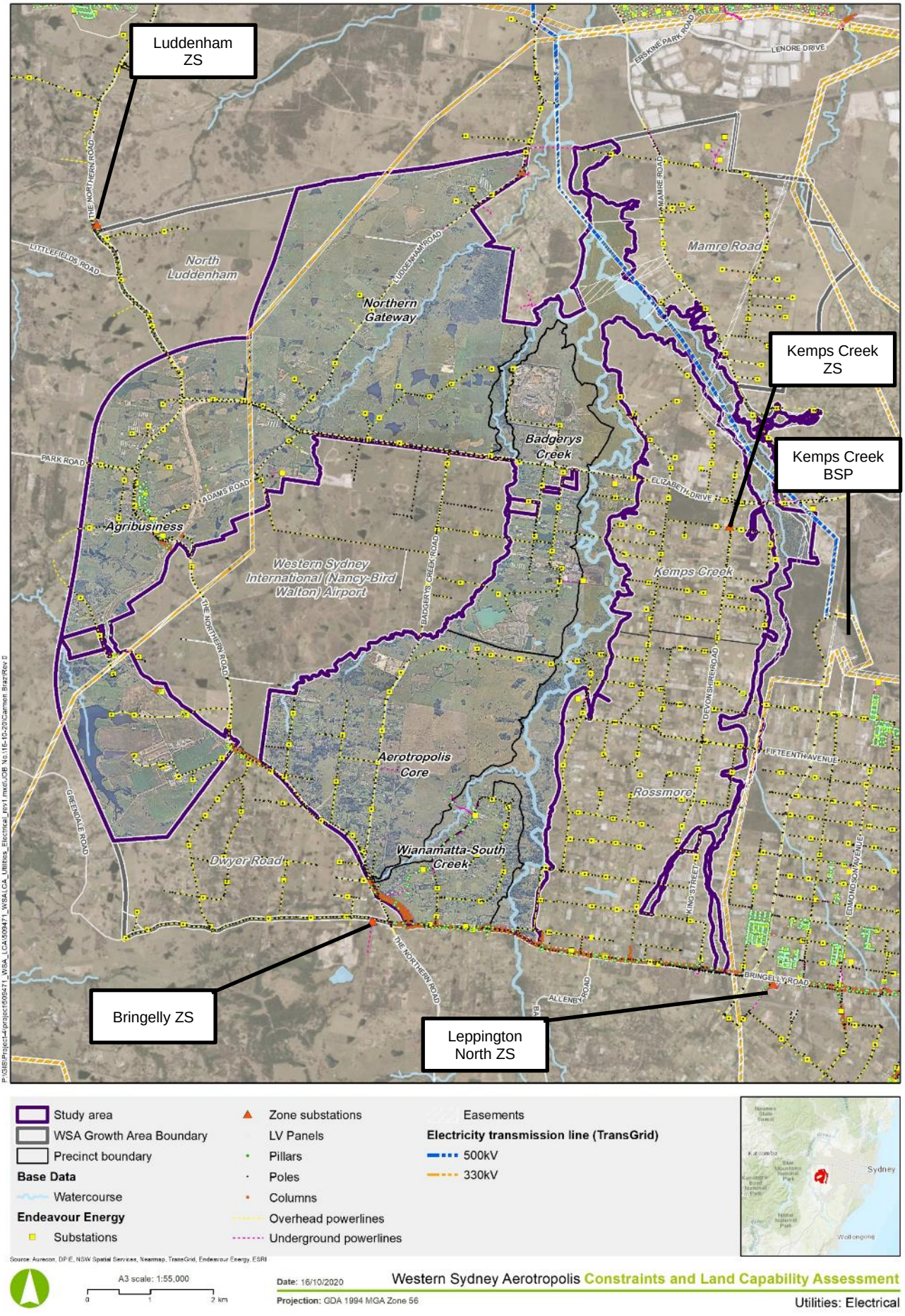


Figure 11: Endeavour Energy Infrastructure in the Aerotropolis and surrounding region

A ring of sub transmission network exists at the outer perimeter of the precincts mainly of two voltage levels i.e. 132kV and 33kV. An 132kV line (Line 93X) runs from Nepean Transmission Substation northward along Camden Valley Way providing a tee connection to the Bringelly zone substation. The 33kV network supplies the Bringelly, Luddenham and Kemps Creek zone substations and these in turn services the precincts with several 11kV distribution feeders through to the rural properties. Almost all the existing network is overhead powerlines and poles that would ultimately be upgraded to suit future growth and likely be undergrounded at the same time.

Existing Capacity

Endeavour Energy has no zone substations directly within the initial Aerotropolis precincts and power is supplied from the adjoining areas. Three bulk supply points exists namely the Sydney West, Liverpool and Regentville BSP in the periphery (bulk supply points are owned and operated by TransGrid). Sydney West and Liverpool BSP are the main supplying points connection the Bringelly and Kemps creek zone substation. No future expansions are planned to the BSPs with regards to the Aerotropolis as a separate new BSP is being planned near the Aerotropolis (see Planned/Committed Utilities below).

Table 2 below outlines the ZS situated within the region with their available capacities to support interim growth. The forecasted demand and exceedance of current capacity is determined by Endeavour energy which considers a combination of planned load transfers between zone substations, expected spot loads, demand growth due to nearby land developments and seasonal demand fluctuations. The growth forecasts are based on DPIE's forecasts as well as the aforementioned development considerations and as such the current Endeavour Energy forecasts may differ from DPIE's growth forecasts. Endeavour Energy are currently reviewing the growth forecasts in the region as greater details around the Aerotropolis become available and this is expected to influence the sizing and location of proposed infrastructure as shown in Figure 12. A key challenge for the Aerotropolis is forecasting the commercial and industrial electrical demand given that these developments have complex and variable utility demands. However, as an estimate 1 MVA equates to roughly 250-300 typical freestanding dwellings or approximately 300-350 employees (jobs) in industrial/ commercial land uses As can be seen below the existing Zone Substations have limited capacity to supply growth and would require augmentation to deliver any substantive growth in the Aerotropolis. Kemps Creek ZS has the greatest short-term supply potential, however utility capacity is not reserved for individual areas and customers are supplied as connection applications are made.

Table 2: Existing Zone Substations - Available Capacity (Endeavour Energy)

Zone Substation	Installed Firm Capacity (N-1 redundancy) (MVA)	Actual Load 2018 Summer (MVA)*	Available Capacity 2018 Summer (MVA)*	Actual Load 2019 Summer (MVA)*	Available Capacity 2019 Summer (MVA)*	Approximate Residual Capacity in Dwellings**	Approximate Residual Capacity in Jobs**	Forecasted Demand Exceeding Current Capacity
Bringelly ZS	**19**	**16.9**	**2.1**	**12.8**	**6.2**	**1,550**	**1,860**	**After 2024**
North Leppington ZS	45	0.0	45	0.0	45	11,250	13,500	After 2024
Kemps Creek ZS	**25**	**12.7**	**12.3**	**12.0**	**13**	**3,250**	**3,900**	**After 2024**
Mamre ZS	90	55.5	34.5	58.9	31.1	7,775	9,330	After 2024
Luddenham ZS	**15**	**8.3**	**6.7**	**7.8**	**7.2**	**1,800**	**2,160**	**Summer 2023**
North Warragamba ZS	15	11.8	3.2	14.0	1.0	250	300	After 2024
Hinchinbrook ZS	50	43.8	6.8	49.9	0.1	25	30	After 2024

*Supplemental Data from DAPR website

** Residual capacity translated into approximate equivalent dwellings using 1MVA = 250 dwellings or 300 industrial jobs. Figures shown do not consider land use mixes for the zone substation's service area and the available residual capacity to accommodate a combination of dwelling and employment growth.

Planned/Committed Utilities

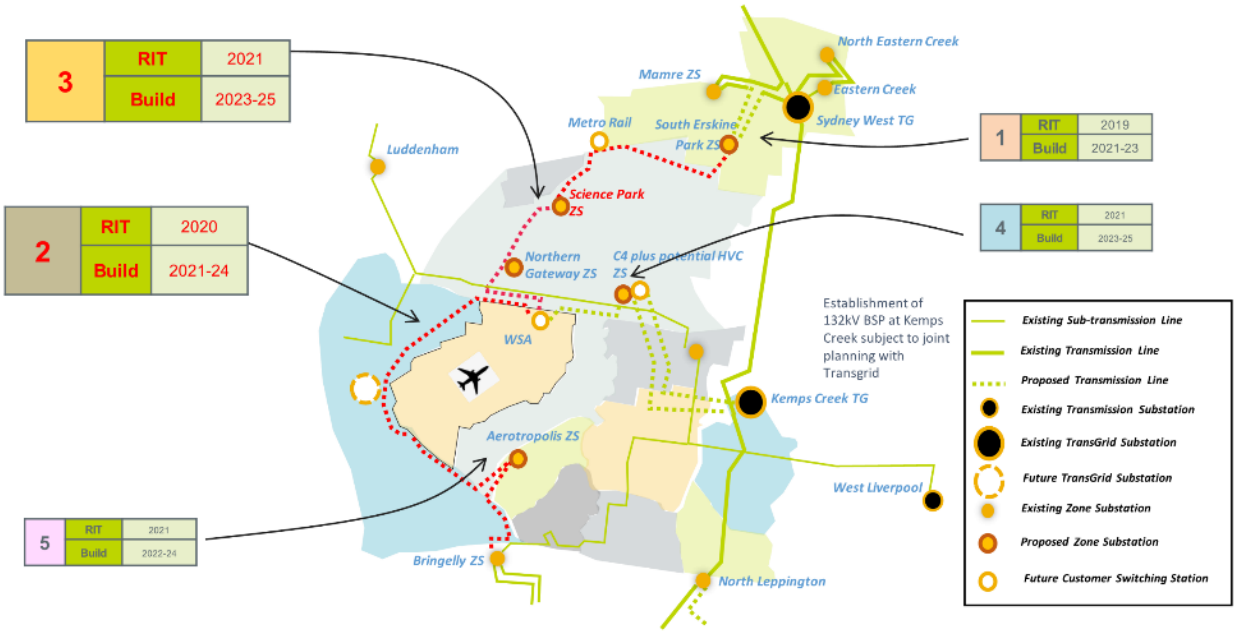
With expected increase in development in the region and correspondingly an increase in the population the load is forecasted to rise substantially in the coming decade. Endeavour Energy has several planned projects such as additional zone substations and bulk supply points to accommodate short to medium term growth. The projects are limited to known development areas such as the Airport, Sydney Metro (Western Sydney Airport), Science Park, Elizabeth Drive developments and Agribusiness Precinct. Endeavour Energy is responding to early growth in the Northern Gateway Precinct, which includes the Sydney Science Park.

In the longer-term Endeavour Energy plans to establish a transmission ring for the Aerotropolis which is much larger than the Airport itself. This involves construction of two 132kV supply feeders along a route that traverses the Aerotropolis and surrounding growth area (as shown in red in Figure 12). This will provide the required N-1 contingency and run between the Bringelly and proposed Sydney Science Park zone substation. The two interconnected supply points to the airport that would also become a 132kV backbone supplying (ultimately) up to 4 to 5 substations additional to the Airport as can be seen in Figure 12 below.

Based on the assessment of options and resulting NPV ranking it is deemed feasible for Endeavour Energy to either undertake the proposed works as a one-time investment activity or divide into two stages for a staged approach. The work items for the proposed plan are as per Table 3 which provides a timetable of the project and its expected date when the infrastructure development is required to meet demand. While there is an expectation for additional infrastructure to address demand, the project viability assessment for a majority of these projects are preliminary at this stage and yet to be completed. Greater Sydney Commission are preparing a separate study on the proposed utilities in the Aerotropolis which is understood to consider, assess and define the site location, size of the bulk infrastructure and overall infrastructure development's viability based on various commercial, procurement and other factors. The key Aerotropolis projects identified in Figure 12 include:

- Project 1: South Erskine park ZS (Mamre Rd Precinct) complete Oct 2022 (not related to initial release precincts)
- Projects 2: Aerotropolis Backbone 132kV feeder (highlighted red)
- Project 3: Science Park and/or Northern Gateway ZS
- Project 4: C4 (Badgerys Creek Precinct) ZS
- Project 5: Aerotropolis Core ZS (or interim upgrade of Bringelly ZS)

Establishment of a new bulk supply point in the Agribusiness Precinct in coordination with TransGrid. Joint Planning discussions are underway with TransGrid to determine the feasibility of a bulk supply point closer to the Airport. An alternative solution under consideration is turning the existing TransGrid 500/330 kV substation into a 132kV bulk supply point. The timing for this will be determined by future load growth on existing bulk supply points.



RIT – Regulatory Investment Test

Figure 12: Proposed Plans - Endeavour Energy

Table 3: Proposed Project Upgrades Summary

Project Developments	Firm Capacity	EE Decision Deadline for Project Viability	Forecasted Exceeded Capacity without Upgrade
Aerotropolis 132kV Supply (Feeder)	N/A	Nov 2021	Nov 2024
Aerotropolis Zone Substation	13 MVA	Nov 2021	Nov 2023
Science Park Zone Substation	6 MVA	Jul 2021	Nov 2023
Luddenham Zone Substation	15 MVA	Apr 2024	Nov 2026
C4 Zone Substation	TBA	2021	Nov 2025

The Airport and the surrounding development areas will require a high supply capacity. Currently, the geographic area is supplied by a predominantly rural overhead network and is not capable of supplying the expected demand of the proposed airport and surrounding development areas. Additional supply from the zone substations show in Table 3 are required to service the Airport itself. However, the load requirements are yet to be finalised and electrical supply is required by 2023/24.

The Sydney Science Park development within the Northern Gateway Precinct will contain a range of mixed uses located adjacent to the proposed Western Sydney Airport. The 11kV network supplying this area from Kemps Creek, Luddenham and Mamre Zone Substation is of a rural construction and does not have sufficient capacity to supply the forecast level of growth.

Future Network Needs

Though power distribution network exists in the region the capacities are significantly constrained and unable to support future forecasted loads. The expected additional load by 2036 is 160MVA. The heatmap as shown in Figure 13 released by Endeavour Energy while forecasting connection demand depicts this with much of the zone substations having either limited / no capacity to service or being physically too far from the supply point. Much of the Agribusiness and Aerotropolis Core precincts cannot be serviced while only a portion of Northern Gateway Precinct can be supplied power with residual capacities in the network.

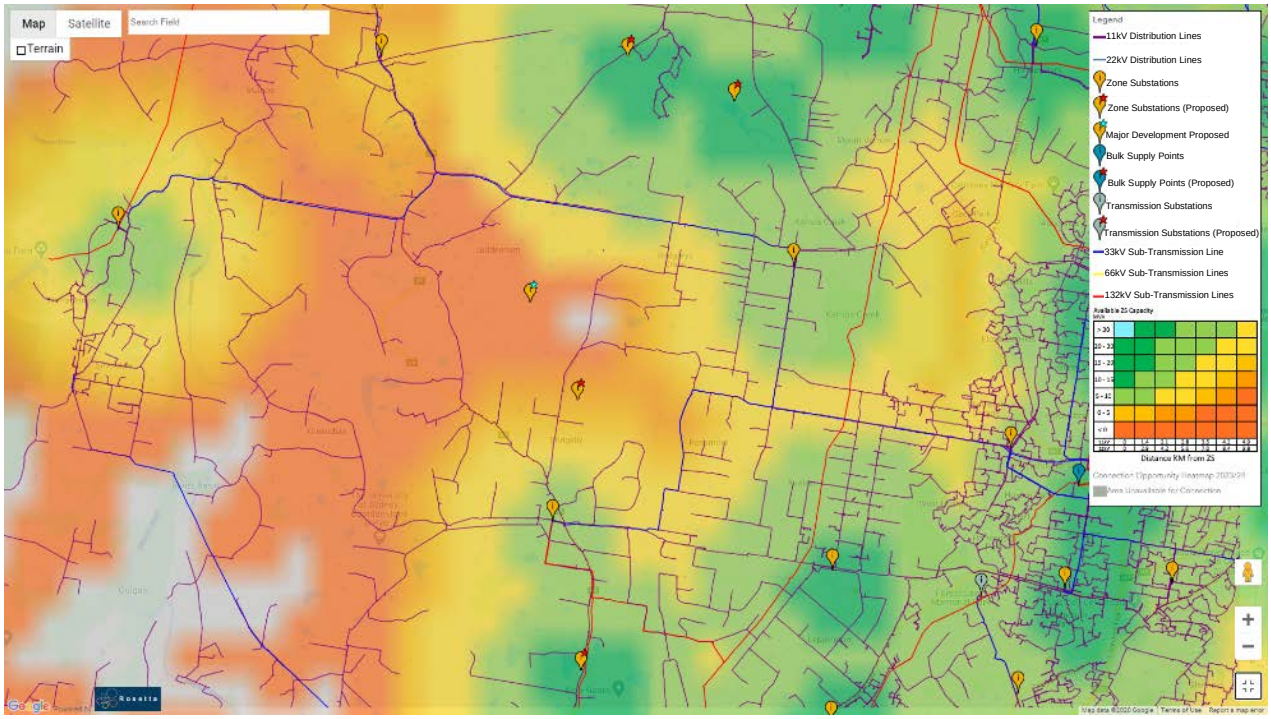


Figure 13: Electrical Capacity Heatmap 2023/24

Based on recent information, the most notable electrical load drivers in the region have been identified and include the following:

- Development within the Agribusiness Precinct which will involve intensive agriculture production (e.g. glasshouses) that will target export opportunities. The relocation of Sydney Markets has been announced as part of the establishment of this precinct.
- The commitment to establish a shared university campus and a new business park that will focus on advanced manufacturing and aerospace industries in the Aerotropolis Core Precinct.
- The announcement of the Sydney Metro – Western Sydney Airport connecting St Marys to the new Airport, which is planned to be in operation when the Airport opens for passenger services. This also enables higher densities near the proposed rail stations. The Metro is expected to be a large energy user and supply options are still in planning, but Stage 1 load requirements are expected to be at a subtransmission voltage (33/132kV).

With the Commonwealth Government committed to providing power connection to the Airport by 2024, plans for servicing the rest of the Aerotropolis are naturally interlinked. The distribution feeder can be further developed to provide more connections however, the sub transmission infrastructure in the area is deemed insufficient to cater for the planned development of the Aerotropolis with limitations in the 132kV and 33kV. Endeavour Energy plans to address that through its new investment plan to augment these networks and provide a connection point for Airport.

Endeavour Energy has further identified future projects and are mainly driven by new release of residential, commercial and industrial areas and are development driven. The stated projects are:

- Austral Permanent ZS
- Bringelly ZS Augmentation
- Kemps Creek BSP Works
- Rossmore ZS
- 132kV Kemps Creek Conversion

These plans occur beyond the 5-year planning period and there is uncertainty regarding the timing of the need. These network needs may become RIT-D projects if the criteria are met and when the need is more certain due to load applications or when asset condition and end-of-life actors become more evident.

3.4.2 TransGrid

Existing Utilities

TransGrid is a transmission network service provider and operates the high voltage lines in NSW and ACT. TransGrid's assets consist of high voltage overhead and underground transmission lines (132kV to 500kV) and transmission substations (TS) some of which serve as bulk supply points. They connect to the distribution network operator which is Endeavour Energy in the Aerotropolis.

Within the Aerotropolis, TransGrid's major assets in the area are as listed below and can be seen in Figure 14 below:

- Sydney West 330/132kV TS;
- Kemps Creek 500/300kV substation north of Austral Precinct;
- 330kV transmission line (Line 39) connecting from the Bannaby Transmission Substation to Sydney West that passes through the Agribusiness, Airport and Northern Gateway precincts. It has a 60m wide easement associated which needs to be considered in future land use planning. A small section of Line 39 currently crossed the Airport proposed first runway location and is now relocated as an underground line along the boundary of the Airport but wholly located on crown land; and
- Two 500kV transmission line (Line 5A1) from Eraring Power Station to Kemps Creek Transmission Substation with a generally north-south alignment and adjacent to the Mamre Road.

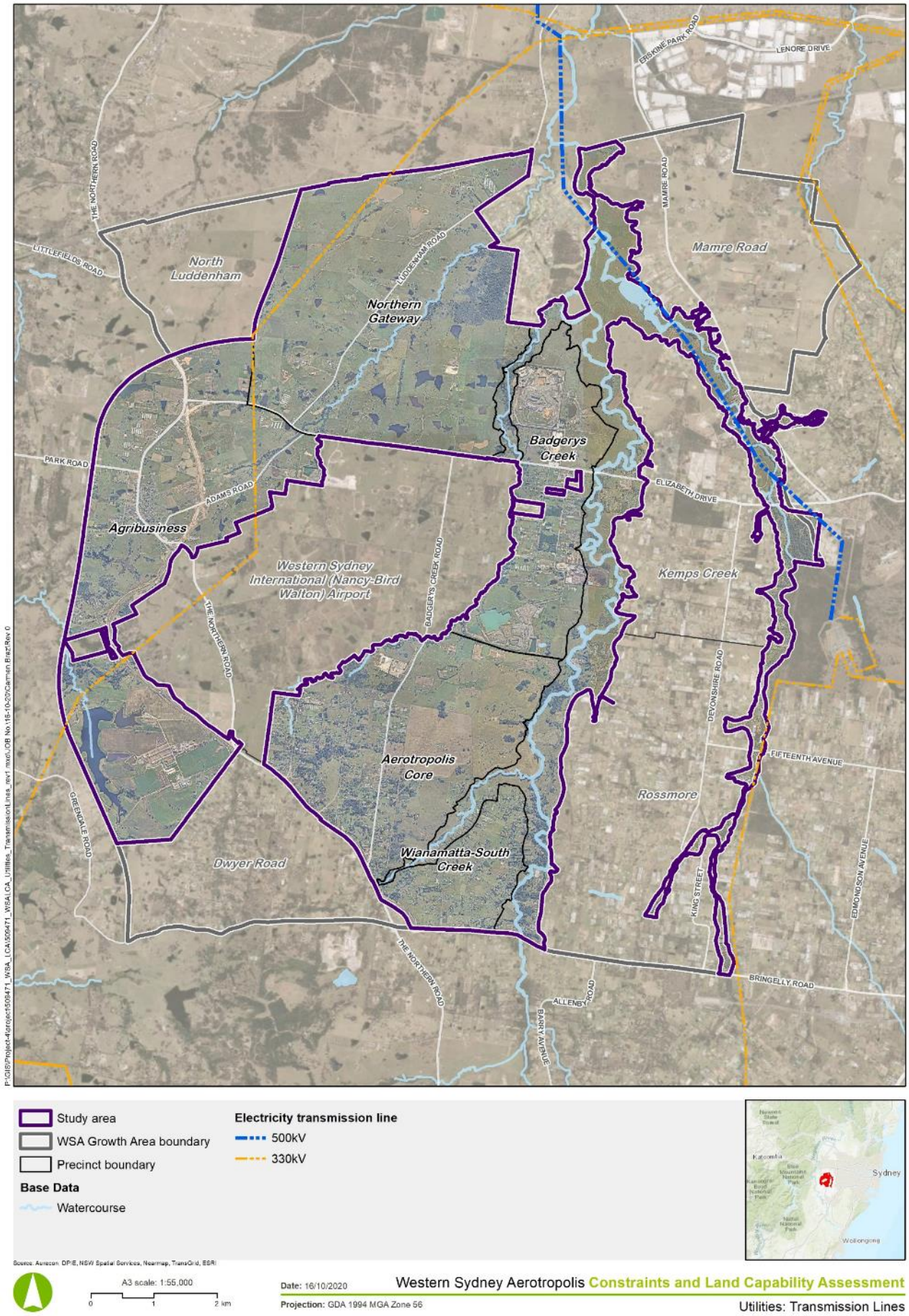


Figure 14: TransGrid Infrastructure in the Aerotropolis and surrounding region

Planned/Committed Utilities

TransGrid are planning to develop the following infrastructure upgrades:

- New bulk supply point in conjunction with Endeavour Energy to support additional load demand and additional 900MW growth expected in the Aerotropolis, including the new Airport and the initial Aerotropolis Core, Agribusiness, Northern Gateway and Badgerys Creek precincts. The initial location suggests it will be connected to Line 39 or as an upgrade to the existing Kemps Creek substation. However, the final location is yet to determined.
- New 132 kV switching station at TransGrid's Kemps Creek 500/330 kV substation. This switching station may be a temporary upgrade given that there is potential for the Kemps Creek substation to be upgraded to a bulk supply point at a later stage as noted above.
- Indicative concepts of a 500kV transmission line to be built to connect the Southern Tablelands with Western Sydney. The alignment is yet to be determined but is expected to traverse the western boundary of the Agribusiness Precinct. The land required and associated easements for this transmission line and a potential additional bulk supply point should be considered in planning for future land use.

Existing Residual Capacity

There are three existing transmission substations within the vicinity of the Aerotropolis and four major transmission lines. Bannanby to Sydney West has limited capacity remaining with medium congestion while the other three are due to remain lowly congested until 2021. The substation and transmission lines rating are as listed in Tables 4 and 5 below:

Table 4: TransGrid TS

Name	Rating
Kemps Creek TS	500/300kV
Sydney West TS	300/132kV
Liverpool TS	330/132kV

Table 5: TransGrid Transmission Lines

Line Name	Rating	Loading N-1 Utilisation	Available Capacity	Congestion - Existing
Line: 39 - Bannaby 330KV to Sydney West 330KV	330kV	81%	19%	Medium
Line: 37 – Kemps Creek to Macarthur	330kV	46%	54%	Low
Line: 5A1 - Eraring PS to Kemps Creek	500kV	54%	46%	Low
Line: 5A2 - Eraring PS to Kemps Creek	500kV	54%	46%	Low

Based on the above utilisation rates it is expected that TransGrid has some residual capacity the 330kV Sydney West to Bannaby transmission line (Line 39) to cater for load growth of 150-200MW. This is expected to support growth in the Aerotropolis by approximately late 2020's to 2030 but will be determined by growth in the Aerotropolis and the likely future demands including future data centre requirements.

3.5 Telecommunications

The vast majority of telecommunications networks in the area are owned and operated by Telstra with third parties such as Optus either attached to existing poles or in a Telstra-owned conduit. As such for the purpose of this assessment telecommunications searches have been limited to Telstra and the more recent NBN Co. DBYD information has confirmed that Optus cables are generally located within Telstra shared trenches and therefore this validates this assumption.

The vast majority of existing telecommunications networks are affixed to existing overhead poles. These will need to be converted to underground as development occurs or as NBN rolls out.

3.5.1 Telstra/Optus

Telstra and Optus were unable to provide GIS data for their existing infrastructure in the Aerotropolis. However, based on DBYD information the region is currently well serviced with telecommunications infrastructure with the majority of existing servicing being through overhead poles and wires. Telecommunications servicing is not seen as a constraint to development however, should be a consideration when designing future service allocations to ensure sufficient space is available for growth and the current and growing increase in demand for digital data intensive workplaces and industries. As development grows these rural style connections are expected to be replaced with undergrounded fibre services. New fibre networks will need to be rolled out in the future as development occurs. Backhaul charges may be required to bring the service to a site but is not seen as a constraint to development. In the future big data users are likely to utilise the precinct and bespoke telecommunications networks will be required to support these projects (such as data centres). New network exchanges are likely to be required for the precincts as development occurs. Telstra/Optus/NBN are established as cost recovery businesses and respond to development applications and are less likely to engage in speculative development without a supporting business case.

Defence-hardened communications will need to be considered for the precinct for not only future defence sites but also the Airport and data centre communications however, these will likely be bespoke connections and not aid in growth. Furthermore, fixed wired communications are becoming less prominent with the advent of 5G and growth networks should consider the advantages of wireless technology.

3.5.2 NBN Co

NBN is the wholesale provider of broadband access predominantly to retail service providers through two service categories, fixed line and fixed wireless. Therefore, the provision responsibility in the area would be upon NBN Co. There is limited existing telecommunication infrastructure within the Aerotropolis given only portions of the Agribusiness and Aerotropolis Core precincts are serviced. Fixed NBN line construction works have commenced within the Northern Gateway Precinct south-east of Luddenham Road. Figure 15 below shows the current roll out of NBN in and around the Aerotropolis. Future infrastructure rollout across the region is likely to be staged to match the pace of overall development in the region.

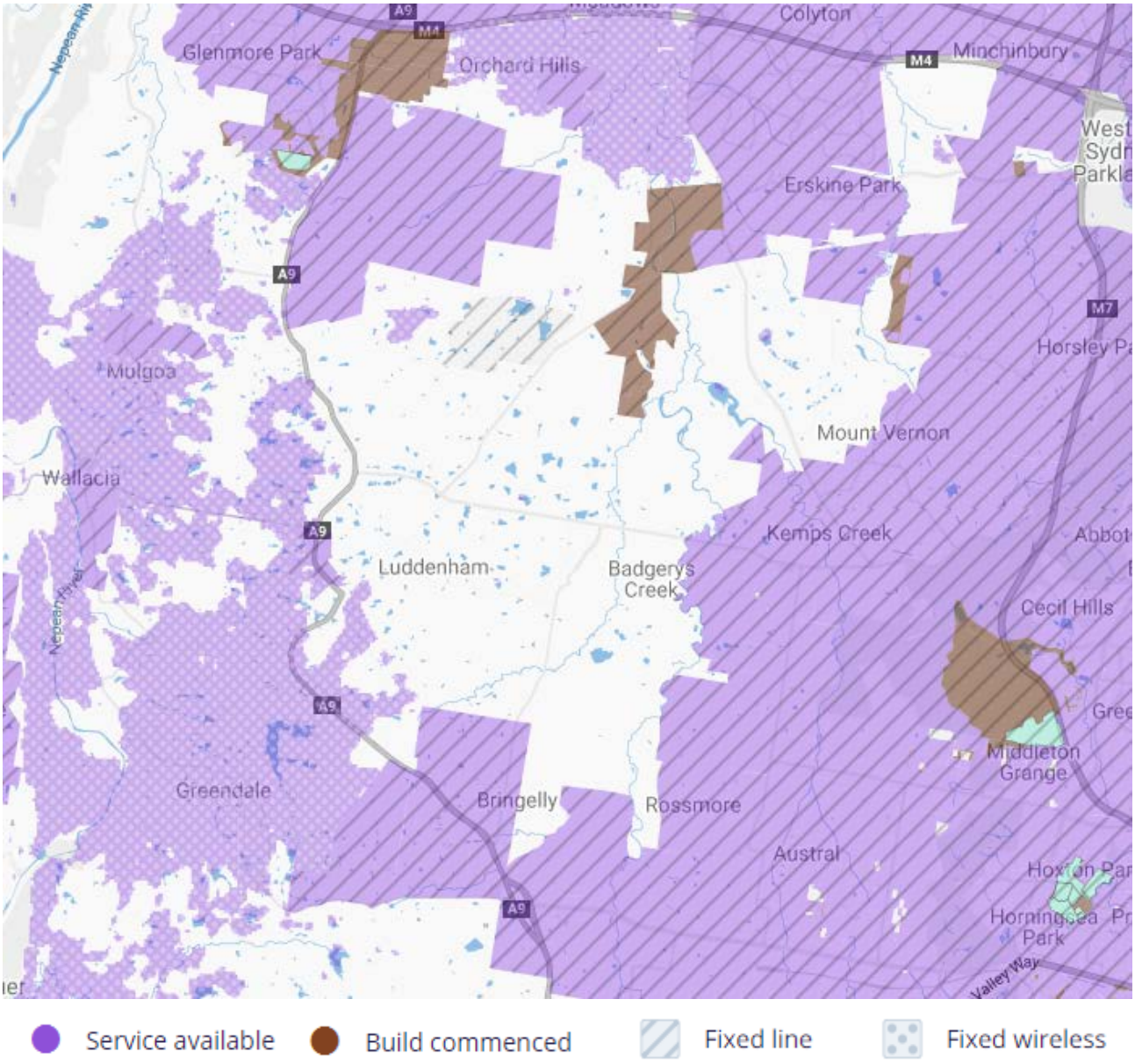


Figure 15: NBN Coverage in the Aerotropolis and surrounding region (Source: NBN)

3.5.3 Mobile Coverage

There is good mobile service in the Aerotropolis with near full 3G and 4G coverage being provided and no immediate capacity limitations (as such a figure of 3G and 4G coverage is not provided as there are no unserviced areas). Considering the Aerotropolis is still largely rural there is limited 5G roll out in the region which is largely due to the limited demand. Some 5G coverage exists north west of Cecil Park and south of Kemps Creek while planned works near Hinchinbrook, the Airport and the part of the Northern Gateway Precinct are underway. Figure 16 shows the current 5G coverage for Telstra in pink and planned works in purple. Future infrastructure rollout across the region is likely to be staged to match the pace of overall development in the Aerotropolis which includes the additional telecommunications towers. Similarly, whist this shows the Telstra 5G coverage other mobile providers are known to also be expanding this technology as well, allowing future residents access to multiple providers.

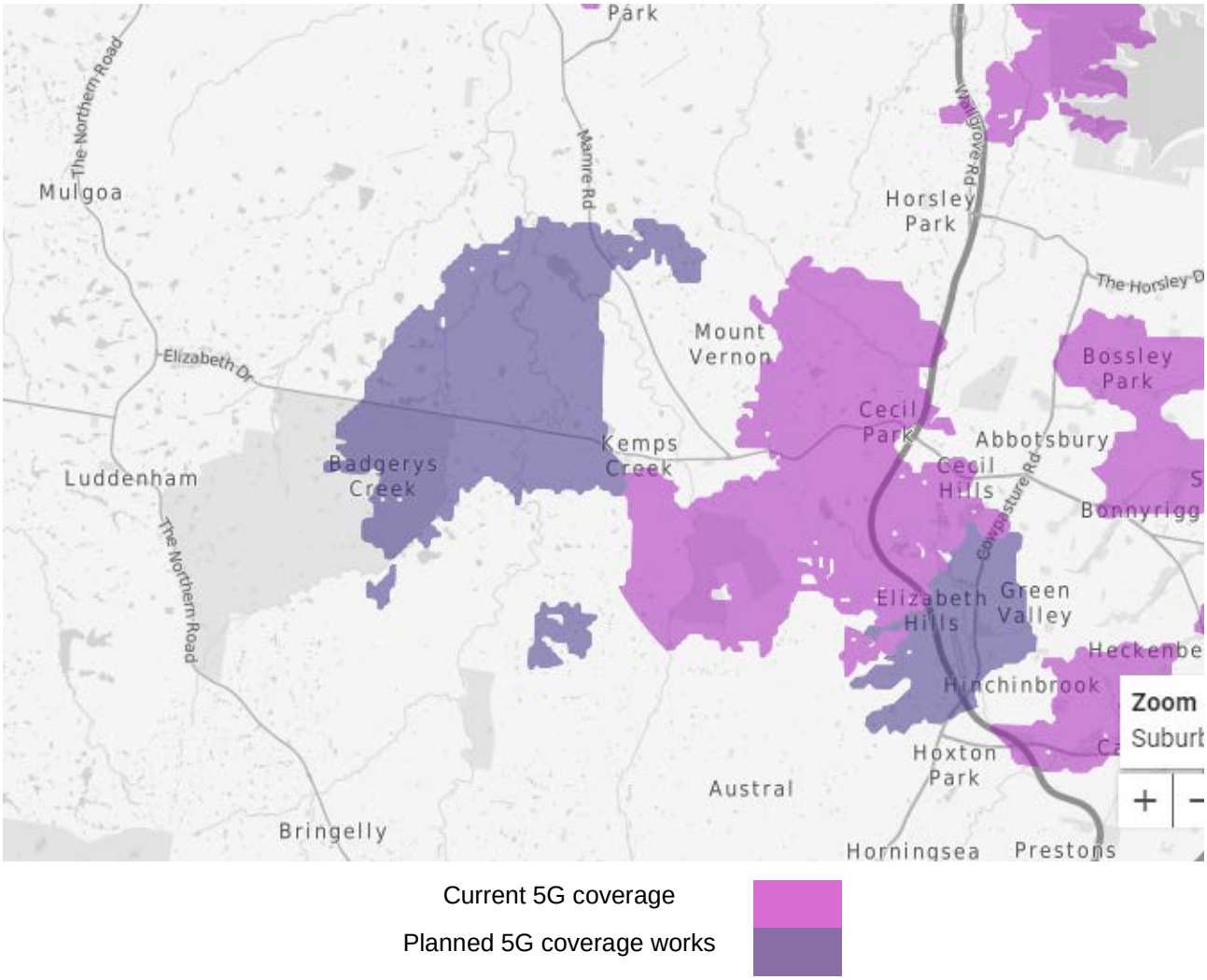


Figure 16: Current and Planned 5G Coverage in the Aerotropolis and surrounding region (Telstra)

Increased bandwidth demand onset by the construction of the Airport, commercial hub and technology park would have to be catered for by investments in NBN (or similar) and 5G infrastructure. While 4G coverage is complete in the Aerotropolis, capacity augmentation may also be required for networks to accommodate increased demand this would be through a combination of increasing mobile phone tower base station capacities and /or installing additional mobile phone towers as development occurs. Telstra are planning to decommission their 3G coverage in 2024 and customers would have to make a shift to newer 4G capable devices.

There are a host of telecommunication towers in and around the Aerotropolis. The tower ownership includes that of NBN, Telstra and Optus and can be used to provide / extend service in the Aerotropolis precincts. There are mainly rural poles mounted telecommunications providing connections in the region. The tower site locations ae displayed in Figure 17 below:

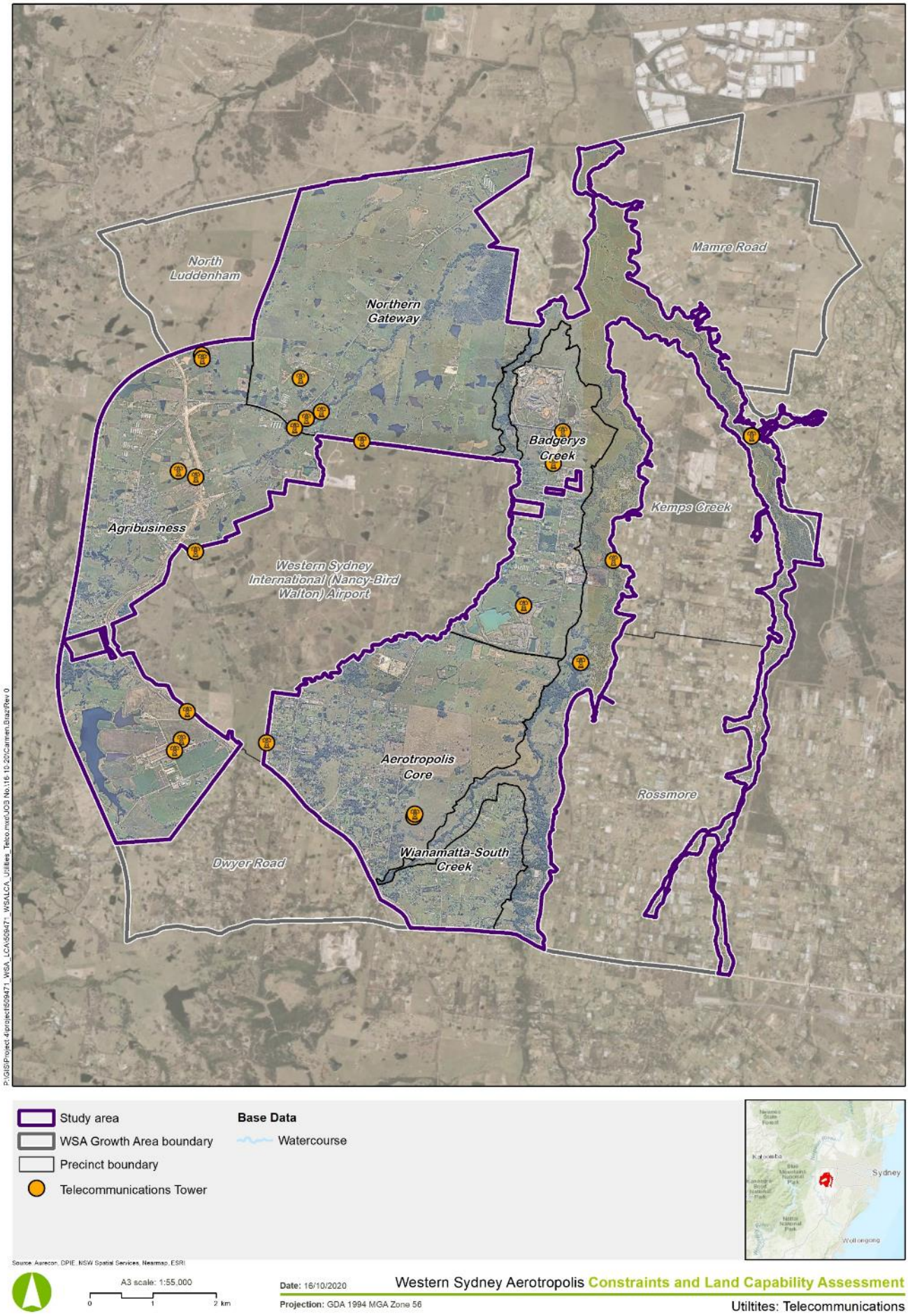


Figure 17: Telecommunication Tower Sites in the Aerotropolis and surrounding region

3.6 Stormwater

3.6.1 Existing Utilities

Existing stormwater infrastructure within the initial Aerotropolis precincts are located at the local sag points of the various rural roads and are used to provide a road crossing between the drainage swales on either side of the road. Underground stormwater pit and pipes networks are more commonly located where there are areas of increased development density such as the Luddenham Village within the Agribusiness Precinct. Water quality and quantity treatment measures were provided by Liverpool City Council and Penrith City Council, of which there are very limited items within the Aerotropolis and generally only service small individual developments. There are no existing regional water quality initiatives in the area such as water harvesting plans and wetlands however, these will be required as development occurs in the future. Figure 18 highlights the existing council owned stormwater infrastructure across the aerotropolis.

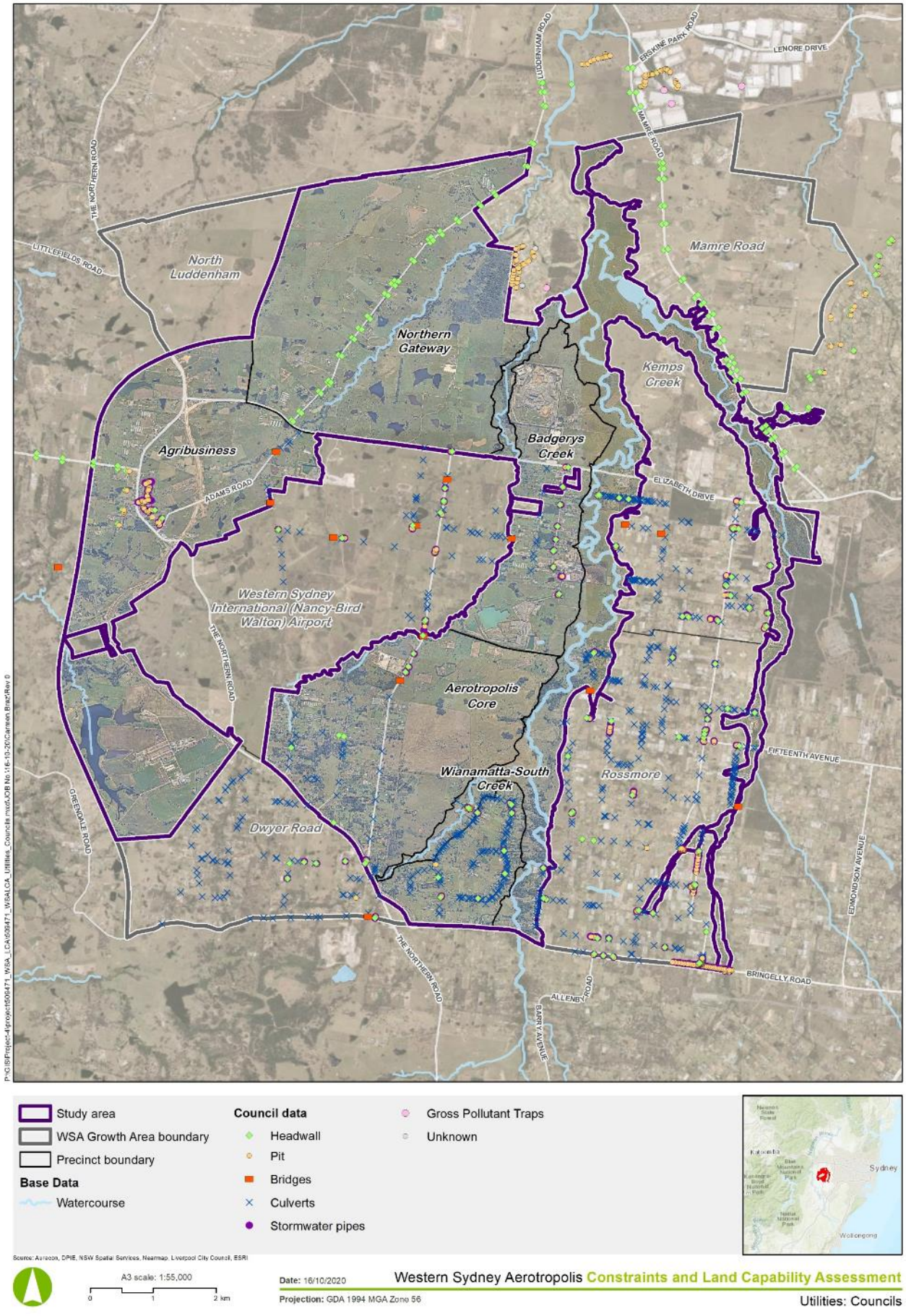


Figure 18: Existing Stormwater Infrastructure in the Aerotropolis and surrounding region

3.6.2 Planned/ Committed Utilities

It is understood that there are no major committed Liverpool City Council and Penrith City Council stormwater infrastructure projects proposed for the Aerotropolis Precincts. However, the expectation is that currently installed or planned infrastructure is not applicable or suitable to service the Aerotropolis and existing culverts will not provide flood immunity for storms greater than the 5 - 10 year ARI event. It is understood that Sydney Water are undertaking a separate study to assess the stormwater requirements in the Aerotropolis which will include a Water Sensitive Urban Design strategy that considers stormwater detention and water quality treatment.

3.6.3 Existing Capacity

The existing network is expected to be sized for the current rural catchments and limited capacity for significant future development and modification of catchments. This is not a constraint to future growth, as traditional development intensification from rural developments would naturally result in upgrades to the stormwater network as roads are upgraded. Significant stormwater pit and pipe upgrades and development of additional water quality and quantity treatment measures are required to accommodate future development. The future stormwater network will require a combination of detention basins and channel upgrades to support the future growth. This is a traditional servicing strategy adopted in the rezoned precincts of the SWGC however innovative integrated water strategies such as recycling, reuse and harvesting systems could be explored in the proposed servicing strategy ebbing prepared by Sydney Water.

4 Precincts Specific Existing Service Assessment

The following precinct specific summaries are provided in addition to the regional commentary above. Please refer Appendix A for summary figures.

4.1 Aerotropolis Core and Badgerys Creek Precincts

The Aerotropolis Core Precinct is designed to be a new metropolitan centre, leveraging off from its close proximity to the airside it would act as an airport city with prime focus towards commercial activities. The Precinct is identified for early activation to transition to higher order commercial development. Infrastructure servicing and phasing are required to optimise investment and delivery.

Utilities infrastructure within the Aerotropolis is limited due to its rural land use, lack of user demand and distance from existing networks. Refer to Appendix A for plans of the existing utility infrastructure within the Aerotropolis Core and Badgerys Creek precincts.

Utility	Key Findings	Future Plans
Electrical	The Aerotropolis Core Precinct is being serviced electrical power from the south with connection from the Bringelly zone substation (ZS). The ZS has a residual capacity of 6.2MVA (circa 1,500 dwellings) and is insufficient to support the project significant development and growth in the precinct. Badgerys Creek has limited 11kV distribution network and is supplied power by the Kemps Creek ZS to the west. The residual capacity on the ZS is estimated to be 13MVA (circa 3,250 dwellings). Part of 33kV sub transmission line along Elizabeth Drive passes through the precinct. The existing electrical network is limited to a rural style pole mounted overhead supply which would be replaced and development occurs.	Endeavour Energy has proposed to build a new zone substation within the Aerotropolis Core to cater for the initial demand and is to undergo a Regulatory Investment Test. Longer-term supply can be sourced from the new bulk supply point being constructed in the Agribusiness precinct near the Airport. Within the Badgerys Creek precinct, Endeavour Energy are looking to locate the proposed zone substation north of Elizabeth Drive.
Water	There is minimal reticulation within the Aerotropolis with only a few existing 100-200mm water mains. The pipes are mainly for rural use and hence are unlikely to support further augmentations. A 300mm pipe exists along Elizabeth Drive in the Badgerys Creek Precinct and future upgrades are required for the trunk mains. The reticulation in the Aerotropolis combined are supplied from two reservoirs, the south east regions from the Leppington reservoir while the northern areas from the Cecil Park reservoir. No other reservoirs exist within the Aerotropolis. Sydney Water have indicated that these reservoirs also have limited capacity to support initial development and new trunk mains and reservoir upgrades are proposed.	Future demand for water is to be supplied from the Oran Park 600mm mains extension from Northern Road to the Aerotropolis Core. The extension project is expected to be delivered by Sydney Water in late 2020. Sydney Water are also planning and building a series of trunk mains and will explore a new reservoir in the precinct to support. The supply capacity of the new main to the Aerotropolis Core is unknown at this stage. Recycled Water is expected to be an option for the precinct as Sydney Water are creating the new AWRC at Upper South Creek.

Utility	Key Findings	Future Plans
Sewer	No existing servicing of wastewater in the Aerotropolis with the nearest wastewater reticulation near Austral and Leppington but is unlikely to service Aerotropolis Core and Badgerys Creek as they are approaching capacity and pumping to these locations may be cost prohibitive.	The Aerotropolis and surrounding region will ultimately to be serviced by the new advanced water recycling centre to be constructed in Upper South Creek. The expected delivery of the facility is in 2025 and temporary solutions are being explored by Sydney Water. Additional mains and a pumping station along South Creek are proposed to service the Aerotropolis Core and Badgerys Creek. It is understood that Sydney Water are designing these mains to accommodate the ultimate development removing the need for future upgrades, but these mains are still in planning.
Gas	The Aerotropolis Core Precinct has minimal gas reticulation with existing secondary mains in the north passing through the Badgerys Creek Precinct. This pipeline is supplied from the Horsley Park facility and has an existing secondary regulator set on the pipes to provide medium pressure for industrial loads in the Aerotropolis Core Precinct. At the southern tip of the precinct another secondary main exists near Bringelly and is connected to the West Hoxton primary regulation station. Fortunately for these precincts having the secondary main will allow some organic growth in the short term however, longer term network extensions are required to support any substantial growth. There is room within the network for augmentation to support organic growth, but the distribution mains network needs to be adequately laid out in the Aerotropolis.	Jemena's recommended plan to connect gas supply for the airport includes mains extension (250mm ST) via extension along Elizabeth Drive. A separate main from the south near Bringelly Road and interconnection on Badgerys Creek Drive has been proposed to service the Aerotropolis Core Precinct. This would serve as a possible future gas supply point for the precinct and to ensure sufficient capacity of reliability of supply. From the secondary mains within the Badgerys Creek Precinct a 250mm ST line would be extended from Elizabeth Drive along the northern boundary of the airport and onwards towards the Sydney Science Park. On the north-east tip of the Badgerys Creek Precinct, Jemena will supply the Sydney Water's AWRC with gas to meet its plant operational demand by 2024 and a 2.5km 150mm ST line is planned to be extended from near Kemps Creek.
Telecommunications	A host of telecommunication towers exist around the Aerotropolis with tower ownership by NBN Co., Telstra and Optus (Figure 17). There are three telecommunications towers within the precinct and would need to be modified and replaced as development occurs. The mobile network is currently providing partial fixed wireless NBN services to rural landholdings within a Portion of the Aerotropolis Core. 3G and 4G mobile coverage is present throughout the Aerotropolis with partial existing 5G mobile coverage. In addition to the mobile network there is extensive above ground (pole mounted) wired telecommunications connections network. This is an existing rural type connection and will likely be upgraded as development occurs and changed to fibre.	Rollout plans for the various service providers are staged to match the location and pace of development in the Aerotropolis. No significant individual infrastructure items are proposed as of yet.

4.2 Northern Gateway Precinct

The Northern Gateway Precinct will be a major Airport interface, serving as a key strategic centre linking the Airport with the Western Parkland City Metropolitan Cluster. It would harness existing and emerging economic opportunities catalysed by the Airport while building on the approved Sydney Science Park development to provide a variety of employment generating uses.

These ventures would trigger sizeable growth in the region and result in an increase in demand for utilities. Currently there is a negligible utilities network to support the forecast growth and hence to realise full potential, it is important to invest in essential services infrastructure. Refer to Appendix A for plans of the existing utility infrastructure within the Northern Gateway Precinct.

Utility	Key Findings	Future Plans
Electrical	Northern Gateway Precinct has sparse 11kV distribution network and is serviced primarily by the Luddenham ZS in the north west. The remaining capacity on the ZS is estimated to be 7.2MVA (circa 1,800 Dwellings). Although some capacity remains it is not dedicated to the Northern Gateway Precinct and may supply power to neighbouring precincts on a 'first come first served' basis. On the southern boundary a 33kV sub-transmission line exists (owned by Endeavour Energy) while a portion of TransGrid's 330kV Bannaby to Sydney West transmission line traverses through the region connecting to the bulk supply point at Eastern Creek. 200MW capacity has been confirmed along the transmission line to cater for load growth and is to bulk supply the area beyond 2030. The 330kV transmission line does not follow any road alignment and traverses private property. It is expected that this transmission line will remain in place and future land use planning will need to consider the impact of this alignment on development. A 60m wide easement is associated with this line. The existing electrical network is limited to a rural style pole mounted overhead supply which would be replaced as development occurs.	Endeavour Energy is responding to early growth in the Northern Gateway Precinct and Science Park by developing a new 132kV feeder and potentially two zone substations. The feeder is expected to extend from the new 132kV loop network as shown in figure 12. This includes a 6MVA Science Park ZS while the other ZS is to be constructed north of Elizabeth Drive. Coupled together the ZSs should provide adequate capacity and reliability for the region.
Water	Other than a single main along the Elizabeth Drive there is no potable water network within the Northern Gateway Precinct. With no reservoir within the area, the 300mm mains are supplied from Cecil Park. The mains are for rural use and hence are unlikely to support further augmentation/growth. Along the northern boundary of the Northern Gateway Precinct, WaterNSW's Warragamba Pipelines traverse, connecting and supplying water from Warragamba Dam to Prospect Water Filtration Plant (WFP) and Prospect Reservoir. These pipelines transfer raw water to Sydney Water. They need to be protected in the future and no development can occur over them. There are no immediate plans to upgrade these pipelines and they may not be used as a supply point for the precinct.	Sydney Water are aware of the current network limitations and plans for a staged delivery of trunk water assets from 2021 including a new 450mm main along Luddenham road to the Science Park but will also provide some spare capacity to the Northern Gateway.

Utility	Key Findings	Future Plans
Sewer	No existing servicing of wastewater in the Aerotropolis. The nearest wastewater reticulation is near Minchinbury towards the north east and could potentially be extended into the area where feasible. All existing properties discharge sewer through on lot disposal systems.	The region is ultimately to be serviced by the new advanced water recycling centre to be constructed in Upper South Creek. The expected delivery of the facility is in 2025 and temporary intimin solutions are being explored by Sydney Water to supply growth in the short term before the AWRC comes online.
Gas	The Northern Gateway Precinct has no gas network assets. The nearest existing secondary mains are located south east along Elizabeth Drive has sufficient capacity but would need to be extended to the site to support growth in the new development areas.	Jemena's recommended plan is to construct 5km 150mm secondary pipeline from the proposed Airport line to Sydney Science Park. While extensions along Elizabeth Drive and Luddenham Road supplemented with Secondary Regulating Sets (SRS) and construction of medium pressure network would supply other parts of the Precinct.
Telecommunications	A host of telecommunication towers exist around the Aerotropolis with tower ownership by NBN Co., Telstra and Optus (Figure 17). There are five telecommunications towers within the precinct and would need to be modified and replaced as development occurs. The mobile network is currently providing partial fixed wireless NBN services to rural landholdings within a Portion of the Aerotropolis Core. 3G and 4G mobile coverage is present throughout the Aerotropolis with partial existing 5G mobile coverage. In addition to the mobile network there is extensive above ground (pole mounted) wired telecommunications connections network. This is an existing rural type connection and will likely be upgraded as development occurs and changed to fibre.	Rollout plans for the various service providers are staged to match the location and pace of development in the Aerotropolis. No significant individual infrastructure items are proposed as of yet.

4.3 Agribusiness Precinct

The Agribusiness Precinct will skirt the western edge of the Airport and will support the long-term growth of agriculture and agribusiness in the Aerotropolis. The Precinct will build on existing agricultural operations and natural landscape acting as a catalyst for agricultural export from the region. The Airport will service connections for an increasing demand of agricultural products domestically and internationally.

The area is predominantly greenfield and withdrawn from trunk infrastructure. The precinct has little residual capacity to supply development in the short term without significant investment by agencies or third-party operators. Refer to Appendix A for plan of the existing utility infrastructure within the Agribusiness Precinct.

Utility	Key Findings	Future Plans
Electrical	The Agribusiness Precinct is serviced by the Luddenham ZS and Bringelly ZS's, located to the north-west and south-east, with 7.2MVA (Circa 1,800 dwellings) and 6.2MVA (Circa 1,500 dwellings) residual capacity respectively. Residual capacity is not dedicated to the precinct and can be utilised by other localities within the Zone Substation catchment. The Bringelly ZS is also due for augmentation beyond the current 5-year planning period. There are only a few Endeavour Energy 11kV distribution feeders in the region. Portion of Endeavour Energy's 33kV sub transmission lines traverses along Elizabeth Drive and Park Road. Additionally, TransGrid's 330kV Bannaby to West Sydney transmission line passes within the Agribusiness Precinct before diverting towards the Northern Gateway Precinct. The 330kV transmission line does not follow any road alignment and traverses private property. It is expected that this transmission line will remain in place and future land use planning will need to consider the impact of this alignment on development. A 60m wide easement is associated with this line. The existing electrical network is limited to a rural style pole mounted overhead supply which would be replaced as development occurs.	TransGrid and Endeavour Energy in joint planning are proposing to build a bulk supply point (BSP) in the Agriculture / Agribusiness zone (subject to detailed planning). The BSP is to be located close to the Airport and may serve as the feeding point for both the Airport as well as the Agribusiness Precinct. Furthermore, development of a transmission ring around the airport is proposed by Endeavour Energy and is designed to provide reliable supply for the Airport. The ring composes of two 132kV feeders that would be navigate within the Agribusiness Precinct.
Water	There is minimal reticulation within the Agribusiness Precinct with only a few existing 200-500mm & 100-200mm pipes. There are no reservoirs within the Agribusiness precinct and therefore the water mains connect from the Warragamba reservoir in the west. The Warragamba reservoir can act as an alternate water source however, existing capacity is limited. Much work has to be done to develop the reticulation network within the Precinct however, given the distance to existing servicing and the isolated nature of the Precinct, this does present some opportunities for decentralised 'off the grid' systems and alternative servicing strategies to be implemented and reduce capex costs. This would also support the vision and aspirations for the precinct.	Sydney Water plans to undertake Oran Park extension, a 600mm main to be extended from The Northern Road to the Aerotropolis Core Precinct. The water mains could also service the Agribusiness Precinct.
Sewer	There are no Sydney Water wastewater services. All existing properties have rural onsite disposal systems. Similarly, to potable water given the distance to existing servicing and the isolated nature of the Precinct, this does present some opportunities for decentralised 'off the grid' systems and alternative servicing strategies to be implemented and reduce capex costs. This would also support the vision and aspirations for the precinct.	The region is ultimately to be serviced by the new advanced water recycling centre to be constructed in Upper South Creek. The expected delivery of the facility is in 2025 and temporary solutions are being explored. A new gravity main is also to be installed along Cosgroves Creek and will be sized to suit the ultimate development and connect to the AWRC.

Utility	Key Findings	Future Plans
Gas	There is no gas reticulation within the Agribusiness Precinct. Large lands are set to be retained for agricultural purposes and it is anticipated demand for gas to remain low for the area. Jemena are undertaking plans to provide gas for the Aerotropolis and the Airport in 2022 and 2024 respectively. Extension of from these mains may also provide service for the Agribusiness Precinct. A reticulation network needs to be developed for the area.	Plans for the Agribusiness Precinct are still at a high-level concept phase with uncertainties about the land use and demand. It is beyond the 5 years planning scope of Jemena but is also not an essential service for development.
Telecommunications	A host of telecommunication towers exist around the Aerotropolis with tower ownership by NBN Co., Telstra and Optus (Figure 17). There are five telecommunications towers within the precinct and would need to be modified and replaced as development occurs. The mobile network is currently providing partial fixed wireless NBN services to rural landholdings within a Portion of the Aerotropolis Core. 3G and 4G mobile coverage is present throughout the Aerotropolis with partial existing 5G mobile coverage. In addition to the mobile network there is extensive above ground (pole mounted) wired telecommunications connections network. This is an existing rural type connection and will likely be upgraded as development occurs and changed to fibre.	Rollout plans for the various service providers are staged to match the location and pace of development in the Aerotropolis. No significant individual infrastructure items are proposed as of yet.

5 Delivery Challenges and Opportunities

The following section outlines some of the historical challenges to service delivery within the Aerotropolis and greenfield development in general. There are a number of constraints to the rollout of infrastructure that transcend simply available capacity. This section of the report is provided to identify historical constraints and opportunities for the rollout of trunk infrastructure and the ability for the precinct to be serviced efficiently. Aurecon understands that a strong servicing strategy needs to outline a staged development pathway to promote the efficient rollout of utility services.

5.1 Fragmented Land and Capacity to Pay

Development rollout in new growth and greenfield areas is dependent on a number of factors such as supply and demand, to the ability for a prospective developer to generate revenue or uplift. The latter is a further dependant on a rage of projects costs such as design, civil works, environmental constraints, approvals and available servicing capacity. In the instance that there is not sufficient utility supply in the existing network, a developer would be required to augment the network to bring additional supply to the site. This is often referred to as ‘utility headworks’ or ‘lead-in’ infrastructure. The Aerotropolis is largely a greenfield development where there is little existing infrastructure to support growth. Often the headworks required to service a development can be onerous if the prospective development is not at a sufficient scale to be able to fund these works and can result in development sitting dormant until such time as utility authorities are able to fund headworks themselves as part of their capital works program. Future servicing strategies for the Aerotropolis should consider the availability of supply and the challenges faced through small fragmented land holdings. The future servicing strategies should consider these challenges when designing networks and consider opportunities to fast track lead-in infrastructure where appropriate. Furthermore, locating high demand developments closer to existing established networks also reduces the distance that large utility network upgrades must traverse.

5.2 Multiple Growth Fronts

The Aerotropolis is comprised of a large number of different landowners, with varying appetites and timelines for development. This can often lead to competing interests across a precinct for utility services with agencies receiving multiple applications that are all geospatially separate with multiple development fronts. This can lead to ‘patchy’ or out of sequence developments and creates an additional burden on utility authorities. One such solution that has been adopted to help support and focus development fronts in the staged release of precincts. This has been undertaken in Leppington, Riverstone East and Vineyard Precincts. These precincts identified “early activation areas” that considered a number of development constraints including the availability of services to achieve ‘quick wins’ and limit the challenges identified in section 5.1. A sequenced rollout of sub-precincts could also be considered in the overall infrastructure and implementation plans where appropriate.

Appendix A
Aerotropolis Region Existing Utility Plans

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