

Sewer

The ultimate trunk strategy to service the 4,000 lots involves primarily pumping stations and rising mains to the Riverstone WWTP. It is the most downstream catchment of the western precincts and closest to the WWTP. As described previously, some of these networks serve a greater purpose in servicing upstream catchments including Marsden Park and Marsden Park Industrial. Each precinct is generally located within separate catchment and is proposed to have its own independent network.

Water

Water servicing to accommodate the 4,000 lots will be delivered via extension of the Richmond Road trunk main and extension of existing networks in Riverstone and West Schofields depending on the sub-precinct to be serviced.

Electrical

Servicing of the 4,000 potential lots has been accounted for under the new Marsden Park zone substation, with Stage 1 delivered in early 2015 and Stage 2 anticipated to be needed by 2021.

Table 2.7: Marsden Park - Remaining Infrastructure to be Delivered

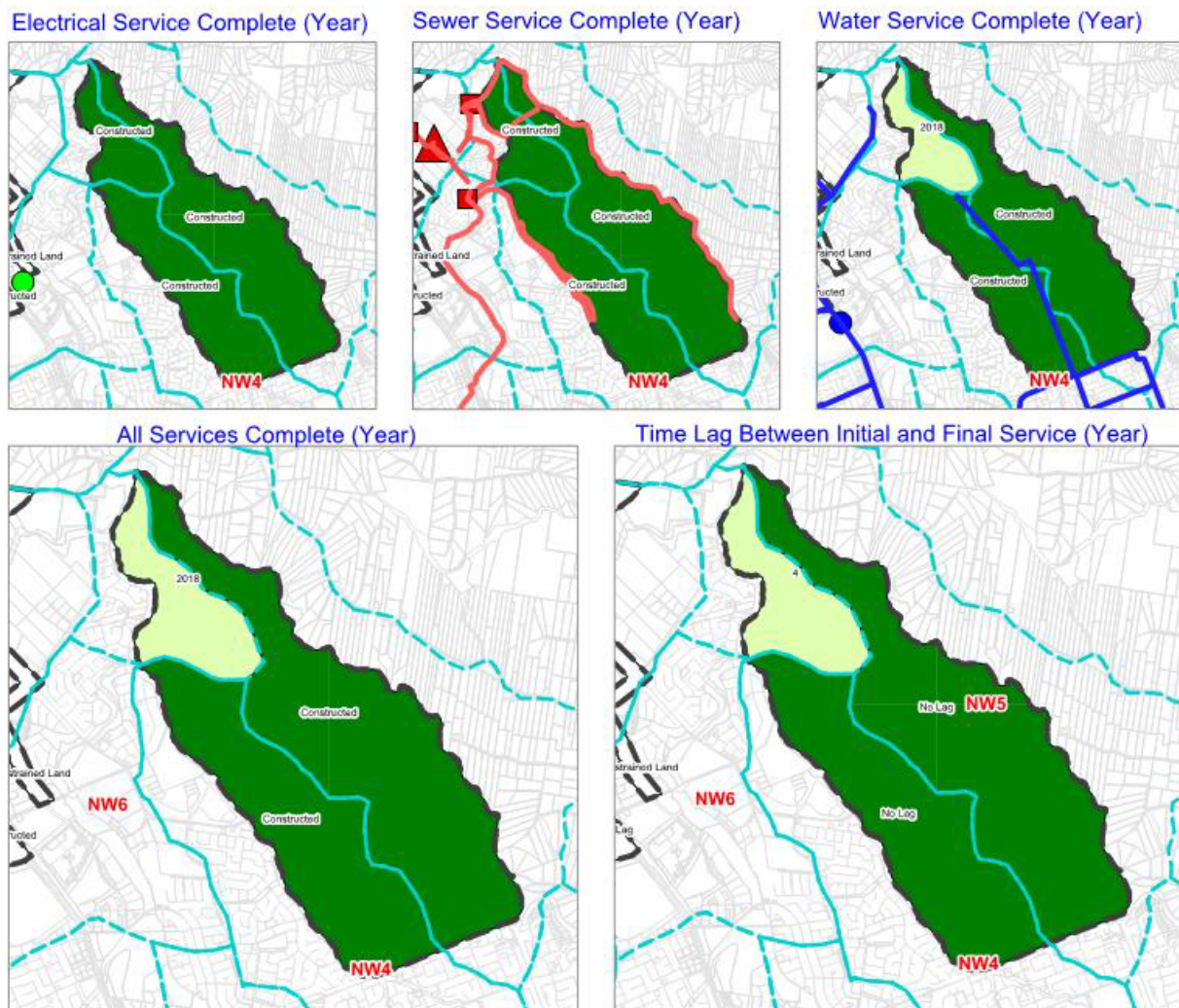
Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
Marsden Park North	Developer to provide infrastructure at pace with projected dwelling delivery	-	-

2.1.8 North Kellyville

Located at the east and isolated from the greater NWPLRA, North Kellyville was rezoned for development in December 2008. It has an anticipated dwelling yield of 5,185.

A large amount of interest has been shown in the precinct with 347 new dwellings constructed to date. Existing lot fragmentation means that the roughly 1,850 dwellings which are at various stages of development (i.e. application lodged, approved or under construction), are generally from small subdivisions.

Figure 2.10: North Kellyville Servicing Maps



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Consisting of two primary catchments, package 1 was completed as of 2011 and package 2&3A was completed in early 2015 have delivered full trunk serviceability to the precinct via the Smalls Creek and Cattai Creek carrier mains on the western and eastern boundaries of the site respectively. There are two existing pumping stations (Infrastructure item nos. 15 and 16) which currently pump portions of Riverstone over the crest from the second Ponds Creek catchment to the Eastern Creek catchment. In due course, it is expected that these pumping stations will become redundant and the pockets of land they service will be connected to the Second Ponds Creek carrier main via new mains.

Sydney Water has identified that they only have overall capacity for 4,500 dwellings within the precincts. This would indicate that an upgrade to accommodate the additional 685 dwellings to meet the total yield will be required at some point. It has been assumed this will occur when the current infrastructure reaches capacity under a low growth scenario.

Water

Package 1 delivered a new trunk main along Hezlett Road to Withers Road as of 2011. While capacity to service the entire precinct is there, Sydney Water may deliver Package 3 which will consist of lead-ins as required.

Sydney Water has identified that they only have overall capacity for 4,500 dwellings within the precincts. This would indicate that an upgrade to accommodate the additional 685 dwellings to meet the total yield will be required at some point. It has been assumed this will occur when the current infrastructure reaches capacity under a low growth scenario.

Electrical

The new Mungerie Park zone substation located on Commercial Road at Rouse Hill, provides the ultimate supply to the precinct.

Table 2.8: North Kellyville - Remaining Infrastructure to be Delivered

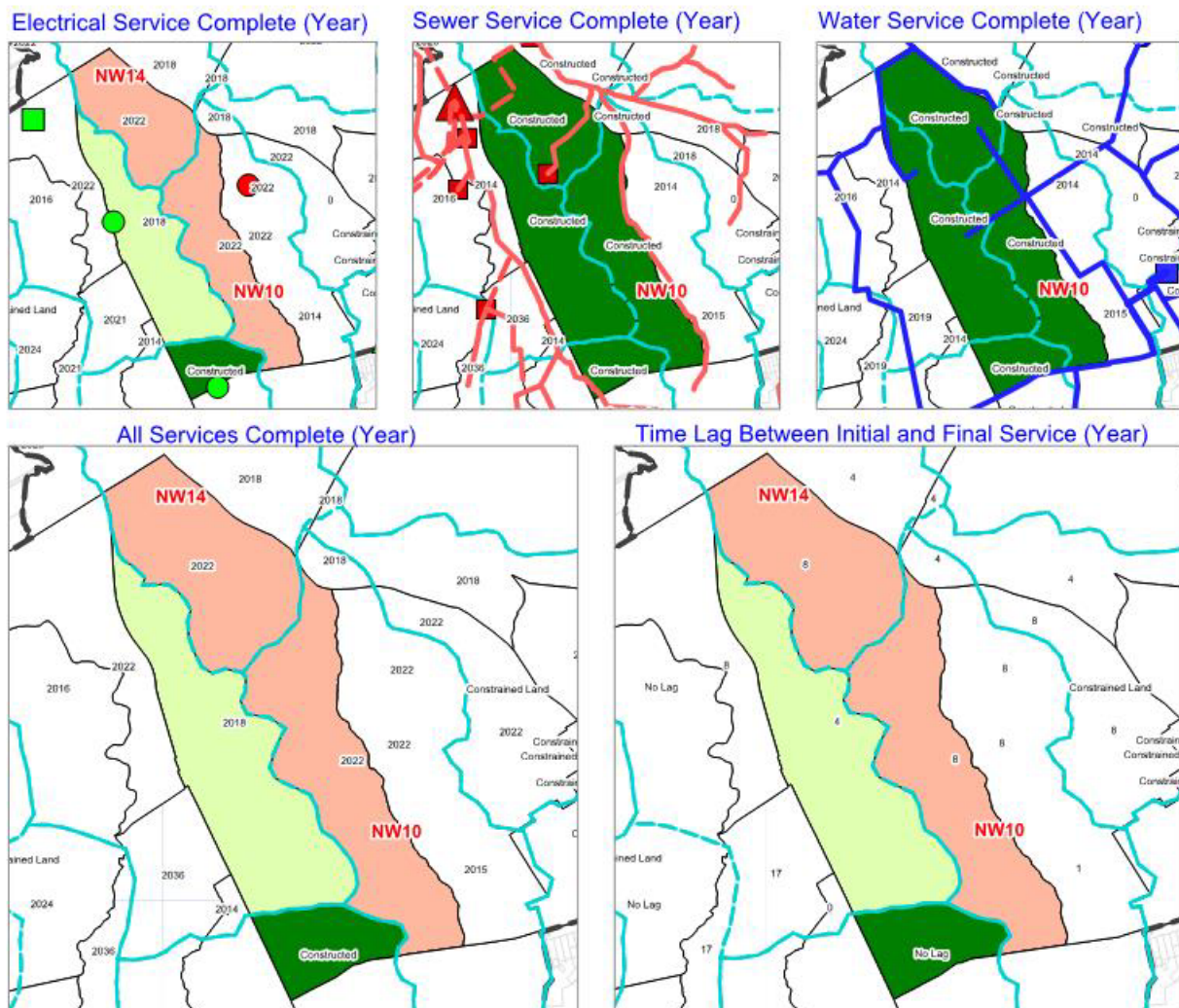
Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
North Kellyville	Upgrade to Sydney Water Infrastructure	2042	685

2.1.9 Riverstone

Located centrally within the NWPLRA, bordered by First Ponds Creek and Windsor Road to the east, Schofields Road to the south and the Western Railway line to the west, Riverstone was rezoned for development in May 2010. It has an anticipated dwelling yield of 8,900.

Consisting of a combination of infill and Greenfield sites, residential lot subdivisions are making up the majority of the product. Approximately 1,200 dwellings are currently at various stages of development (i.e. application lodged, approved or under construction), with 46 new dwellings been constructed to date.

Figure 2.11: Riverstone Servicing Maps



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Separated into three major catchments, the precinct is serviced by existing infrastructure and the package 2&3A works delivered early 2015. The western catchment drains towards Eastern Creek and is largely serviced by existing infrastructure. The northern catchment drains to a new carrier main along the Killarney Chain of Ponds delivered under the package 2&3A works, along with the eastern catchment which drains to a new First Ponds Creek carrier main.

Sydney Water has identified that they only have overall capacity for 8,533 dwellings within the precincts. This would indicate that an upgrade to accommodate the additional 367 dwellings to meet the total yield will be required at some point. It has been assumed this will occur when the current infrastructure reaches capacity under a low growth scenario.

Water

Riverstone is serviced by the package 1 works, providing trunk water along Schofields Road and package 2&3A, providing trunk water along Clarke and Edmund Streets. Works were delivered as of 2011 and early 2015 respectively.

Sydney Water has identified that they only have overall capacity for 8,533 dwellings within the precincts. This would indicate that an upgrade to accommodate the additional 367 dwellings to meet the total yield will be required at some point. It has been assumed this will occur when the current infrastructure reaches capacity under a low growth scenario.

Electrical

The existing Riverstone Zone substation located at the corner of Riverstone Parade and Bourke Street, currently supplies the majority of the precinct and a large portion of the NWPLRA as far east as North Box Hill. Other precincts serviced by the Riverstone ZS include; Riverstone East, Box Hill and Box Hill Industrial, Vineyard and Riverstone West. Network augmentations in the Box Hill area in 2018 will free capacity for an approximate 1,500 lots. This is based on additional capacity to Box Hill area of 3,750 lots, where it is assumed that approximately 1500 of which will offset existing load on Riverstone zone substation. Construction of the North Box Hill and Riverstone East/ Box Hill zone substation (location to be determined) will offset the remaining load on Riverstone ZS providing the ultimate capacity for Riverstone in 2022. A small area to the south of Riverstone is also serviced by the existing Schofields zone substation.

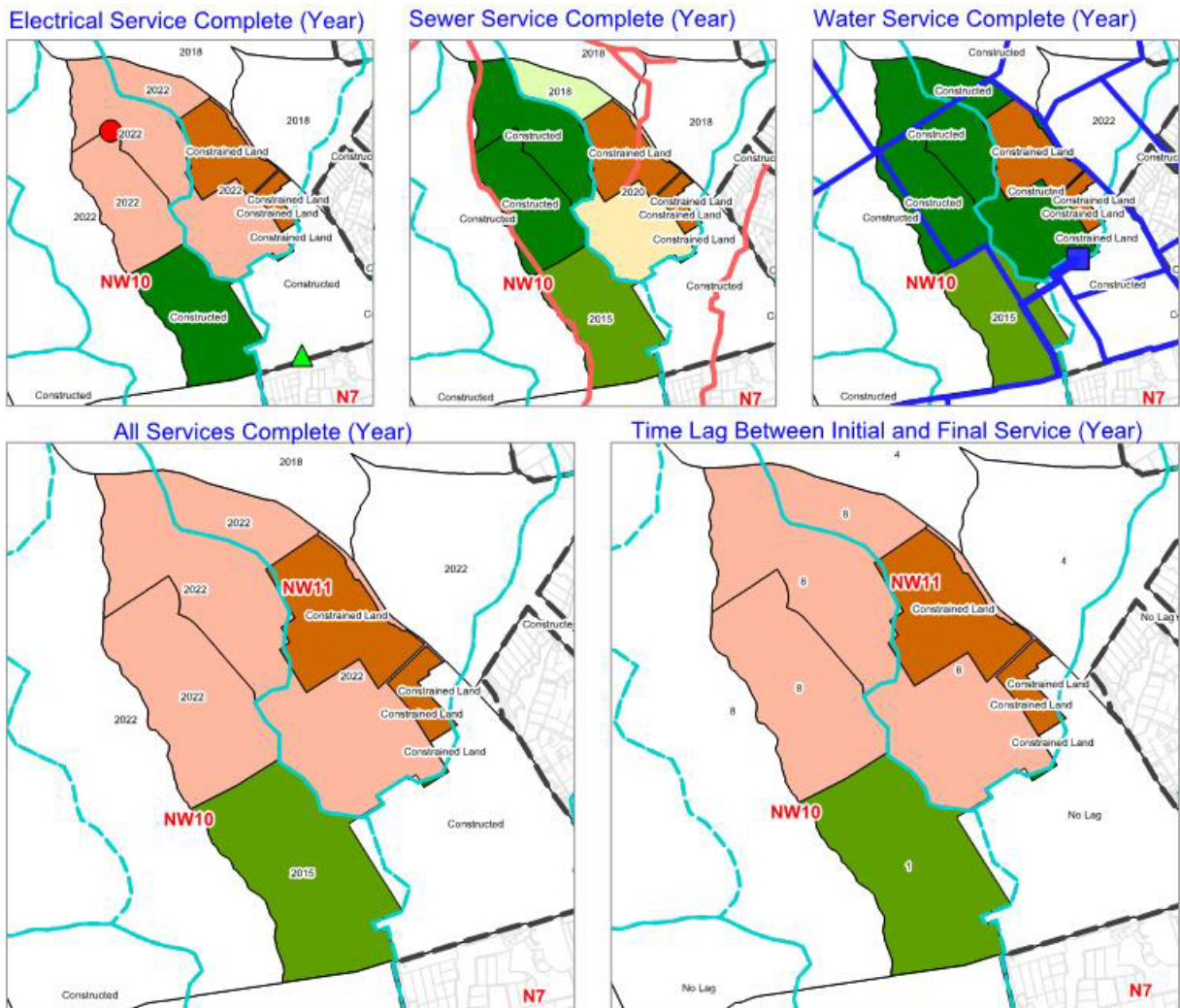
Table 2.9: Riverstone - Remaining Infrastructure to be Delivered

Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
Riverstone	22kV conversion and upgrade	2018	1,500
	New Riverstone East/ Box Hill zone substation (Infrastructure item no. 22)	2022	6552 In conjunction with item 23
	New North Box Hill zone substation (Infrastructure item no. 23)	2022	6552 in conjunction with Item 22
	Upgrade to Sydney Water Infrastructure	2050	367

2.1.10 Riverstone East

Located in the eastern section of the NWPLRA, bordered by Windsor Road to the east, First Ponds Creek to the west and Schofields Road to the south, Riverstone East was released for planning in 2013 and is to be rezoned in stages, with the Stage 1 draft ILP to be exhibited imminently. The precinct has an anticipated dwelling yield of 6,000.

Figure 2.12: Riverstone East Servicing Maps



Sewer

The vast majority of the precinct drains to the new First Ponds Creek carrier main, delivered under package 2&3A completed early 2015. Two areas drain to the Killarney Chain of Ponds, beneath Windsor Road. Both require the Package 3 works to take place, though the more southern of the two requires an additional extension to the Package 3 works as part of a future undetermined package of works. Sydney Water has no planned date for these works, and as such Mott MacDonald has estimated that it could be required by 2020.

Water

Package 2&3A completed constructed early 2015 and provided service to the overall precinct via new trunk mains along Tallawong Road, Guntawong Road, Clarke Street and Garfield Road East.

Electrical

The new Schofields zone substation located on Schofields Road, can provide initial supply to the southern portion of the site (1,400 dwellings), with the ultimate supply coming from a new zone substation. The new zone substation will be provided in either Riverstone East or Box Hill, a location is yet to be determined. This is currently anticipated for delivery by 2022.

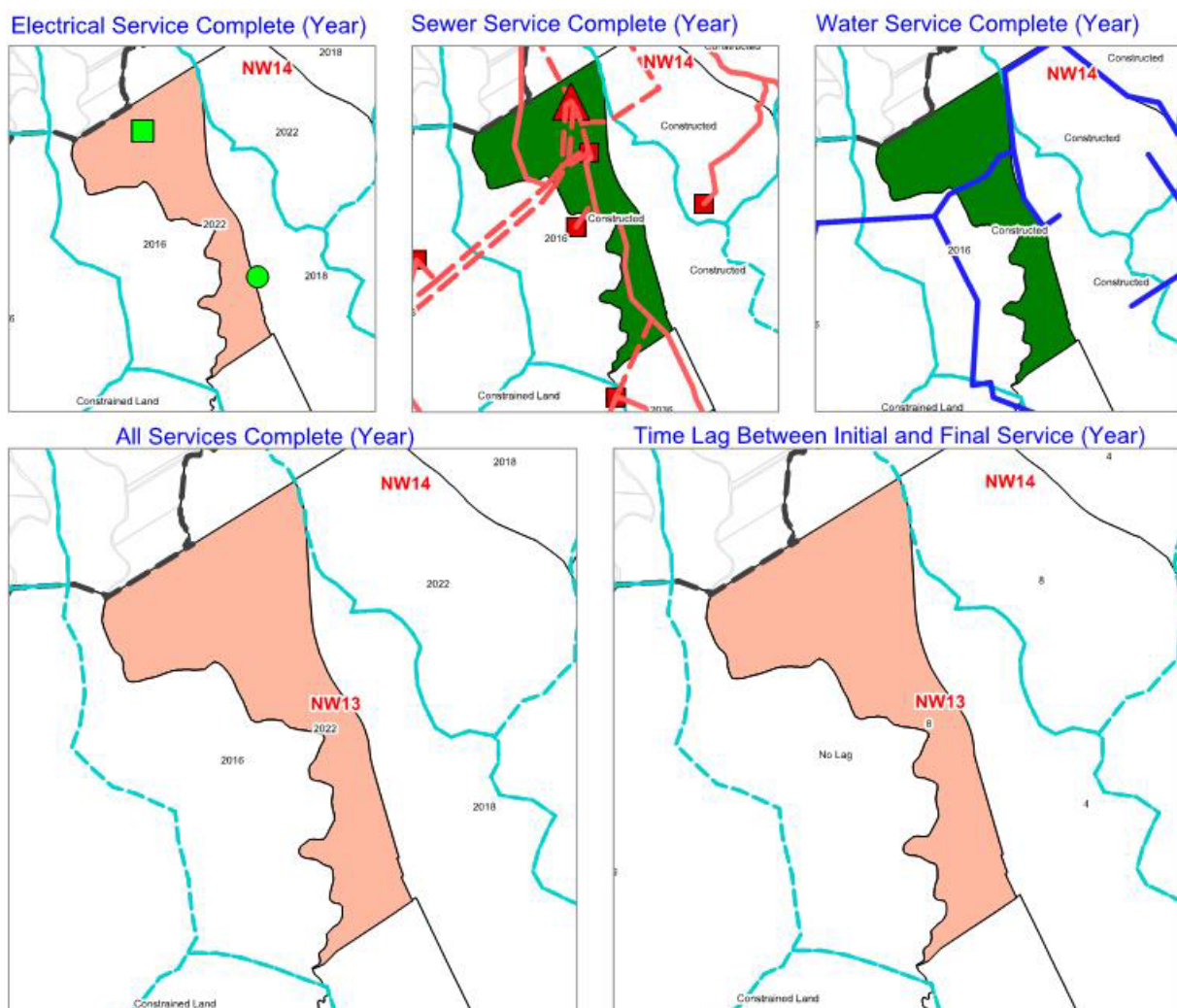
Table 2.10: Riverstone East -Remaining Infrastructure to be Delivered

Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
Riverstone East	Feeders from Schofields zone substation (Infrastructure item no. 25)	2016	1,400
	New main to the Killarney Chain of Ponds carrier main	2020	451
	New Riverstone East/ Box Hill zone substation (Infrastructure item no. 22)	2022	4,600

2.1.11 Riverstone West

Located in the central northern section of the NWPLRA, bordered by Eastern Creek to the west and the Western Rail line to the east, Riverstone West was rezoned for development in August 2009. It is not intended to provide housing, but only employment land, with an anticipated capacity for 12,000 new jobs.

Figure 2.13: Riverstone West Servicing Maps



Sewer

Serviced by existing infrastructure.

Water

Serviced by existing infrastructure

Electrical

Supply is to be provided progressively from the existing Riverstone zone substation once capacity is offset by the new North Box Hill and Riverstone East/ Box Hill zone substations.

Table 2.11: Riverstone West - Remaining Infrastructure to be Delivered

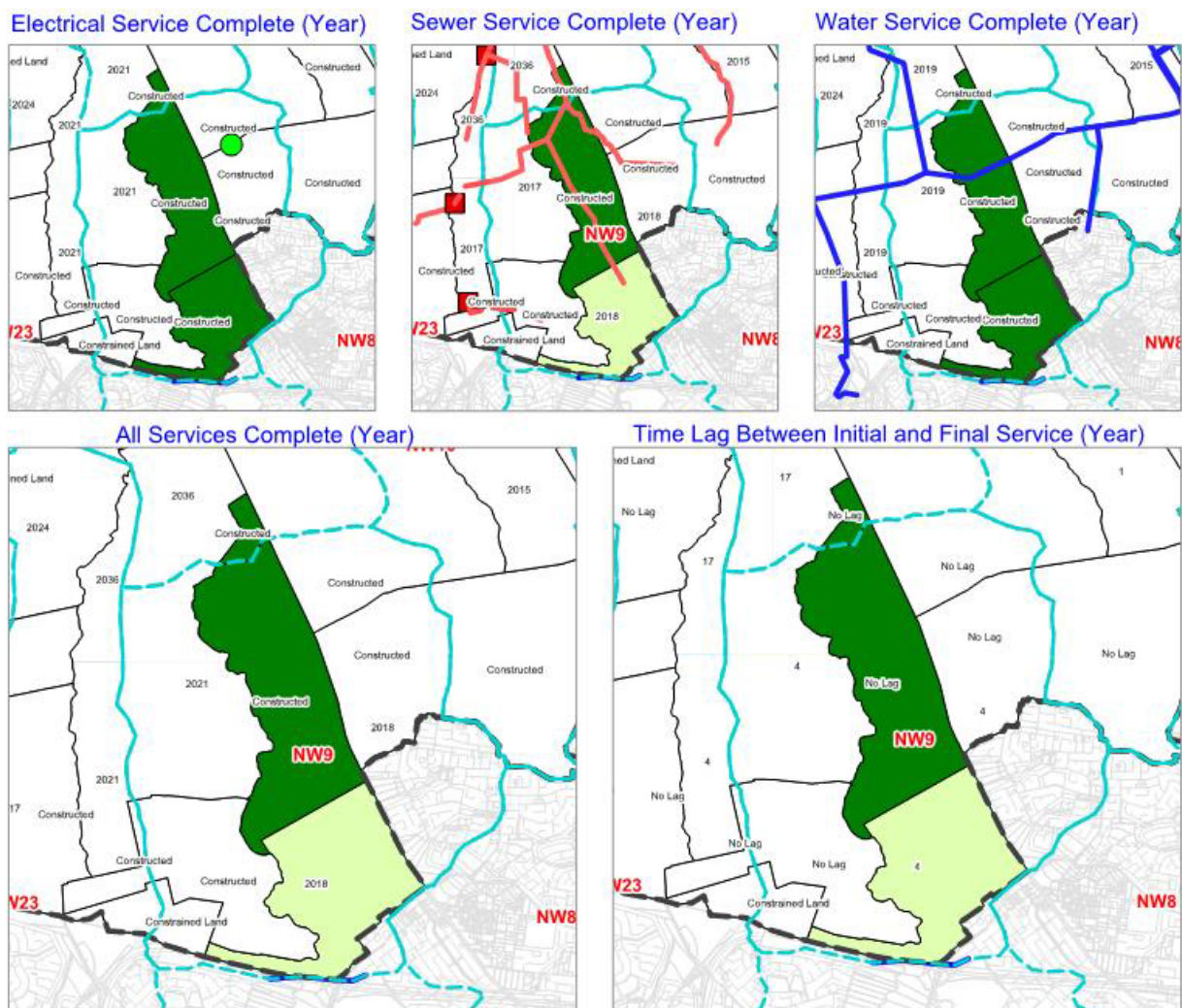
Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
Riverstone West	Employment Land only – no impact to dwellings	-	-

2.1.12 Schofields

Located centrally at the most southern portion of the NWPLRA, bordered by the Western Rail line to the east, the Westlink M7 to the south and Eastern Creek to the west, Schofields was rezoned for development in May 2012. It has an anticipated dwelling yield of 2,811.

Roughly 1,100 dwellings are currently at various stages of development (i.e. application lodged, approved or under construction), with the large majority of these being provided by a single developer. Located adjacent to the Schofields train station, these are primarily made up of units and townhouses.

Figure 2.14: Schofields Servicing Maps



Sewer

The package 2&3A works completed early 2015 provided a new extension to the existing carrier main along Eastern Creek to service 2,000 new dwellings. Future works under package 3 anticipated for delivery by 2018 (indicative - funding not yet committed) will service the remainder of the precinct.

Water

The package 2&3A works completed early 2015 provided new trunk mains to service 2,000 new dwellings. The remainder of the precinct is generally serviced by existing infrastructure.

Electrical

The new Schofields zone substation located on Schofields Road, within the adjacent Alex Avenue precinct provides the ultimate supply.

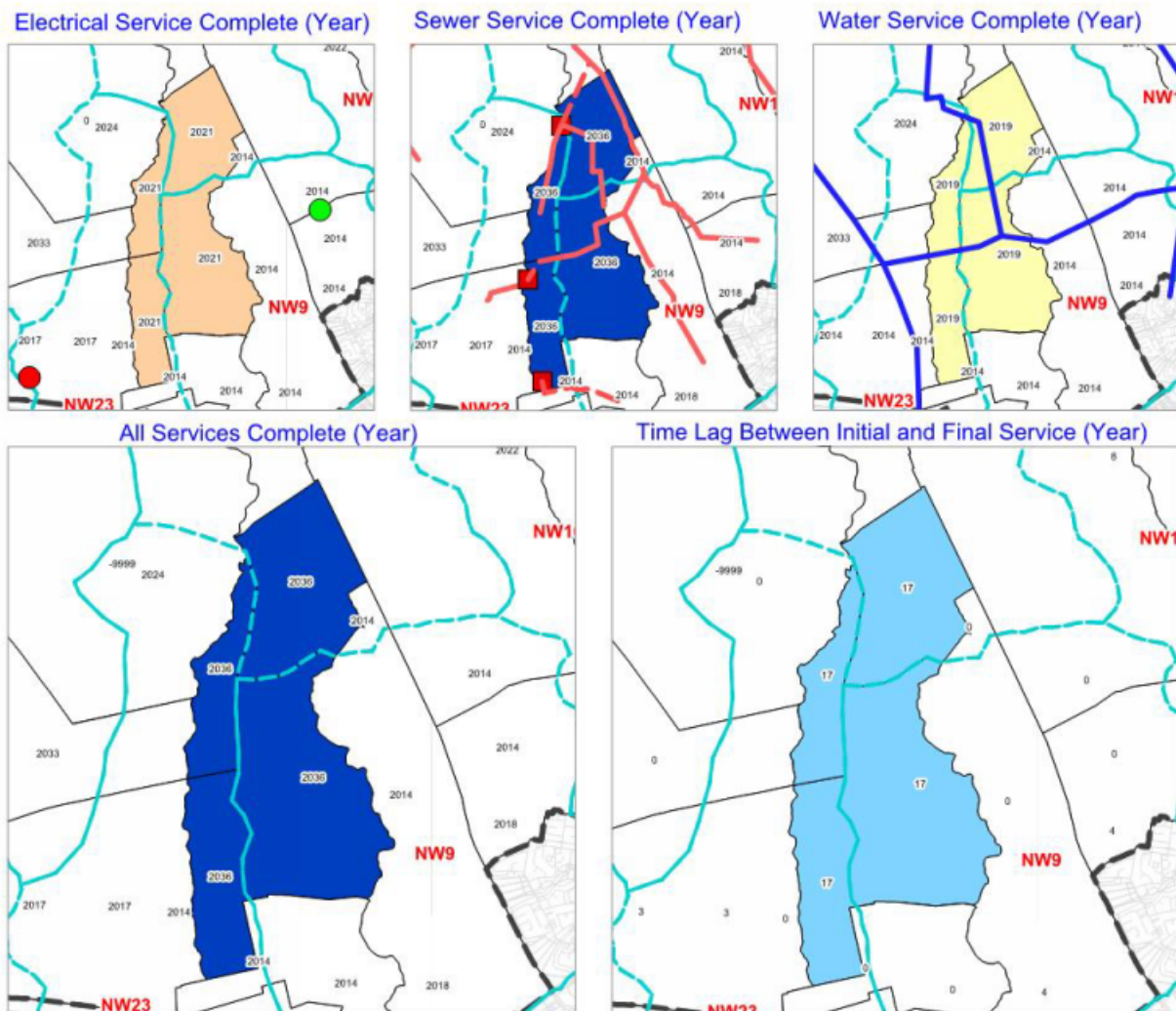
Table 2.12: Schofields - Remaining Infrastructure to be Delivered

Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
Schofields	Package 3 sewer works	2018	1,170

2.1.13 West Schofields

Located centrally in the southern portion of the NWPLRA, boarded by Eastern Creek to the east, Bells Creek to west and Townson Road to the south, West Schofields is yet to be released for planning. It has an anticipated dwelling yield of 2,000. No lots have been provided as yet.

Figure 2.15: West Schofields Servicing Maps



Sewer

Divided into a number of minor catchments, the precinct is proposed to be serviced by SPS B and associated gravity and rising mains delivering waste water to the existing Riverstone WWTP network. As the precinct has not been released for planning to be rezoned, Sydney Water has no committed strategy. There are opportunities to accelerate or stage proposed infrastructure or upgrade existing infrastructure both within and in surrounding precincts to enable earlier servicing.

Water

The precinct is largely serviced by existing infrastructure, with some upgrades through the precinct to unlock other areas of the NWPLRA. Some minor extensions and upgrades are anticipated to be delivered by 2019 to unlock the entire precinct.

Electrical

The ultimate Marsden Park zone substation will provide servicing for the entire precinct anticipated to be delivered by 2021. Feeders will need to be delivered to the precinct.

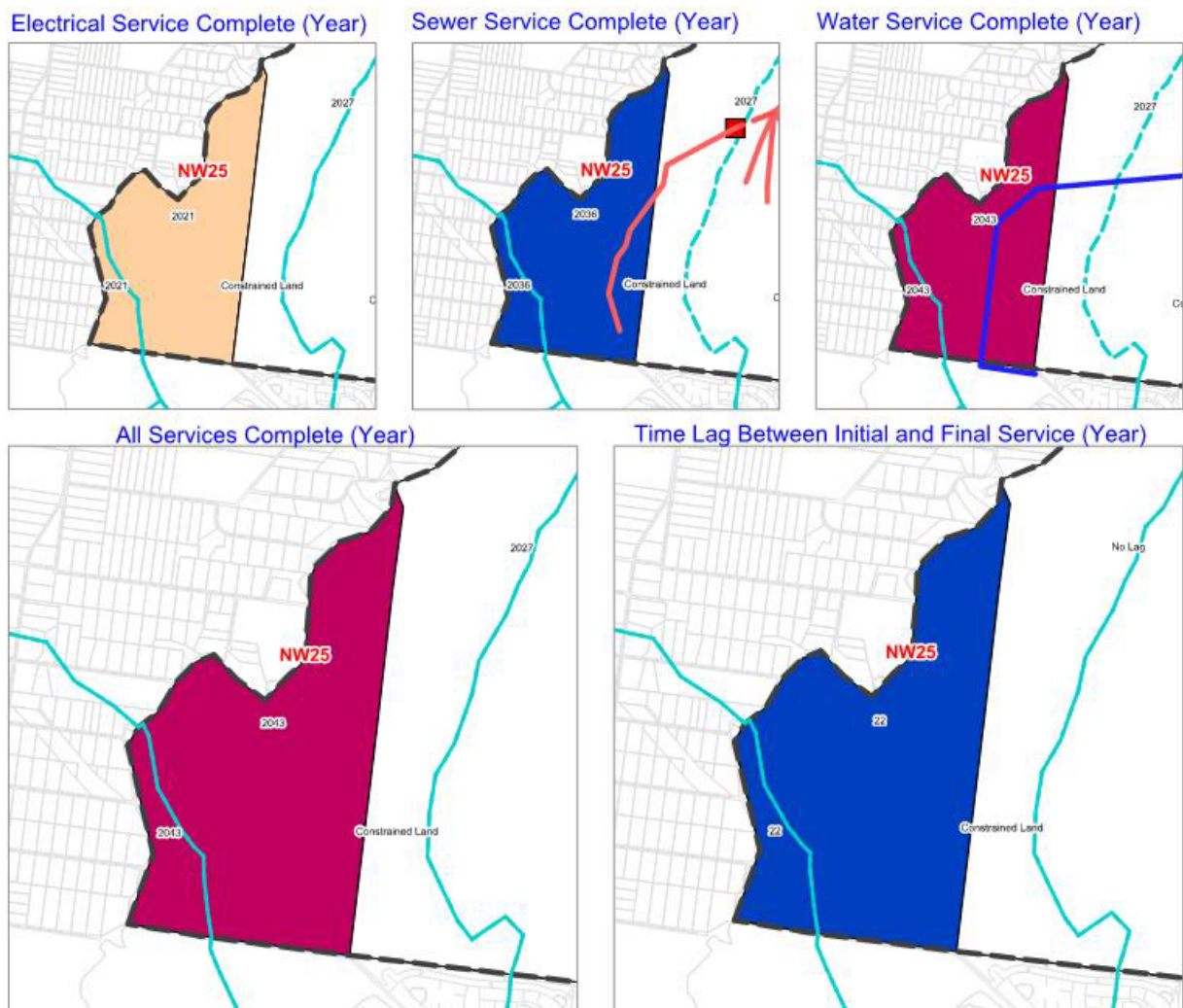
Table 2.13: West Schofields - Remaining Infrastructure to be Delivered

Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
	Marsden Park zone substation (Infrastructure item no. 20)	2021	2,000
	New sewer pumping station - SPS B (Infrastructure item no. 6)	2036	3,278
	New sewer mains to SPS B (Infrastructure item no. 6)	2036	3,278

2.1.14 Shanes Park

Located at the very west of the NWPLRA, boarded by Stony Creek Road to the east and South/Wianamatta Creek to the west, Shanes Park is yet to be released for planning. It has an anticipated dwelling yield of 500. No lots have been provided as yet.

Figure 2.16: Shanes Park Servicing Maps



Sewer

SPS A and extension of the Marsden Park sewer works is anticipated to be delivered by 2036.

Water

Extension of the Marsden Park water works is anticipated to be delivered by 2043.

Electrical

Service is to be supplied by the ultimate Marsden Park zone substation.

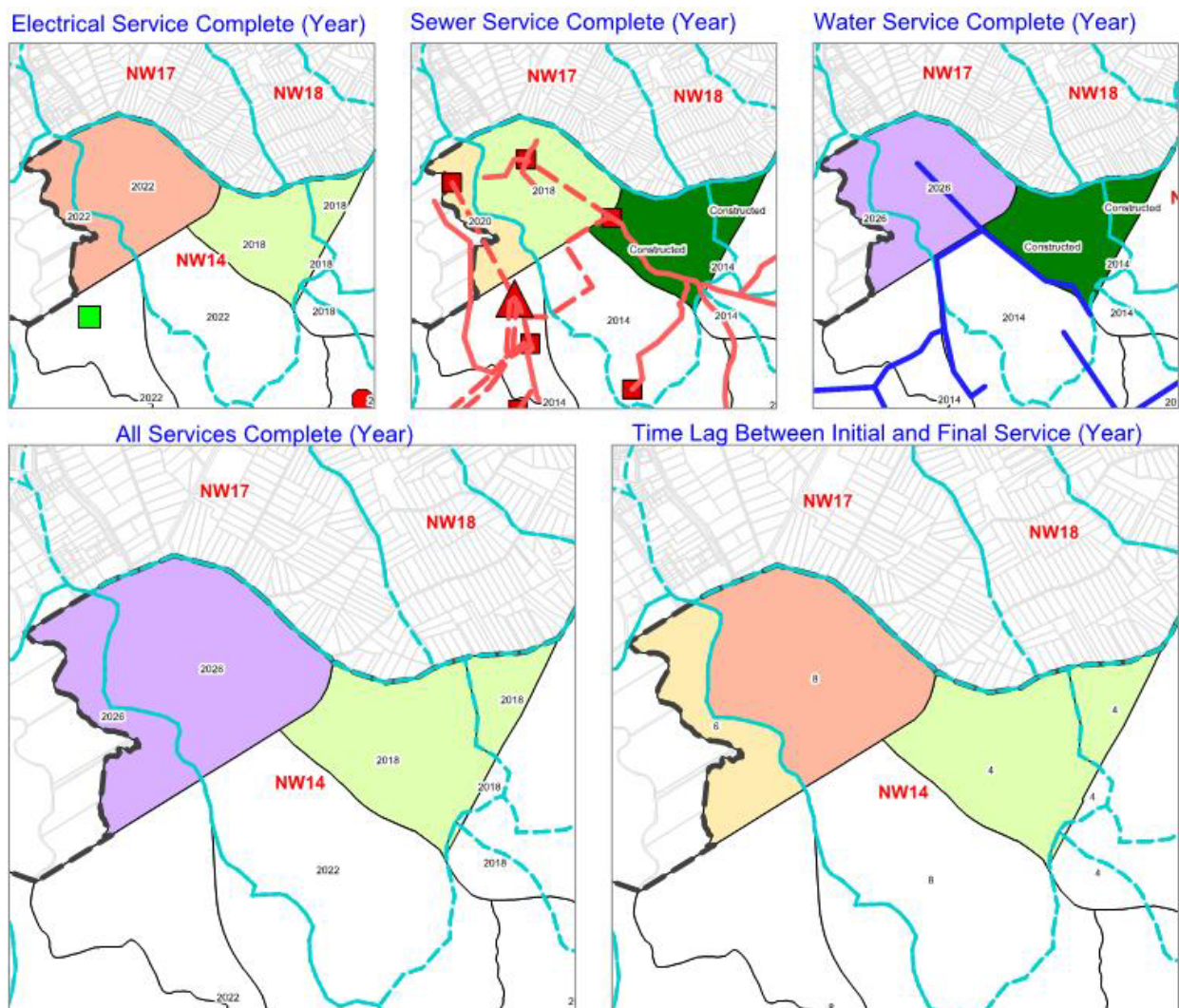
Table 2.14: Shanes Park - Remaining Infrastructure to be Delivered

Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
Shanes Park	Marsden Park zone substation (Infrastructure item no. 20)	2021	500
	SPS A (infrastructure item no. 10) Extension of sewer carrier mains from Marsden Park	2036	500
	Extension of water mains from Marsden Park	2043	500

2.1.15 Vineyard

Located centrally at the very north of the NWPLRA, boarded by Windsor Road and Bandon Road to the south, Boundary Road to the east, Commercial Road to the north and Eastern Creek to the west, Vineyard was released for planning in 2013. It has an anticipated dwelling yield of 2,500.

Figure 2.17: Vineyard Servicing Maps



Sewer

The waste water servicing strategy is broken into two primary catchments. The first has delivered a new trunk carrier main along Killarney Chain of Ponds under package 2&3A up to Chapman Road as of early 2015. These works included a pumping station (infrastructure item no. 3) and associated rising main conveying waste water to the Riverstone Waste Water Treatment Plant (infrastructure item no. 17), located on Boundary Road. This can service up to 2,000 new dwellings, generally to the portion of the site east of Chapman Road. The second component to be delivered under package 3 will provide two pumping stations (infrastructure item nos. 1 and 2) and associated rising mains connecting to the Package 2&3A pumping station and directly to Riverstone WWTP. This will generally service the portion of the site west of Chapman and Boundary Roads. The package 3 works have commenced detailed planning and are anticipated to be delivered by 2018 and 2020 dependent on the rezoning of the precinct. Sydney Water has not committed funding for the delivery of Package 3.

Water

There is capacity in the existing network to service approximately 900 new dwellings. The package 3 works have commenced detailed planning and will service the remaining precinct. No delivery dates have been determined. Mott MacDonald has assumed they will be delivered by 2026, based on the Sydney Water provided delivery timeframe of 2026 to 2040.

Electrical

There is existing capacity in the Riverstone zone substation (infrastructure item no. 21) to supply 400 initial dwellings. Network augmentations in the Box Hill area in 2018 will enable a second feeder for 600 lots to be supplied to the precinct. The Riverstone East/ Box Hill zone substation will provide the ultimate supply to the precinct in 2022.

Table 2.15: Vineyard - Remaining Infrastructure to be Delivered

Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
Vineyard	New feeder from Riverstone zone substation (Infrastructure item no. 21)	2016	400
	Second feeder from Box Hill augmentation (Infrastructure item no. 21)	2018	600
	New Sewer pump station and associated mains (Infrastructure item no. 2)	2018	1,520
	New Sewer pump stations and associated mains (Infrastructure item no.1)	2020	654
	New Riverstone East/ Box Hill zone substation (Infrastructure item no. 22)	2022	1,500
	Upgrades to water mains	2026	1,600

2.2 Current Authority Strategy Summary

The below tables summarise the previous identified precinct information which can also be found in more detail in Appendix B. The first shows a summary of all identified infrastructure items, approximate overall capacities of each item and when they are currently anticipated to be delivered. The second shows the remaining infrastructure to be delivered for each precinct, when it is anticipated to be delivered and the additional capacity of lots able to be serviced. The third shows the availability of lots able to be serviced over time under the current authorities servicing strategies. It should be noted the serviceability is dependent on the provision of all critical services being sewer, water and electricity.

It should further be noted that the below does not represent dwelling demand or production forecasts. It shows the number of dwellings able to be developed as a result of the availability of trunk services infrastructure.

Table 2.16: NWPLRA Bulk Infrastructure Table

Infrastructure Number	Authority Code	Description	Anticipated Delivery Date	Planned Capacity (dwellings)
1	SPS W	Vineyard (West) Sewer Pump Station pumping to Riverstone WWTP	2020	654
2	SPS E	Vineyard (North) Sewer Pump Station – SPS1154	2018	1,520
3	SPS 1154	Existing Vineyard (East) Sewer Pump Station pumping to Riverstone WWTP	existing	26,601
4	PAP C*	Marsden Park North Sewer Pump Station pumping to Riverstone Carrier	2036*	2,300
5	PAP G*	Marsden Park North Sewer Pump Station pumping to Riverstone Wastewater Carrier	2020*	9,281
6	SPS B	Schofields West Pump Station pumping to Riverstone Carrier	2036	3,278
7	PAP S/1173 *	Marsden Park Industrial Sewer Pump Station pumping to Riverstone Carrier	2017*	1,228
8	SPS 118	Existing Schofields West (services Colebee) Sewer Pump Station pumping to Quakers Hill WWTP	existing	1,000
9	PAP F/1160 *	Marsden Park Sewer Pump Station pumping to Riverstone Wastewater Carrier	2016*	5,276
10	SPS A	Marsden Park (West) Sewer Pump Station pumping to PAP F/1160	2036	1,679
11	SPS 1022	Existing Sewer Pump Station – North Kellyville	existing	1,540
12	SPS 1139	Existing Sewer Pump Station pumping to North Kellyville	existing	3,143
13	SPS 1107	Existing Sewer Pump Station pumping to North Kellyville	existing	2,960

Infrastructure Number	Authority Code	Description	Anticipated Delivery Date	Planned Capacity (dwellings)
14	SPS 0564	Existing Sewer Pump Station pumping to Riverstone West	existing	31,231
15	SPS 0571	Existing Sewer Pump Station pumping to Riverstone	existing	Already Decommissioned
16	SPS 0572	Existing Sewer Pump Station pumping to Riverstone	existing	No future plans
17	RIV WWTP	Existing Riverstone Wastewater Treatment Plant	existing	62,523
18	RH WWTP	Existing Rouse Hill Wastewater Treatment Plant	existing	7,643
19	SMP ZS	South Marsden Park zone substation (Stage 1 – 16.5 MVA)	2017	1,351
20	MP ZS	Marsden Park zone substation (Stage 1 - 45 MVA)	existing	18,489
21	RIV ZS	Existing Riverstone zone substation (33 MVA)	existing	10,546
22	RE/BH ZS	Riverstone East/ Box Hill zone substation (45/90 MVA)	2022	10,589
23	NBH ZS	North Box Hill zone substation (45 MVA)	2022	5,366
24	MUP ZS	Existing Mungerie Park zone substation (90 MVA)	existing	8,804
25	SCH ZS	Existing Schofields zone substation (45/ 90MVA)	existing	12,861
26	VBSP	Existing Vineyard Bulk Supply Point	existing	Sufficient Capacity
27	RHWR	Rouse Hill Water Reservoir	existing	62,523
28	VWPS	Vineyard Water Pumping Station	existing	Not Assessed (62,523)

*Delivery dates are indicative and are to be determined by the developer based on their development program

It should be noted that the *Service Authority Planned Capacity* in the Table 2.16 has been adapted from information sourced from Sydney Water infrastructure capacities for each precinct as a whole. Mott MacDonald as part of the assessment has; based on area, distributed the capacities across each of the identified drainage sub-catchments. From this it was identified which precincts impact on each infrastructure item (this is shown in detail in Appendix A). Some catchments impact a number of infrastructure items, this is particularly evident where pump stations transfer to multiple pump stations before reaching a WWTP. An example of this is where Catchment 14D, affects SPS E (Infrastructure item no. 2), SPS 1154 (Infrastructure item no. 3) and Riverstone WWTP (Infrastructure item no. 17).

Table 2.17: NWPLRA – Precinct Infrastructure Table

Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
Alex Avenue	Package 3 sewer works	2018	661
Area 20	Fully serviced	-	-
	22kV conversion and upgrade	2018	1,500
	Sewer carrier main to Killarney Chain of Ponds	2018	3,542*
	Extension of Terry Road Water main	2022	1,485*
Box Hill and Box Hill Industrial	New Riverstone East/ Box Hill zone substation (Infrastructure item no. 22)	2022	6552 In conjunction with item 23
	New North Box Hill zone substation (Infrastructure item no. 23)	2022	6552 in conjunction with Item 22
Colebee	Fully serviced	-	-
Marsden Park Industrial	Developer to provide infrastructure at pace with projected dwelling delivery	-	-
Marsden Park	Developer to provide infrastructure at pace with projected dwelling delivery	-	-
Marsden Park North	Developer to provide infrastructure at pace with projected dwelling delivery	-	-
North Kellyville	Upgrade to Sydney Water Infrastructure	2042**	685
	22kV conversion and upgrade	2018	1,500
	New Riverstone East/ Box Hill zone substation (Infrastructure item no. 22)	2022	6552 In conjunction with item 23
Riverstone	New North Box Hill zone substation (Infrastructure item no. 23)	2022	6552 in conjunction with Item 22
	Upgrade to Sydney Water Infrastructure	2050	367
	Feeders from Schofields zone substation (Infrastructure item no. 25)	2016	1,400
Riverstone East	New main to the Killarney Chain of Ponds carrier main	2020	451*
	New Riverstone East/ Box Hill zone substation (Infrastructure item no. 22)	2022	4,600
Riverstone West	Employment Land only – no impact to dwellings	-	-
Schofields	Package 3 sewer works	2018	1,170
	Marsden Park zone substation (Infrastructure item no. 20)	2021	2,000*
West Schofields	New sewer pumping station - SPS B (Infrastructure item no. 6)	2036	3,278
	New sewer mains to SPS B (Infrastructure item no. 6)	2036	3,278

Precinct	Remaining Infrastructure	Anticipated Delivery Date	Estimate of Additional* Capacity (lots)
Shanes Park	Marsden Park zone substation (Infrastructure item no. 20)	2021	500*
	Extension of sewer carrier mains from Marsden Park	2036	500*
	Extension of water mains from Marsden Park	2043	500*
Vineyard	New feeder from Riverstone zone substation (Infrastructure item no. 21)	2016	400
	Second feeder from Box Hill augmentation (Infrastructure item no. 21)	2018	600*
	New Sewer pump station and associated mains (Infrastructure item no. 2)	2018	1,520*#
	New Sewer pump stations and associated mains (Infrastructure item nos.1)	2020	654*
	New Riverstone East/ Box Hill zone substation (Infrastructure item no. 22)	2022	1,500*#
	Upgrades to water mains	2026	1,600

*Indicates dwelling capacity is reliant on other bulk pieces of infrastructure.

** indicates that the date is based on the "Low Growth Scenario"

indicates that together these precincts provide only the number of dwellings indicated

Table 2.18: Utility Service Capacity Upgrades

Year	Progressive Lots Served												Total
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026 onwards	
Precinct													
Alex Avenue	5,579			661									6,240
Area 20	2,500												2,500
Box Hill & BHI	1,600			1,500				6,552					9,652
Colebee	1,000												1,000
Marsden Park Industrial			600				400					228	1,228
Marsden Park	2,400						2,400					5,508	10,308
Marsden Park North			2,800							1,200			4,000
North Kellyville	4,500											685	5,185
Riverstone	841			1,500				6,192				367	8,900
Riverstone East		1,400						4,600					6,000
Riverstone West													0
Schofields	1,641			1,170									2,811
West Schofields												2,000	2,000
Shanes Park												500	500
Vineyard	0	400		750								1,350	2,500
ANNUAL TOTAL	20,061	1,800	3,400	5,581	0	0	2,800	17,344	0	1,200	0	10,638	62,824

Note: Delivery times in the above table are indicative only and are subject to refinement.

Note: The capacities shown are only for trunk/ bulk infrastructure. Minor reticulation works will be required to service individual developments.

2.3 Development Issues

2.3.1 Utility Issues

2.3.1.1 Sewer

The sewer services primarily rely on gravity for disposal and are closely linked to catchment topography. The previously defined precinct boundaries often related to major roads, creeks, etc. As a result of this, servicing catchments for sewer were often spread across two or three precincts. In some instances, this also left areas within rezoned precincts without service provision for some period of time. For this exercise, the major sewer catchments have been mapped and analysed as packages, rather than the precinct boundaries and provided in Appendix A.

2.3.1.2 Electrical

The current supply philosophy from Endeavour Energy is to stage their capital expenditure and react to growth and applications for connection. Initially, this typically involves the extension of high voltage feeders (generally able to supply up to 700 dwellings per feeder) from nearby zone substations to areas of new development until there is a warrant for a new zone substation. These feeders are often at the developer's expense. For unfragmented land (which usually attracts large developers) this is not normally an issue, but in highly fragmented areas (which generally attract smaller developers) it often presents a cash flow issue that prevents them from pursuing development.

2.3.1.3 Water

Due to technological advances and a greater community awareness of water consumption, the existing water infrastructure generally has more existing residual capacity than the other services. However, significant upgrades are still required to service higher areas and those areas where the land use has changed from rural uses.

2.3.1.4 Developer Driven Precincts

Some precincts are being delivered wholly by single or a limited number of developers which include Marsden Park, Marsden Park Industrial and Marsden Park North. As these precincts are generally being delivered under a PAP, the developer is responsible for supplying all trunk infrastructure. As most are in early stages of development and planning, they have only developed schemes for these initial stages and not the entire precinct. Sydney Water has a general layout and anticipated ultimate strategy though is largely dependent on how and when the developer will roll-out each precinct.

2.3.1.5 Land Fragmentation

As mentioned above, unfragmented land attracting larger developers, results in developer led infrastructure (e.g. Marsden Park). The converse is also evident, where the highly fragmented land has attracted smaller developers, without the capital to fund these lead-in works. This has resulted in very slow development in some rezoned land where land ownership is more fragmented.

3 Housing Market Needs Analysis

AEC has undertaken an economic and property market assessment into the housing needs of the greater Sydney Metropolitan area and the role the NWPLRA has and will continue to play in meeting the growing needs.

3.1 Observed Development Activity

The assessment shows that the number of dwellings in various stages of development across the priority land release area is approximately 11,500. This is broken down for each precinct in Table 3.1 and summarised below.

Table 3.1: Residential Development Pipeline

Precinct	Status	Residential Lots
Alex Avenue	Rezoned	1,353
Area 20	Rezoned	2,131
Box Hill and Box Hill Ind.	Rezoned	259
Colebee	Rezoned	915
Marsden Park Industrial	Rezoned	650
Marsden Park	Rezoned	2,000
Marsden Park North	Released for Precinct Planning	-
North Kellyville	Rezoned	1,838
Riverstone	Rezoned	1,189
Riverstone East	Released for Precinct Planning	-
Riverstone West	Rezoned	-
Schofields	Rezoned	1,131
West Schofields	Partially Released for Planning (400 of 2000)	-
Shanes Park	Not Released	-
Vineyard	Released for Precinct Planning	-
Total		11,466

AEC Group: Priority Growth Areas: NWGC – Housing Market Needs Analysis – Working Draft 08.05.2015

3.2 Projected Dwelling Demand

As part of this assessment, AEC have projected the housing demand in the NWPLRA by examining various factors of influence which include but are not limited to:

- Projected population growth;
- Changes in households and socio-demographic profile;
- Employment opportunities and growth;
- Accessibility to and availability of transport networks, proximity to employment and key services and social infrastructure;
- Affordability of housing;

They have examined two growth scenarios where 10% and 20% of housing demand is reduced in the greater Sydney area and re-directed to the priority land release areas. They have been called the ‘Low Growth Scenario’ and ‘High Growth Scenarios’ respectively.

In addition to these AEC have assessed the growth as two sub scenarios, being ‘without capacity constraints’ and ‘with capacity constraints’. This provides a clear distinction between the number of dwellings which are required to be produced to meet demand and number which will likely be produced considering market constraints. This is to address the reality that although a precinct is rezoned, *constraints such as small lot patterns, fragmented land ownership, lack of available services infrastructure and issues of financial feasibility can cumulatively impact the capacity of land to deliver new housing².*

As a worst case scenario in relation to projected demand required to be met, the high growth without capacity constraints will form the targeted demand rates to assess the current servicing strategy against. A summary of the projected demand has been extracted from the AEC report and presented below.

Table 3.2: Projections of Dwellings –Low Density - Low and High Growth Scenarios

	Cumulative Dwelling Increase						
	2015	2016	2021	2026	2031	2036	Ultimate
Low Growth Scenario	1,682	3,364	12,009	20,209	28,369	38,409	62,824
High Growth Scenario	3,010	6,020	21,450	36,025	50,515	62,824	62,824

AEC Group: Priority Growth Areas: NWGC – Housing Market Needs Analysis

Table 3.3: Projections of Dwellings –Low Density - Low and High Growth Scenarios

	Cumulative Dwelling Increase						
	2015	2016	2021	2026	2031	2036	Ultimate
Low Growth Scenario	1,682	3,364	12,009	20,209	28,369	38,409	92,533
High Growth Scenario	3,010	6,020	21,450	36,025	50,515	62,824	92,533

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Recent evidence has suggested that changes in lot size and mix, due to the Housing Diversity Package, affordability, etc. have resulted in dwelling densities considerably higher than those listed as minimum lot densities in the ILPs. An assessment was therefore undertaken by AEC on the likely maximum dwelling density.

² AEC Group: Priority Growth Areas: NWGC – Housing Market Needs Analysis

Table 3.4: Dwelling Yield and Growth Scenarios – Density Achieved (Anticipated Year)

Density Scenario	Yield (Dwellings)	Low Growth Scenario (Year Achieved) ³	High Growth Scenario (Year Achieved) ³
Low Density	62,824	2052	2044
High Density	92,533	-	2052

Source: AEC Group

The information gathered in this section has been used to form the basis of the analysis by developing an annual demand and corresponding lot uptake. This is discussed in detail in Section 4 with supporting information shown in Appendix C and Appendix D.

³ Estimated completion date based on extrapolation of AEC data

4 Supply and Demand Analysis

The previous sections of the report outlined existing service capacities, future servicing strategies and housing forecasts. This section uses this information to assess the available dwelling supply associated with the infrastructure provisions against the market capacity to purchase them. This will highlight areas where supply falls short of demand, where bringing key pieces of infrastructure forward will supply additional dwellings and where supply is in excess of demand, where it may be possible to delay the infrastructure.

4.1 Methodology

In accordance with the methodology in Section 1.4 the below analysis has been undertaken in a two-step process to determine opportunities and constraints within the current servicing strategies and develop alternative servicing strategies under different growth and density scenarios.

Based on the market needs analysis, development scenarios have been tested against the current planned infrastructure authority strategy to determine any issues in the current strategies and the ability to meet market demand. The three below scenarios have been tested as upper and lower bound solutions.

The following scenarios assess the current authority strategies against different density and growth combinations,

- Low Growth – Low Density (LGLD) - 62,824 Dwellings
- High Growth – Low Density (HGLD) - 62,824 Dwellings
- High Growth – High Density (HGHD) - 92,533 Dwellings

The scenarios were assessed to prioritise servicing catchments, remove development lags, and provide guidance to authorities on the estimated service dates for revised trunk infrastructure. It also estimates the date existing constructed services will be exhausted based on the different density and growth scenarios and explore potential opportunities for sub-precincts to be reprogrammed.

4.1.1 Estimation of Lot Supply

The supply of dwellings was estimated on the provision of trunk infrastructure items only (waste water treatment plants, pump stations, zone substations, etc.) and did not take into account other factors such as land fragmentation or smaller infrastructure items such as pad mount substations, sewer feeders, etc. The proposed timing and increase in dwelling capacity of infrastructure was based on meetings and written advice from Sydney Water and Endeavour Energy. As pieces of infrastructure are delivered in each precinct the supply is increased accordingly.

4.1.2 Estimation of Market Demand

The demand analysis was based on the estimated market demand (without service capacity constraints) across the zoned and serviced precincts on a year by year basis. Market demand in each of the precincts was estimated by subtracting the known 'single developer' delivery targets (e.g. Marsden Park, Colebee,

etc.) from the estimated total market demand for the NWPLRA and then equally distributing the remainder of the demand across the precincts where zoning and infrastructure permitted.

In addition to this, a 'practical supply limit' has been estimated for the fragmented, or non-developer driven precincts. This represents an estimation of the 'achievable' limit of dwelling supply for each precinct in a given year. These figures were based on advice from AEC and are generally capped at approximately 400 lots per year per precinct, depending on the housing type and market forces. Initial limits for some precincts are as low as 200 lots per year per precinct to allow some time for momentum to gather in particular locations as development is in its infancy.

Figure 4.1: Low Growth Low Density (LGLD) Scenario

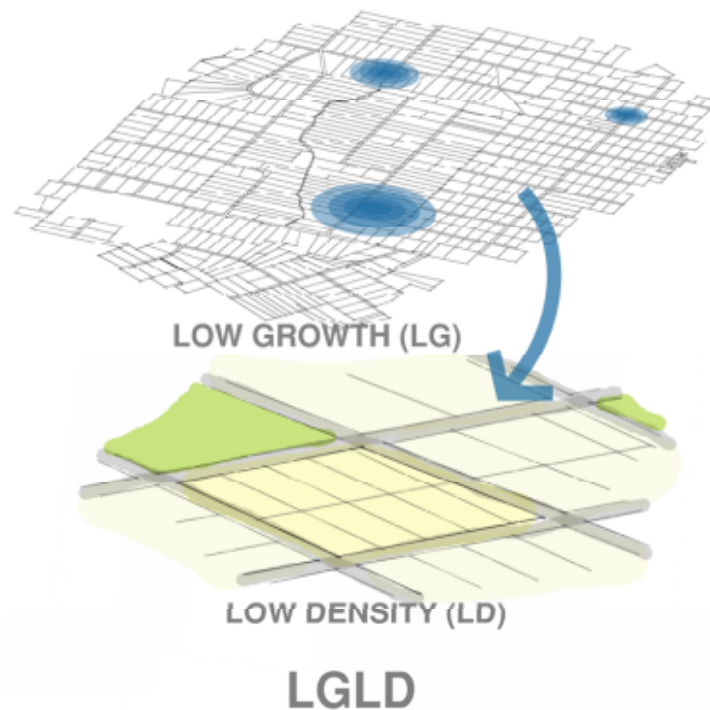
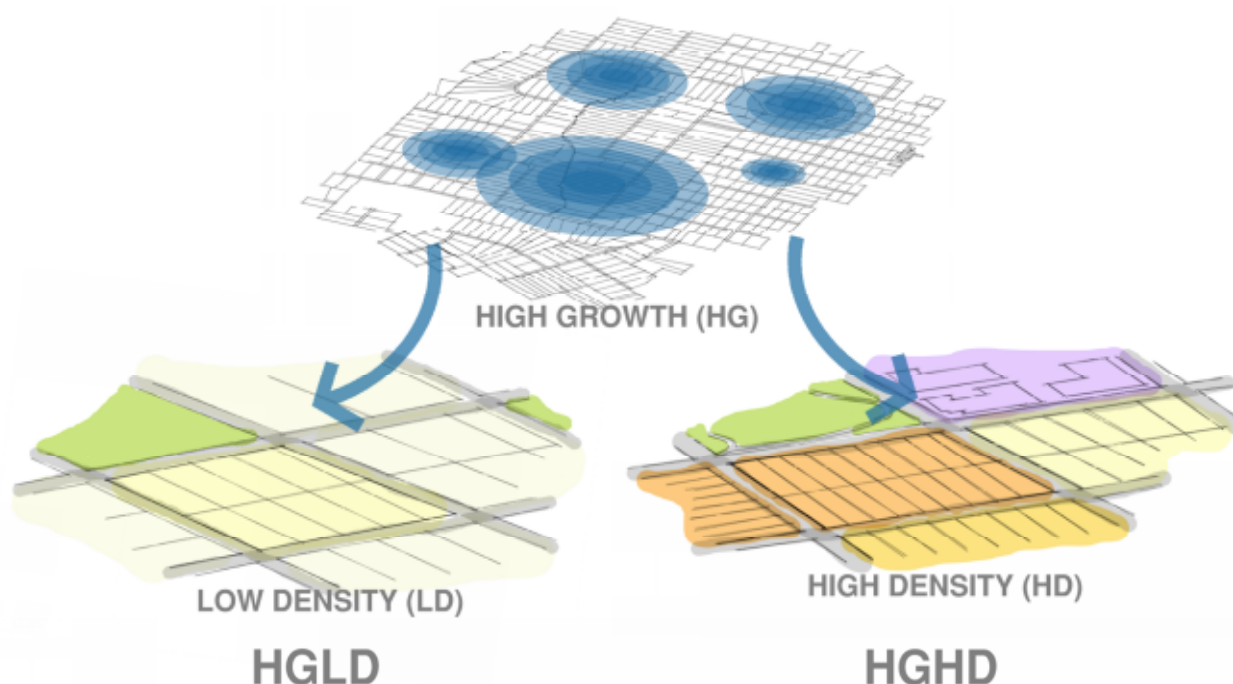


Figure 4.2: High Growth Low Density (HGLD) & High Growth High Density (HGHD) Scenarios



The above scenarios have been tested against the current authority program of works and included in Appendix C. The assessments map existing authority strategies against market demand on a year by year basis. The observations of these base strategies is discussed in Section 4.2.

The following definitions provide in reference to the Servicing Strategies in Appendix C.

Capacity Increases: Denotes the increase in "serviceable" lots, relating to a new piece or package of trunk infrastructure items being constructed. For example this may relate to a new sewer pump station being constructed which unlocks additional land to be developed. The number denotes the number of dwellings that can be serviced by this infrastructure addition.

Trunk Infrastructure Capacity: This is the residual number of "serviceable" lots in a precinct after subtracting the previous year's development (Distributed Market Demand, "Green" rows)

Practical Supply Limit: The practical supply limit refers to the amount of dwellings that could be "practically" constructed and delivered by developers in a precinct for a given year. These figures were based on advice from AEC. Supply numbers in developer driven precincts have been supplied by the developers.

Market Demand: This is the yearly market demand for a given growth scenario (LG or HG) based on the AEC market projections. The overall aim of the analysis is to determine where housing supply does not meet market demand for a given year or if there is significant oversupply.

Distributed Demand: This is the anticipated lots that are developed in an available precinct. Here, AEC's market capacity (Required Demand) is distributed across the precincts that have ability (trunk infrastructure capacity) to service lots. Here the sum of all the green rows for a given year should equal the market capacity, meaning demand is met. Where the green rows do not equal the market capacity then there is an overflow of supply. This overflow gets carried to the following year increasing the Required Demand.

Figure 4.3: Procedure for determining issues in the current authority servicing strategy



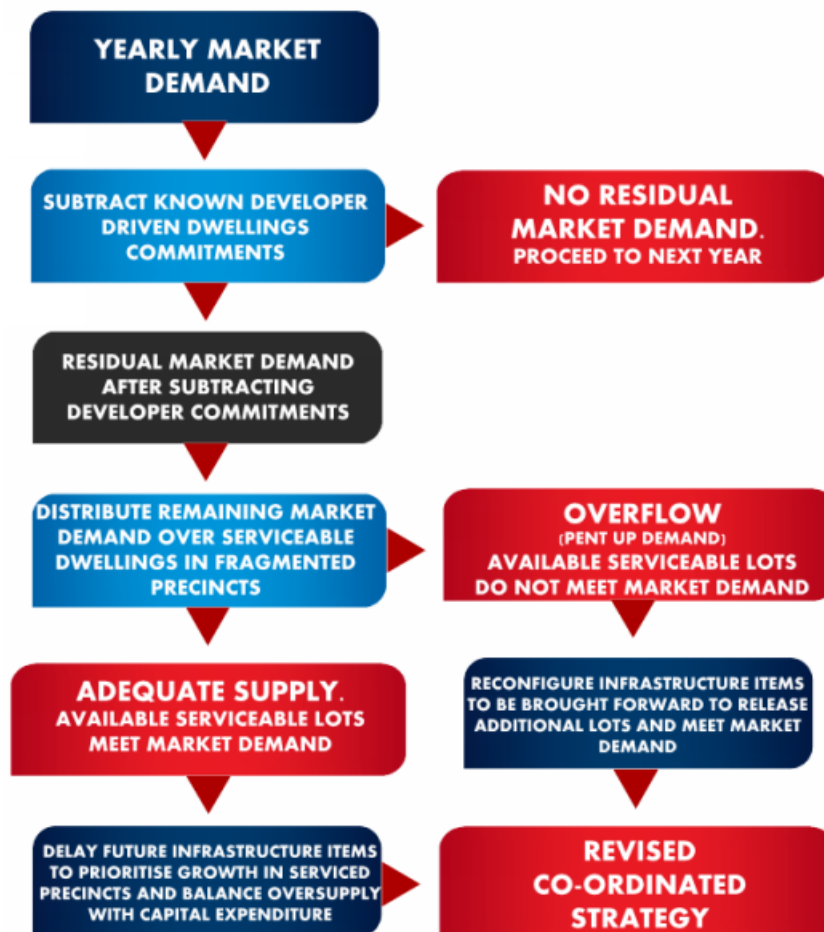
Based on the Distributed Market Demand for the different AEC growth scenarios (High Growth/Low Growth), the analysis undertaken in this report simulates market uptake of lots within the precincts based on the programmed (but not necessarily committed) infrastructure items by authorities. This above procedure allows the assessment of under and oversupply of housing due to infrastructure servicing to be determined. Two main constraints/opportunities are observed.

Servicing Undersupply: There are lags in time due to the different delivery programs of the service authorities. Because service upgrades are not coordinated across authorities, often precincts are lacking in all three critical services. These instances result in an undersupply of developable land causing development to stall.

Servicing Oversupply: This relates to infrastructure capacities being delivered ahead of the market demand. Oversupply can relate to inefficient provision of trunk services causing high early capital expenditure. In this instance, delaying planned infrastructure, or staging upgrades will provide a more efficient use of infrastructure funding.

Based on the Strategy in figure 4.3 above the LGLD, HGLD & HGHD strategies are revised to provide alternative servicing scenarios as per the below procedure.

Figure 4.4: Procedure for determining Revised Strategy



The alternative servicing strategies aim to balance development lags and servicing oversupply and are located in Appendix D. The results of the assessment are discussed in Sections 4.3 & 4.4.

4.1.3 Scenario Testing

Models were created for the different scenarios identified in Section 4.1 and based on the methodology outlined in Figure 4.3. Testing of the current scenario allowed opportunities and constraints to be identified to promote efficient delivery of services and prompt development of dwellings, refer Section 4.2 for analysis and findings. The different growth scenarios dictate how long a precinct takes to become fully developed.

It is important to note that the current authority strategies have been based on the minimum ILP densities (62,824). Under a high density scenario (92,533) analysis was also undertaken to determine when surplus capacity in the networks (if available) would begin to be used, and then when additional infrastructure may be needed.

4.2 Analysis of Current Strategy (LGLD, HGLD & HGHD)

The current strategy for delivery of infrastructure as provided by the service authorities was tested against the three scenarios as outlined in Section 4.1. Some general observations included that in a Low Growth Scenario, there is a drawn out uptake of dwellings, with an apparent oversupply in the next 10 years. This is highlighted by the high practical supply limit and low distributed market demand in each precinct. In contrast, under a High Growth Scenario, there are instances where capacity is exhausted and development within a precinct can no longer be supported. The different issues are explored in more detail in the following sections.

4.2.1 Appropriate Infrastructure Delivery in Precincts

As documented in Section 2.1, many of the precincts in the NWPLRA are currently, or are about to commence lot production and have an appropriate infrastructure delivery plan. These include the 'developer driven' precincts of:

- Colebee;
- Marsden Park Industrial;
- Marsden Park; and
- Marsden Park North.

And the authority serviced precincts of:

- Alex Avenue;
- Area 20;
- Box Hill and Box Hill Industrial;
- North Kellyville;
- Riverstone; and
- Schofields.

The remaining precincts are due to be rezoned imminently or not yet released for planning noting infrastructure is still generally flexible within these precincts.

4.2.2 Stalled Development Within Precincts

Under a high growth scenario, some precincts suffer from stalled lot delivery after initial development has commenced. Lot production in the Riverstone East precinct, for example, is reduced to a maximum of approximately 70 lots in 2021 due to a lack of service capacity. These Precincts include:

- Riverstone East;
- Schofields West; and
- Vineyard.

It should be noted that the rezoning of Riverstone East is proposed to be staged to partially account for this lag in servicing infrastructure.

4.2.3 Oversupply of Infrastructure Within Precincts

The High and Low Growth scenarios both have instances where infrastructure is proposed to be provided before the market shows an obvious need for it. As an example, sewer upgrade works scheduled for delivery in 2018 (indicative - funding not yet committed) currently in Schofields could be delayed until 2028 and 2020 in low and high growth scenarios respectively. Depending on the growth scenario, the following precincts could be considered to be oversupplied:

- Box Hill and Box Hill Industrial;
- Riverstone; and
- Schofields.

4.2.4 Late Rezoning of Precincts

The Shanes Park precinct was originally earmarked for dwelling supply in 2043. However there is an apparent shortfall in supply across the overall Growth Centre much earlier than this. There is opportunity to bring this precinct forward to assist in meeting demand. Shanes Park is the only precinct subject to these conditions.

4.2.5 Early Rezoning of Precincts

When analysing a low growth scenario, some infrastructure being delivered to precincts not yet rezoned pushes supply ahead of demand. Whilst this could be a positive driver for housing affordability, it also represents an opportunity for these funds to be spent in a more focused manner. Precincts affected in this manner include:

- West Schofields; and
- Vineyard.

4.3 Coordinated Infrastructure Strategy – (LGLD, HGLD)

There is no requirement to alter the servicing strategies in many of the precincts. However, some of the precincts contain key pieces of infrastructure that can be brought forward to prevent lags in development, or delayed to prioritise infrastructure expenditure where demand is being met.

4.3.1 Riverstone, Riverstone East & Box Hill/Box Hill Industrial

These precincts are currently supplied by the existing Riverstone zone substation, which has limited capacity and cannot support continued development. Initial development can be supplied from the Schofields (infrastructure item no. 25) and Mungerie Park zone substations (infrastructure item no. 24) for the Riverstone (approx. 850 lots), Riverstone East (1,400 lots) and Box Hill/ Box Hill Industrial (1,600 lots) precincts respectively. Network augmentations proposed for 2018 will see an increase in capacity for Riverstone and Box Hill/Box Hill Industrial and is expected to support development for the next 7-8 years under a high growth scenario and longer for a low growth scenario. The Riverstone East precinct however, will exhaust capacity generally by 2021 in a High Growth scenario.

The new Riverstone East/ Box Hill zone substation (infrastructure item no. 22) and North Box Hill Zone substation (infrastructure item no. 23) are required to be commissioned to supply the ultimate capacity in these three precincts though is currently proposed for delivery in 2022. It is therefore an option to accelerate the delivery of these zone substations to be commissioned in some capacity by 2020 in the high growth scenario or delay their need until 2028 in the low growth scenario.

4.3.2 West Schofields

The ultimate Marsden Park zone substation (infrastructure item no. 20) anticipated to be commissioned by approximately 2021 as part of the Marsden Park precinct, led by Stockland Development, will supply the entire West Schofields precinct with power. Some trunk water main extensions are proposed for 2019. Sydney Water has no plans for sewer while the precinct is not released for planning, and currently anticipates delivery in 2036 (indicative - funding not yet committed) by providing SPS B and associated gravity and rising mains.

Analysis of the market demand across the NWPLRA shows no initial need to activate this precinct as sufficient capacity exists elsewhere to accommodate the market demand. As development progresses and precincts reach capacity, new areas need to be released and rezoned to ensure market demand is continued to be achieved. This provides an opportunity to optimise authority expenditure and focus development to meet market demand without over or undersupplying the market. This may be achieved by a combination of accelerating and delaying the delivery of the sewer and water infrastructure in the West Schofields precinct, with SPS B and associated mains being the critical item to unlock the precinct. The minor water main upgrades can be delayed to suit the release of the precinct as needed, in line with the delivery of SPS B. Under a high growth scenario roll-out could begin in 2027, by accelerating SPS B from the current anticipated delivery date of 2036, whereas under a low growth scenario it could be delayed until 2039.

4.3.3 Vineyard

Electrical supply is due to be brought in to the precinct at different times to suit development in line with the commissioning of the North Box Hill and Riverstone East/ Box Hill zone substations. With the exception of relatively minor initial supply (400 lots) from the Riverstone zone substation, and network augmentations providing some additional capacity in the Vineyard precinct (2018). The commissioning of the new Riverstone East/ Box Hill zone substation in 2022 will provide the remainder of the ultimate electrical supply. For sewer, approximately 50 percent of the precinct was serviced by the package 2&3A sewer works (completed in early 2015) and a large portion of future developments within the precinct able to be supported by the existing water reticulation network.

As the current sewer works provide capacity to the southern area of the precinct, future sewer and water works will unlock the remainder of the greater northern portion of the site in two phases. The first phase includes the Vineyard North sewer pump station and rising main and is proposed for completion in 2018 (indicative - funding not yet committed). This will unlock the central northern area of the precinct. The

second phase includes the Vineyard West sewer pump station and rising main and is proposed for completion in 2020 (indicative - funding not yet committed).

Similar to West Schofields, the planned lot delivery at Vineyard provides an apparent excess supply. In this instance the delivery of infrastructure can be pushed back to when supply is required

Therefore there may be an opportunity to delay the Vineyard North sewer pump station and rising main from 2018 to 2041 in a low growth scenario and 2030 in a high growth scenario. And the Vineyard West sewer pump station and rising main to be delayed from 2020 to 2033 for the high growth scenario and 2043 for the low growth scenario.

4.3.4 Shanes Park

The Shanes Park precinct will have electrical supply by 2021 from the Marsden Park zone substation. As this is not a developer driven precinct it will most likely rely on trunk sewer and water infrastructure to be extended from the Marsden Park infrastructure. These services are not planned to be constructed until approximately 2043 for water and 2036 for sewer. Under a low growth scenario it is proposed to delay both services until 2044 to optimise capital expenditure as the market does not show an apparent need for this precinct. However, under a high growth scenario, their delivery could be brought forward to 2032 to accelerate the precinct and fill in an undersupply in the market.

4.3.5 Authority Comments

Both Sydney Water and Endeavour Energy have outlined that their current strategies for proposed infrastructure and staging is based on growth projections provided by the DPE, current at the time. The authorities review the servicing strategies periodically.

While it is noted that the options of accelerating infrastructure would need a detailed assessment of the actual market uptake in the coming years to justify the capital expenditure, the alternative options supplied within this report provide consideration of current and future planned infrastructure and expected progression of precinct development under varying scenarios of growth and density. They should be used as a guide to monitor the market uptake and coordinate capital expenditure across the service authorities.

4.4 Sensitivity Analysis - High Growth High Density (HGHD)

Recent changes in lot size and mix, due to the Housing Diversity Package, affordability, etc. have resulted in dwelling densities considerably higher than those previously estimated. An analysis has been undertaken on both the Low and High Density scenario supplied by AEC on the overall capacity of the infrastructure as well as an estimate of when the capacity of the infrastructure is reached.

The testing undertaken in section 4.3 and shown in detail in Appendix D illustrates the critical infrastructure capacities as well as the anticipated point in time where that capacity is reached. The table below shows the results of the capacity assessment for the low dwelling yield scenario. The results indicated that three

(3) sewer pump stations and the Rouse Hill Waste Water Treatment Plant have more dwellings in their service catchment than the apparent capacity of the infrastructure. No issues were observed in the electrical supply for the low growth scenario.

Table 4.1: Low Density Scenario – Sydney Water Capacity Assessment

Infrastructure Number	Infrastructure Item	Sydney Water Capacity (Dwellings)	Low Density Yield (Dwellings)	Shortfall (Dwellings)	Capacity Reached (Year)
13	SPS 1107	2960	3410	451	2040
11	SPS 1022	1540	1774	234	2041
12	SPS 1139	3143	3359	215	2045
18	Rouse Hill WWTP	7643	8543	900	2041

The same assessment was undertaken on the high dwelling yield scenario found similar issues, as is shown below. The higher load on infrastructure has resulted in considerably more items requiring increased capacity. These include existing pieces of infrastructure that will need to be upgraded, as well as items that are not yet constructed. Service Authorities should consider whether all new infrastructure be designed to accommodate either the high density scenario from the onset, or that they are able to be staged in a manner that can eventually cater for the high densities.

It should be noted that no analysis was undertaken on the capacity of the water supply network. A more detailed modelling assessment may need to be undertaken in relation to flow capacity and pressure with the increased dwelling yield to determine additional infrastructure required.

Table 4.2: High Density Scenario – Sydney Water Capacity Assessment

Infrastructure Number	Infrastructure Item	Sydney Water Capacity (Dwellings)	High Density Yield (Dwellings)	Shortfall (Dwellings)	Capacity Reached (Year)
1	SPS W	654	915	261	2017
2	SPS E	1520	2127	609	2026
3	SPS 1154	26,601	35419	8,818	2038
4	PAP C	2300	3917	1617	2021
5	PAP G	9281	12439	3158	2031
6	SPS B	3,278	3,968	690	2040
9	PAP F/1160	5276	6737	1461	2045
10	SPS A	1679	2305	626	2048
11	SPS 1022	1540	2649	1109	2029
12	SPS 1139	3143	6143	3000	2024
13	SPS 1107	2960	5091	2131	2028
14	SPS 0564	31231	42230	10999	2033
17	Riverstone WWTP	62,523	77648	15,125	2036
18	Rouse Hill WWTP	7643	13884	6241	2026

*Dates are indicative and are to be determined by the developer based on their development program

Table 4.3: High Density Scenario – Electrical Capacity Assessment

Infrastructure Number	Infrastructure Item	Planned Electrical Capacity (Dwellings)	High Density Yield (Dwellings)	Shortfall (Dwellings)	Capacity Reached (Year)
20	Marsden Park ZS	18489	26797	8308	2034
21	Riverstone ZS	10546	15729	5183	2038
22	Riverstone East / Box Hill ZS	10589	12460	1871	2033
23	North Box Hill ZS	5366	6710	1344	2039
24	Mungerie Park ZS	8804	13141	4337	2029
25	Schofields ZS	12861	15431	2570	2036

Although the high dwelling yield analysis has highlighted a number of upgrades and augmentations required, it is possible that changes in demand profiles, supply technologies and/or the regulatory environment may result in increased efficiencies or reduced demand per dwelling. This could mean that the existing infrastructure is suitable in its current/planned form. It is therefore recommended that the services infrastructure strategy be reviewed regularly to monitor the accuracy of the concepts and assumptions used in this analysis.

5 References

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