SERVICES INFRASTRUCTURE REPORT

WESLEY MISSION FRANK VICKERY VILLAGE

MULTIDISCIPLINARY SERVICES

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2 EXECUTIVE SUMMARY

This services infrastructure report, complied by JHA Consulting Engineers, identifies and summarises the key components of the hydraulic, electrical and communications services of this project.

JHA, in developing the report, endeavour to provide value added advice, providing suitable solutions to cost benefits and buildability, highlight constraints, and other requirements of the project.

This report is a holistic and dynamic document which provides an assessment of the appropriate infrastructure by which all stakeholders can review JHA's considerations and provide feedback for further discussion and resolution. After all such feedback is received; an "agreed solution" will be adopted for design development and costing.

2.1 ELECTRICAL SERVICES

Four substations have been proposed for the overall masterplan of this site, where a preliminary maximum demand of 3316 kVA has been calculated. It is recommended an Application for Connection should be submitted in the short to immediate term to ascertain the feasibility of this project. As each stage is commissioned and fully operable, the energy consumption can be monitored to re-access the maximum demand. The number of substations may change as a result of this.

Back-feeding of the existing Independent Living Units and Residential Aged Care Facilities are required to decommission the existing substation, S.9056. This has been proposed to be completed during Stage 1 works.

Two existing NBN lead-ins from Bellingara Road will need to be amended as the proposed building envelopes from the master plan overlap with these connections. A new NBN lead-in route has been proposed to enter via Wordsworth Place. An application to the Commercial Works Team is recommended in the short term to complete these works prior to Stage 1.

2.2 HYDRAULIC SERVICES

The existing site is serviced with connections into Sydney Waters sewer and water mains (potable water and fire hydrant), council stormwater system, and Jemena natural gas system.

It is proposed that the existing water supply connected to the Bellingara Road water main be retained, as well as a new fire hydrant water supply extended from this authority main to serve the masterplan. It is anticipated that the authority water supply will be able to service the proposed loads within the masterplan, without the need for authority upgrades.

The fire hydrant system is proposed to consist of a fire hydrant booster assembly and a site wide fire hydrant pump set to be located fronting Bellingara Road. The fire hydrant system is proposed to be served off a fire hydrant ring main system which will be developed in stages, to ensure a single pump can be maintained to service operational stages, as well as the proposed future stages.

To service the masterplan with natural gas, it is proposed for a new natural gas connection to be made on the 40mm 210kPa gas main on Bellingara Road, and to decommission the existing service on Wordsworth Place. It is anticipated that the 210kPa gas supply will be able to service the gas requirements of the proposed masterplan.

Preliminary calculations on the proposed sewer loads have determined that the existing 150mm VC sewer connections are inadequate to serve the proposed masterplan. As a result, it is anticipated that major works will be required to extend a new 225mm sewer service from the Sydney Water network, to serve the development.

3 ELECTRICAL SERVICES

3.1 INTRODUCTION

The following electrical service systems have been investigated within this report:

- Electrical Power Supply,
- Maximum Demand,
- Substations,
- Main Switchboards,
- Distribution Boards, and
- Communications.

3.2 CODES AND STANDARDS

Australian Standards	Lighting for Roads & Public Spaces	AS/NZS 1158
	Fire Detection, Warning, Control & Intercom Systems	AS 1670
	Interior and work place lighting	AS/NZS 1680
	Emergency evacuation lighting for buildings – System design, installation and operation	AS/NZS 2293
	Electrical Installation – Wiring Rules	AS/NZS 3000
	Electrical Installations – Classification of the Fire & Mechanical Performance of Wiring Systems Elements	AS/NZS 3013
	Low Voltage Switchgear and control gear general rules	AS/NZS 61439
	Information technology - Generic cabling for customer premises	AS/NZS 11801
	Requirements for customer cabling products	AS/CA S008
	Installation requirements for customer cabling (Wiring Rules)	AS/CA S009
Authorities	National Construction Code	
	New South Wales Service and Installation Rules	
	Ausnet	
	Nation Broadband Network	
	Telstra	

3.3 ELECTRICAL POWER SUPPLY

3.3.1 EXISTING

From the existing Dial Before You Dig (DBYD) information and site observations, it appears that the existing Frank Vickery Village site is served by one on site kiosk substation. The Ausgrid KE kiosk substation S.9056 (Frank Vickery Village) is located adjacent to Vickery Drive near the R.E. Tebbutt Wing Building. The substation has two low voltage supplies known as "No.1 Supply" and No.2 Supply" and appears to be impacted by the Stage 1B works. Stage 1B will impact the existing cable easement.

Existing current and spare capacities is not known at this time.

Based on the DBYD information and site inspection, an existing 100A LV supply to an Independent Living Unit (ILU) opposite 13 Bellingara Road, Sylvania NSW 2224, is the only other supply into the premises. This is supplied via Ausgrid distribution pole CR-08636 and be impacted by Stage 1A works.

Cable Easement to the East and Right of Way to the West of the Substation

Photo of existing Substation

3.3.2 PROPOSED STAGE 1

To cater for the temporary builders' supply and ultimate Stage 1 load, two new 1000 kVA KL kiosk substations will be required. These substations are proposed to be located along Bellingara Road, with the positioning of each substation subject to the most suitable location, maximum demand, and voltage drop.

The proposal of any substation to be located along Port Hacking Road will not be suitable as there is no high voltage cabling along that road.

Should a site fronting Bellingara Road be selected, a cable easement and right of way will not be required. A substation easement of 5.3m x 3.3m will only be required. Selecting a substation site on the frontage allows for connection to the existing Ausgrid HV (high voltage) underground cable running along the frontage in the footway.

It is recommended that a connection application is submitted to Ausgrid as soon as possible to start the process of proposing two substations and the decommissioning of the existing substation. The cost of the connection application will be approximately $500.

Ausgrid will not allow the relocation of the existing substation due to current network standards and age of the existing substation. They will require the establishment of a new substation in a more suitable location for the development and then the decommissioning of the existing substation.

The existing substation easement, cable easement and ROW will be relinquished by Ausgrid once the substation is decommissioned should they not be required.

Refer to the attachment Appendix A for the proposed masterplan substation layout. Two substations are shown along Bellingara Road; Substation No.1 advised to feed Building A – Residential Aged Care Facility (RACF) and Substation No.2 to feed the remaining buildings proposed for Stage 1.

To decommission the existing substation, the existing ILUs and RACF will need to be back-fed from the new substations. Substation No.1 is proposed to back feed the main switchboard (MSB) feeding the ILUs while Substation No.2 is advised to back feed the existing RACF MSB. The existing substation shall be decommissioned after all loads have been relegated to the proposed substations.

3.3.3 PROPOSED STAGE 2

Stage 2 foresees the proposal of Buildings C2. An additional substation has been proposed to cater for these additional buildings.

The location of Substation No.3 is towards the centre of the Village. A cable easement with a minimum width of two meters and a ROW will need to be liaised and established with the local supply authority for approval.

The cable easement shown in the attachment is from Bellingara Road as that is the only high voltage cabling surrounding the Village. The ROW for trucks to deliver the kiosk substation and access for supply authority personnel is proposed to enter the new road via Port Hacking Road.

3.3.4 PROPOSED STAGE 3

Stage 3 anticipates two new buildings, Building E1, E2 and E3. The existing substation introduced in Stage 2 has been calculated to have sufficient spare capacity to cater for the Stage 3 buildings.

3.3.5 PROPOSED STAGE 4

Stage 4 expects four new buildings, D1, D2, D3, and D4. A new substation will be required to accommodate these residencies.

Similarly to Substation No.3, the proposed Substation No.4 is recommended to be located close to the buildings supplied by the substation.

The cable easement has been proposed to be extended from Substation No.3 to avoid creating a new easement from Bellingara Road. Creating a new cable easement from Bellingara Road may have implications along that private road as it may be well developed by the time Stage 4 begins construction.

The ROW access path may continue from the entrance via Port Hacking Road.

3.3.6 CONSTRAINTS

- Application for Connection to Ausgrid recommended to be submitted in the early stages for project feasibility.
- Back-feeding of the existing ILUs and RACF as these existing buildings are retained until the later stages.
- Cable easements shall be coordinated with the architect
- ROW required to be liaised with the supply authority for approval (refer to Substation Constraints Section below).
- The proposed locations and time of installation of these substations will need to be coordinated with the architect and relevant authorities to ensure the substations have been installed and energized prior to commissioning of each stage.
- Council may require the street lighting surrounding the Village to be replaced with new due to upgrading of network.

3.4 MAXIMUM DEMAND

The proposed maximum demand for the masterplan is shown in the table below. With JHAs experience in residential projects, a maximum demand load of 5 kVA has been allowed for each ILU. The VA per square meter rates as per AS3000 was used to complete a preliminary maximum demand for the RACF building.

Proposed Masterplan Maximum Demand

Master Plan	AREA (m2)	Va/sqm	KVA	Amps/Phase
Stage 1				
RACF	12544.0	75	940.8	1359.5
	Number of ILUs	**Va/ILU**	**KVA**	**Amps/Phase**
Building B1	31	5	155.0	224.0
Building B3	25	5	125.0	180.6
Building B4	25	5	125.0	180.6
Building C1	29	5	145.0	209.5
Building C3	20	5	100.0	144.5
Stage 2				
Building C2	31	5	155.0	224.0
Building E3	57	5	285.0	411.8
Stage 3				
Building E1	64	5	320.0	462.4
Building E2	57	5	285.0	411.8
Stage 4				
Building D1	48	5	240.0	346.8
Building D2	48	5	240.0	346.8
Building D3	40	5	200.0	289.0
Total			**3315.80**	**KVA**
Maximum Demand			**4805.51**	**Amps /Phase**

The overall maximum demand is approximately 4806 Amps per phase.

Stage 1 equates to a total of approximately 1591 kVA, thus requiring two 1000 kVA substations for Stage 1.

Stage 2 equals a total of 440 kVA. An additional 1000 kVA substation shall be proposed.

Stage 3 totals 605 kVA. The previous three substations are calculated to have the spare capacity to supply Stage 3.

Stage 4 has a maximum demand of 680 kVA. An additional 1000 kVA substation is calculated to serve the proposed buildings.

The proposal of four 1000 kVA substation for the above maximum demand will leave a spare capacity of approximately 684 kVA for the community hub and future upgrades.

The existing maximum demand of the site is currently un-known at the time of writing.

3.5 MAIN SWITCHBOARD

With the installation of each substation, a new MSB will be required to distribute the electrical supply to each building. All new substations are required to be connected to an MSB to be energised by the supply authority. External MSBs for this project are recommended for ease of access. This will need to be coordinated with the architect to achieve the closest possible proximity to the electrical supply (substation) to reduce voltage drop and reduce the size of submains and thus reducing costs.

If located in a switch room, the room shall have an FRL (fire rating level) of -/120/120 as per NCC and have two egress doors at opposite ends to meet the requirements of AS3000.

The MSB as a minimum shall be as follows:

- Form 3Bih for non-essential bus and form 3B for (life) safety services bus.
- Sized to accommodate the maximum transformer capacity.
- Provided with surge protection.
- 20% spare mounting capacity.
- Allow for future expansion.
- IP42 for indoor or IP65 for external boards
- Provision for temporary generator connection

3.6 DISTRIBUTION BOARDS

All electrical distribution boards (DBs) will be proposed to be located within each building. Multiple switchboards may be required dependant on size and number of levels of each building. It is typical of electrical DBs to be located within dedicated switchboard cupboards.

The dedicated DB cupboard enclosures are proposed to have lockable-hinged doors, be fitted with smoke seals, and constructed from non-combustible materials to meet the requirements of the NCC.

DBs as a minimum shall be as follows:

- Form 2b construction
- Chassis sized to the maximum demand of the board.
- Equipped with surge protection as required.
- 30% spare mounting capacity
- Hinged escutcheon planes.
- Gasketed doors with min 120-degree door swings.
- IP42
- Provision for metering.

Sample image of typical distribution board (with escutcheon panel removed for clarity)

3.7 SUBSTATION CONSTRAINTS

Kiosk substations are not to be installed within buildings, on building roofs, in chambers or covered parking areas or garages.

A clear six meters must be maintained between the kiosk housing and any building air intake or exhaust openings. This applies irrespective of whether the building ducted ventilation system is mechanical or natural and irrespective of whether or not fire dampers are installed in the ducts. Note: Ausgrid does not regard openable windows that provide natural ventilation to one building compartment only, as a building ventilation system opening.

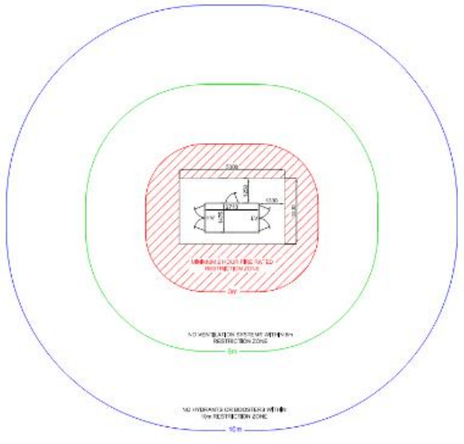
A clear three meters must be maintained between the kiosk housing and any non-fire rated option of a building. Any option of a building within three meters in any direction from the substation housing is required to have a FRL of not less than 120/120/120.

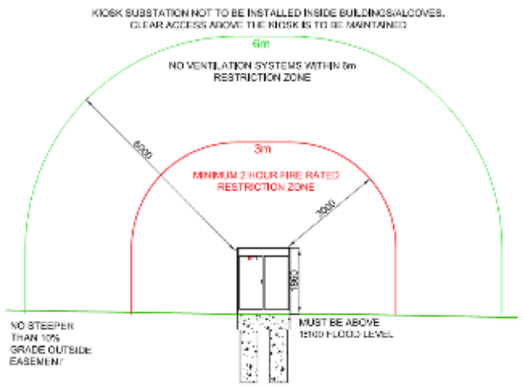
A clear three meters must be maintained between the kiosk housing and any openable or fixed window(s) or glass blockwork or similar, irrespective of their fire rating, unless they are sheltered by a non-ignitable blasting resisting barrier.

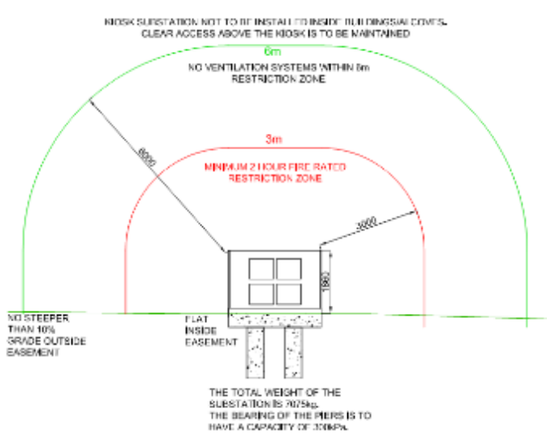
A clear three meters must be maintained between the substation housing and any gas meter, regulator, or exposed gas pipe work, unless they are protected by a non-ignitable blast-resisting barrier.

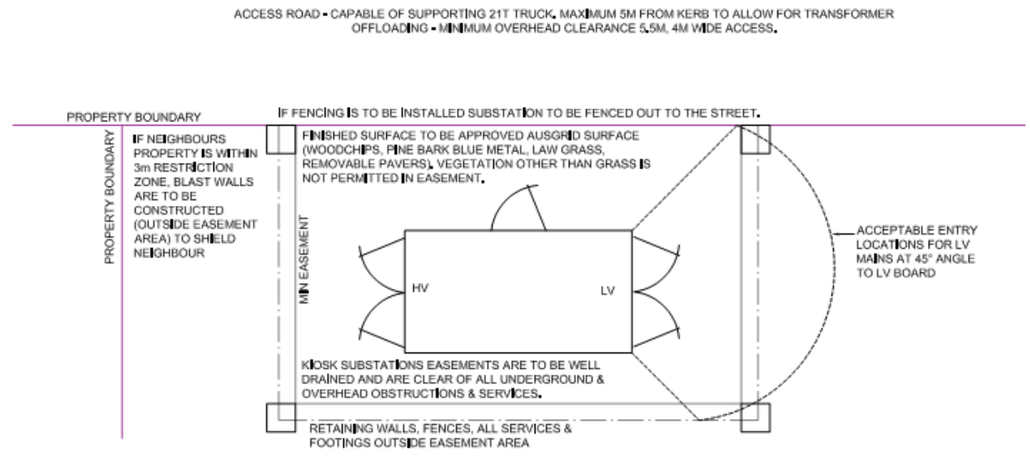
A clear ten meters must be maintained between the substation and external fire hydrants or booster assemblies.

The kiosk substation is to be located at certain minimum distance from communications pits & MEN earthed objects. The minimum separation to be confirmed after conducting an earthing design - subject to Ausgrid approval.









Substation Access

Kiosk substation must have unimpeded access for Ausgrid personnel and vehicles, directly from a public street, for 24 hours per day, seven days per week.

Access from the public road to the substation site must not be fenced or enclosed, unless approval is given in writing by Ausgrid and the conditions listed in the approval are complied with on an ongoing basis by the site owner / customer.

Where the substation easement is not sited along street frontage, the following is required:

Right of carriageway

A heavy truck with a vehicle-mounted crane is needed to install or remove the kiosk substation and equipment. The surface of the right of carriageway should be capable of withstanding a pear-axle group or outrigger loading of 21 tonnes, with the loading on any one pad being up to 15 tonnes.

Access routes must be suitable under all weather conditions and constructed to withstand the loading. The access route should be a minimum of 4.5m wide, have a minimum of four-meter headroom and be continuous from the property boundary to the substation site.

Cable Easement

A cable easement is generally clear of other construction and is required for the installation and future maintenance of mains associated with substations. The width of a cable easement is normally 4.5m for underground **c**ables. This can be reduced to two meters where only one or two cables are installed, and are within or adjacent to ground permitted access to the cables (e.g. Right of carriageway)

Substation Site

It is essential to locate kiosk substations in areas that are well drained and are clear of underground or overhead obstructions.

The finished surface of the substation easement is to be one of the following: woodchips, pine bark blue metal, law grass, removable pavers, or decorative gravel to a depth of 120mm.

Trees shrubs or plants, other than law grass are not allowed in substation easement. Watering systems must not be installed within the substation easement or designated personnel routes.

Any screening vegetation must be outside the easement and must not interfere with access to the substation for both personnel and equipment.

Substation easement area to be made flat and batter external to easement to be no greater than 1:4.

Substation site must be above 1 in 100-year (or less) flood level.

Substation Piers

Refer to Ausgrid Drawing 151572 for standard pier arrangement.

The total weight of the substation is 7075kg. The bearing of the piers is to have a capacity of 300kpa.

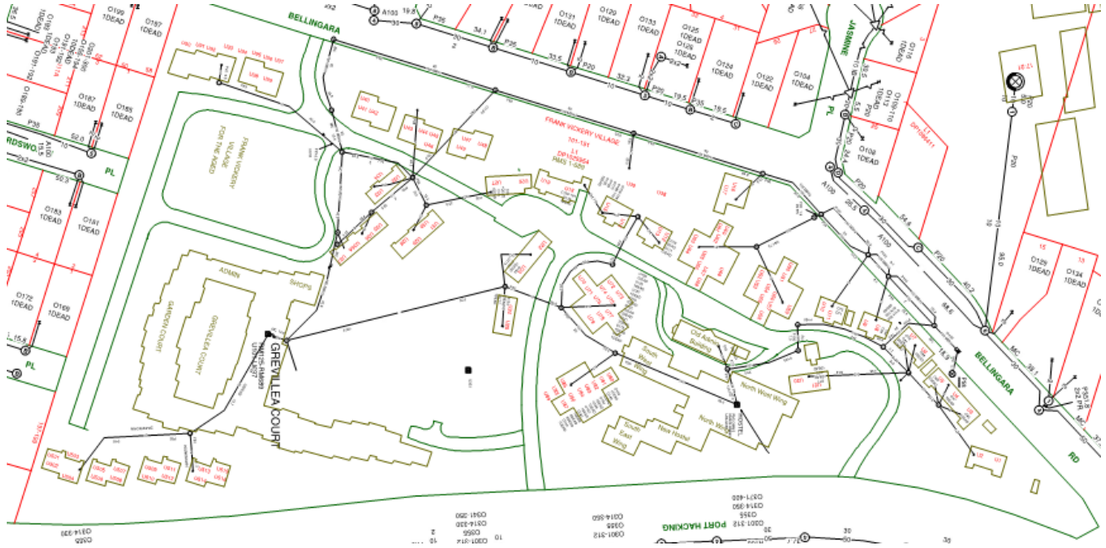
If standard piers do not satisfy structural requirement set out in 151572 a non-standard structural design and certification will be required by a structural engineer.

3.8 COMMUNICATIONS

A DBYD (Dial Before You Dig) application was submitted to determine underground cabling systems. The Telstra and NBNCo services are shown below.

3.8.1 TELSTRA

The existing copper network from Telstra reticulates into most of the buildings throughout the village. The copper network will need to be altered to make way for the new NBN network.

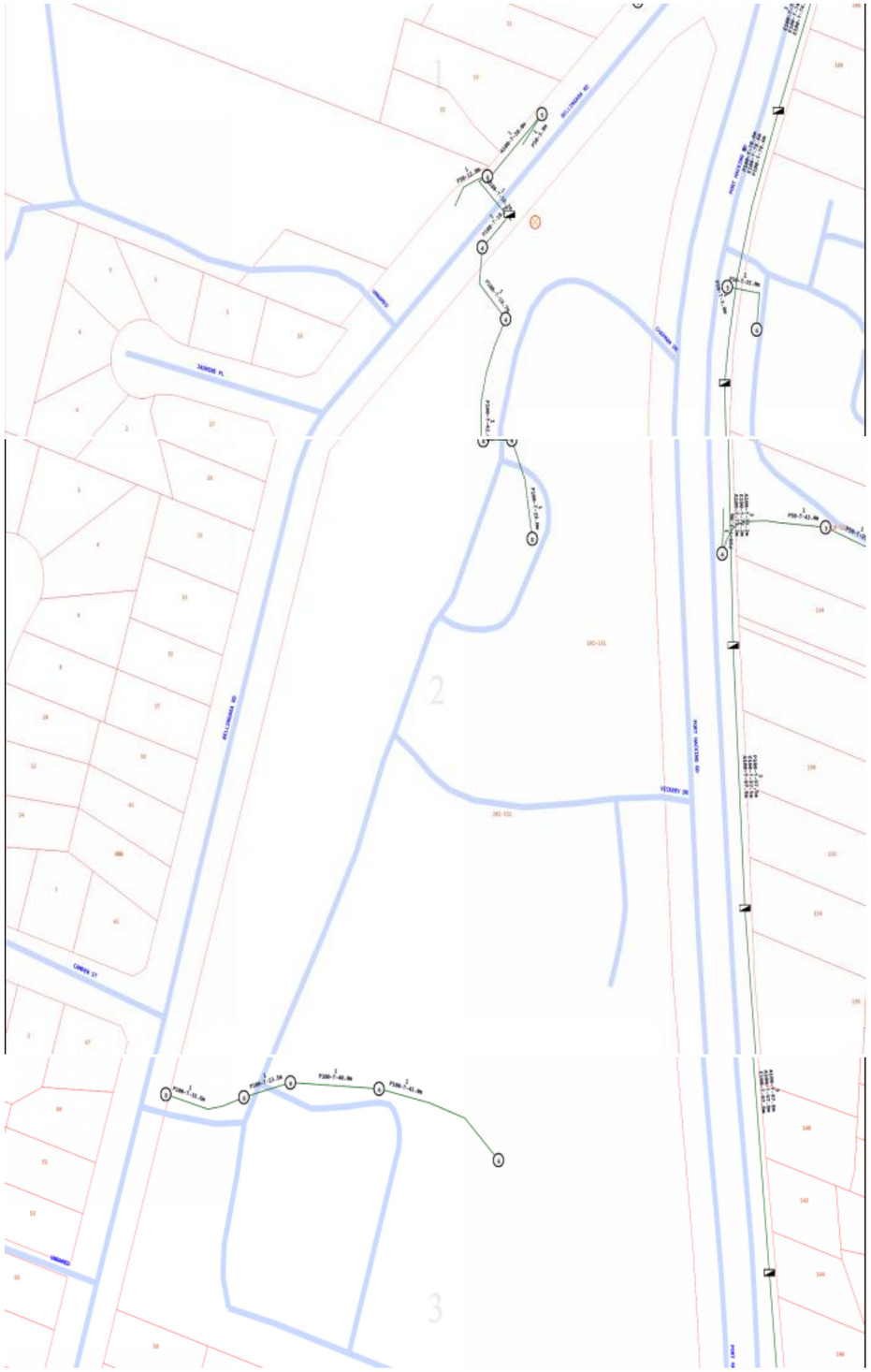


DBYD - Telstra Copper Network Site Plan

The existing copper network are shown via the black lines. Liaising with Telstra will not be required to alter the existing copper network as NBNCo use Telstra pits and cables for their network.

3.8.2 NBNCO

The NBN network has recently been installed at the village, with two separate lead-in locations along Bellingara Rd (refer to image below). These lead-ins will need to be amended to avoid clashing with the proposed building envelopes.



DBYD – NBN Site Plan

NBN Lead-in Overlapping with Proposed Buildings

The new proposed lead-in enters via Wordsworth Place from an existing Telstra pit. The incoming connection will then branch out to all buildings via a pit and pipe system, using NBN approved pits. Typically, a pit will be required at each junction and prior to entering a building.

The NBN incoming lead-in cabling will typically connect to an FDT (Fibre Distribution Terminal) and/or a CTL (Cable Transition Location) located within each building where it will distribute the incoming connection into each ILU. This equipment is typically located within communications risers in each building, allowing the NBN cabling up to the ILUs on the top floor.

An application to the NBN Commercial Works Team is recommended to be submitted in the short term to design, build, and commission a new NBN lead-in prior to Stage 1 works. This is crucial as the existing NBN lead-ins are located in the proposed Stage 1 zone and will be made redundant. The NBN Commercial works team will provide a cost estimate for the proposed works, and will carry out the tasks if accepted.

The application fee to NBN Commercial Works Team varies between $500 - $1100 dependant on size and complexity of the proposed works.

3.8.3 CONSTRAINTS

- The new NBN lead-in cabling will need to be up and running prior to Stage 1 works. An application to the NBN Commercial Works Team is recommended to be submitted in the short term.

The existing copper cabling will need to be altered or made redundant to make way for the new NBN connection.

4 HYDRAULIC SERVICES

4.1 INTRODUCTION

The following hydraulic systems have been investigated within this report:

- Sewer plumbing and drainage system;
- Roof drainage system;
- Potable hot and cold-water system;
- Natural gas system;
- Fire Hydrant System; and
- Fire Hose Reels.

4.2 CODES, STANDARDS & GUIDELINES

4.2.1 RELEVANT CODES & STANDARDS

All new designs solutions shall conform to the relevant Australian Codes and Standards, including to, but not limited to the following

National Construction Code (NCC) – Latest Version;

NCC Section J	Energy Efficiency – Part J, Sections 5.4, J6.6 & 7.2
AS 2419.1 - 2005	Fire Hydrant Installations
AS 2441 - 2005	Installation of Fire Hose Reels
AS 2444 - 2001	Portable Fire Extinguishers
AS 2941 - 2013	Fixed Fire Protection Installations
AS/NZS 3500.1 - 2015	Part 1 Water Services
AS/NZS 3500.2 – 2015	Part 2 Sanitary Plumbing and Drainage
AS/NZS 3500.3 – 2015	Part 3 Stormwater Drainage
AS/NZS 3500.4 - 2015	Part 4 Heated Water Services
AS 5601 - 2013	Gas Installations

4.3 SEWER PLUMBING AND DRAINAGE SYSTEM

4.3.1 EXISTING

The site sewer system is serviced by two connections into separate Sydney Water sewer mains.

The first service is a 150mm uPVC connection into the South-East corner of the site, connected to the 150mm VC authority service on Port Hacking Road.

The second service is a 150mm uPVC connection into the Southern boundary of the site, connected to the 150mm VC authority service on Tennyson Place.

It is understood that all areas within the existing site are able to discharge through gravity sewer systems to the point of connection into the authority sewer, without the need for sewer pumping systems.

4.3.2 PROPOSED

From initial calculations of the proposed yield of the masterplan, the discharging sewer main from the site will be a 300mm service. As the surrounding Sydney Water sewer infrastructure is only 150mm, major works will be required to be undertaken on the Sydney Water infrastructure.

This initial calculation, based on the latest yield option, has been provided below.

The calculation has been based upon an anticipated fixture unit totals below:

- 1-2 beds - 22 fixture units (1x bathroom group, 1x kitchen sink, 1x washing machine, 1x dishwasher and 1x laundry tub); and
- 3 beds - 28 fixture units (2x bathroom group, 1x kitchen sink, 1x washing machine, 1x dishwasher and 1x laundry tub):

Building	Use	Storeys	1-2bed	3bed	Total fixture units
A	RACF	4	38	0	864
B1	ILU	3 & 1	26	7	607
B2	PARK	0	0	0	28
B3	ILU	3 & 1	22	6	518
B4	ILU	7 & 1	43	11	985
C1	ILU	4 & 1	28	7	651
C2	ILU	4 & 1	27	7	629
C3	ILU	3	12	3	295
D1	ILU	2 & 1	13	3	317
D2	ILU	6 & 1	30	8	696
D3	ILU	4	51	8	1,158
D4	ILU	7 & 1	45	3	1,021
E1	ILU	7 & 1	49	13	1,119
E2	ILU	6 & 1	43	11	985
E3	ILU	7 & 1	76	20	1,720
				Total	**11,593**

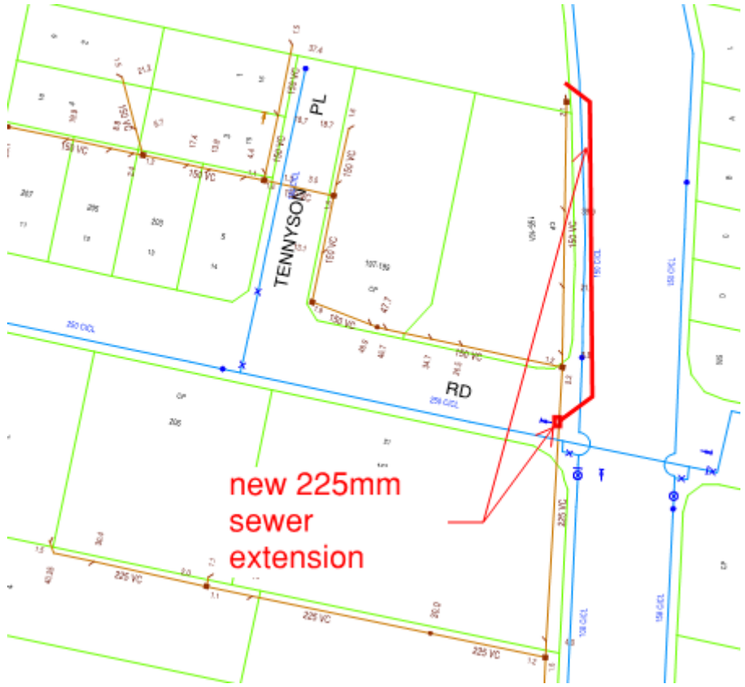
From the Sanitary Plumbing and Drainage Standard (AS 3500.2) table 3.3.1, the total fixture unit count estimated above results in a private sewer main size of 300mm to connect into the Sydney Water sewer main.

Once a DA approval has been received, a Section 73 application to Sydney Water will need to be lodged, in which Sydney Water will assess the existing sewer infrastructure. Sydney Water will then nominate the required infrastructure upgrades (if required) to service the development.

It is understood that the existing DN150 sewer provisions for the site will not be sufficient to serve the development, and it is anticipated that a DN225 reticulation sewer will be required to serve the development. This will require Sydney Water Major works to be conducted to extend a new DN225 sewer service to service the development.

From a staging perspective, it is anticipated that this would need to be extended to serve the stage 1 works as the existing reticulation sewers are nearing capacity.

The figure below illustrates the extent of the anticipated existing sewer drainage extension.



Should fixtures on the Ground/Basement levels not be able to achieve sewer connection via gravity, a sewer pump station/s will be designed into the project to collect and discharge only those fixtures.

4.3.3 GREASE WASTE DRAINAGE

Should grease waste be required for commercial usage, a suitably sized grease arrestor will be provided to treat the greasy wastewater, prior to discharging into the authority sewerage system.

It is assumed pantry and Kitchen/s for resident use are designed to be "Domestic" in nature with no commercial equipment being installed.

Confirmation though is required by the Local Trade Waste Officer/Department on each specific project to confirm that no Grease Arrestor will be required.

Standard DTS pre-treatment devices are required such as in sink basket arrestors to the sink.

4.3.4 MATERIALS

Sewer drainage & sanitary plumbing pipe to be installed in the following materials:

- In ground pipe and fittings to be sewer grade SN8 uPVC pipe, with solvent cement joints.
- Above ground sewer drainage pipe and fittings to be sewer grade SN4 uPVC pipe, with solvent cement joints.

- Hot waste water from dirty utility rooms, plant room, kitchen, and servery rooms to be HDPE with electrofusion joints.
- Rising mains to be PN18 pressure grade PVC. All rising mains shall connect to the boundary trap and protect the building from surcharge via an overflow gully.

4.4 ROOF DRAINAGE SYSTEM

4.4.1 PROPOSED ROOF DRAINAGE SYSTEM

The proposed roof drainage system shall collect the roof water and balcony outlets and reticulate throughout the building to connect to the external connection points as documented by the Civil Engineers connection point for the development.

4.4.2 SIZING

The roof stormwater drainage system will be designed as follows;

- Gravity roof drainage 1 in 100-year ARI
- Box gutter capacity 1 in 100-year ARI
- Eaves gutters capacity 1 in 20-year ARI, TBC by Local requirements in the design phase

4.4.3 MATERIALS

Pipework where concealed in the building extended shall be first quality PVC-U (SWV grade SN8) pipes and fittings with solvent cement welded socketed joints.

Downpipes within the building will be provided with acoustic wrapping in accordance with the acoustic consultant's & clients brief requirements.

4.5 POTABLE COLD WATER SYSTEM

4.5.1 EXISTING

The site potable water system is serviced by two connections into separate Sydney Water water mains. The first service is a 100mm copper supply with an 80mm water meter located on the West boundary adjacent Jasmine place. This service is connected to the 200mm CICL water main on Bellingara Road.

The second service is an 80mm copper service with an 80mm water meter located on the South-East boundary fronting Port Hacking Road. This service is connected to the 150mm CICL water main on Port Hacking Road.

It is understood that the 100mm supply services the potable water supply for the Hostel building, Chapel building and various ILU's, while the 80mm supply services the Terraces, Administration building, Hall and various ILU's

4.5.2 PROPOSED

To service the site masterplan, it is proposed for the existing 100mm copper connection into the 200mm authority water main on Bellingara Road to be retained. It is anticipated that the existing supply size is sufficient to serve the masterplan without the need to upgrade the system. This will be confirmed through a Sydney Water Section 73 application, which should be lodged by a Water Servicing Coordinator once a DA application has been received.

It should be noted that the existing water meter does not currently have a backflow prevention device, and as such, it is recommended that one be installed to meet Sydney Waters requirements.

From the upgraded water meter assembly, the water supply shall extend throughout the site to provide potable cold water to all buildings as necessary. It is anticipated that the multi storey developments will need pumping systems to the incoming water supply, to allow adequate pressure to be provided to all fixtures.

The design criteria of the water pressure for the masterplan shall be as follows:

Minimum Pressure at Fixture (kPa)	Maximum Pressure at Fixture (kPa)
250.0	500.0

All water consuming appliances, fixtures and fittings should be water efficient, and meet the following WELS ratings (Water Efficiency Labelling Scheme)

- 6 Star WELS tapware (bathrooms)
- 6 Star WELS tapware
- 3 Star WEL showerheads (6.0 – 7.5L/min)
- 4 Stat WELS toilets
- 4.5 Star WELS clothes washing machine
- 5.5 Star WELS dishwashers

4.5.3 METERING

The following water metering strategies shall be adopted:

- Water meters for each new ILU block will be provided in a dedicated water meter cupboard, in an accessible location.
- Water meters to all major plant and equipment, including mechanical services, domestic hot water, commercial kitchens, commercial laundry etc.

4.5.4 SIZING

The following sizing criteria applies to the potable cold-water services:

- The potable cold-water pipework is to be designed to allow for 30% of the residents ensuites to be used simultaneously with the kitchen and laundry in operation (at 100% capacity).
- All copper pipework is to be sized to operate at a maximum velocity of 1.5 m/s.

4.5.5 MATERIALS

Potable water pipe to be installed in the following materials:

- In ground pipe and fittings to be either Silver soldered type "B" Copper, approved polyethylene, PN20 or MDPE pipe with electro fusion joints pipe and fittings. Pipe to be fitted with trace wire and tested for continuity prior to handover. All pipework shall be equal to Vinidex or Iplex.
- Reticulated above ground pipe and fittings to be copper type "B" or Grade 316 stainless steel with press-fit joints. Pipework and fittings shall be equal to Viega or Allmach
- Rough- in pipe and fittings to stud walls to be peroxide-cross linked Polyethylene (PE-Xa), with compression sleeve connections. Pipework and fittings shall be equal to Rehau Rautitan/ Auspex. Within masonry walls, pipe and fittings shall be Silver soldered type "B" Copper pipe and fittings.

4.6 POTABLE HOT WATER SYSTEM

4.6.1 PROPOSED HOT WATER SYSTEM

Centralised gas fired hot water plant shall be provided for the proposed RACF and block of ILU's, set at 65°C to provide potable hot water to all sanitary fixtures as necessary.

Warm water is to be supplied at 40.5 to 43°C, via a thermostatic mixing valve (TMV), to the following areas:

- Showers and basin located in residents ensuites
- Residents kitchen sink
- Residents laundry tub

- Basin located in staff areas
- Any resident accessible fixture

Hot water will be directly supplied at 60°C to sinks and appliances located within areas, which are not accessible by residents or required to be limited in temperature.

All hot water pipes are to be insulated to R0.6 or higher.

4.6.2 METERING

The following water metering strategies shall be adopted:

- Hot water meters for each new ILU block will be provided in a dedicated water meter cupboard, in an accessible location. Locations of cupboards shall allow for a maximum hot water dead leg of not less than 10m

4.6.3 SIZING

The following sizing criteria applies to the hot water services:

- The hot water plant is to be sized to accommodate for a 1-hour period, with the following minimum quantities, over the nominated peak period;
    - Ensuites - 45 litres per resident
    - Residents Kitchens - 2.5 litres per resident
    - Back of house areas to be confirmed based on projects requirements
- The hot and warm water pipework is to be designed to allow for 25% of the residents ensuites to be used simultaneously with the kitchen and laundry operating at 100% full capacity.
- Hot water return pipework is to be sized for a maximum temperature loss of ± 5°C
- The time delay of hot or warm water to any fixture outlet, shall not to exceed 15 seconds.
- All copper pipework is to be sized to operate at a maximum velocity of 1.0 m/s

4.6.4 MATERIALS

Potable hot and warm water pipe to be installed in the following materials:

- Reticulated above ground pipe and fittings to be copper type "B" or Grade 316 stainless steel with press-fit joints, complete with 30mm thick insulation. Pipework and fittings shall be equal to Viega or Allmach
- Rough- in pipe and fittings to be peroxide-cross linked Polyethylene (PE-Xa), with compression sleeve connections. Pipework and fittings shall be equal to Rehau Rautitan/ Auspex.

4.7 NATURAL GAS SYSTEM

4.7.1 EXISTING

The site natural gas system is served by the 32mm 210kPa Jemena natural gas supply located on Woodsworth Place. The service extends to the south of Hawkins Crescent, into the master gas meter and regulator to serve the site.

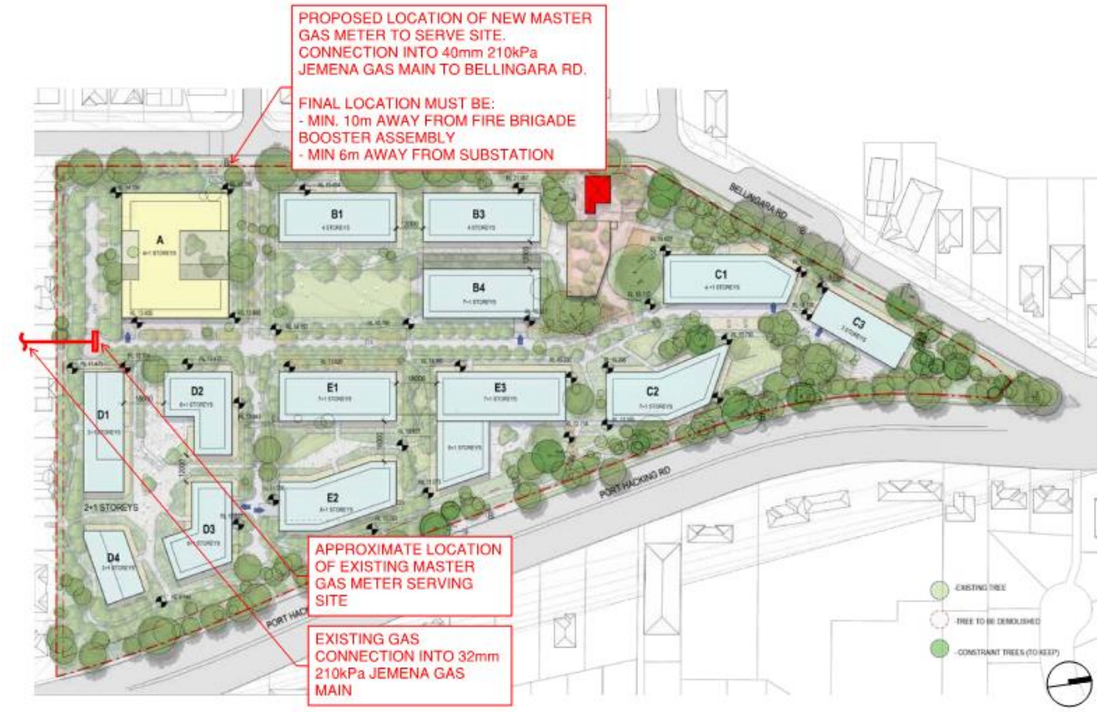
It is understood that the gas system services the buildings plant and equipment, such as mechanical systems and the domestic hot water plant. It is understood that metering is located for each plant to monitor usage

4.7.2 PROPOSED

To service the site masterplan, it is proposed for a new natural gas connection to be made on the 40mm 210kPa Jemena gas main on Bellingara Road, and to decommission the existing service connected to the Wordsworth Place gas main.

It is anticipated that the 210kPa gas service will be able to service the proposed masterplan without the need to upgrade the service. An application to Jemena will need to be prepared during the design phase once all gas appliances and expected usage is determined. Jemena will review the provided information and present the applicant with a gas offer.

The new master gas meter is proposed fronting Bellingara Road, installed to meet Jemena Network Operator rules, and current Australian standards. As such, the location must be coordinated to ensure a minimum 10m away from the fire brigade booster assembly, and a minimum 6m away from electrical substations. The gas supply is to be dropped from 210kPa to 5kPa to service the masterplan



For the proposed masterplan, the new gas supply shall extend to supply the new buildings for the following areas, as required:

- Domestic hot water plant
- Kitchens (where required)
- Mechanical services heating (if required)

4.7.3 METERING

The following water metering strategies shall be adopted:

- Natural gas meters to all major plant and equipment, including mechanical services, domestic hot water, commercial kitchens, commercial laundry etc.

4.7.4 SIZING

The gas pipework is to be designed to allow all gas appliances to be used simultaneously.

4.7.5 MATERIALS

Gas pipe to be installed in the following materials:

- In ground pipe and fittings to be either Silver soldered type "B" Copper, approved polyethylene, PN20 or MDPE pipe with electro fusion joints pipe and fittings. Pipe to be fitted with trace wire and tested for continuity prior to handover. All pipework shall be equal to Vinidex or Iplex.

- Reticulated above ground pipe and fittings to be copper type "B". Pipework and fittings shall be equal to Viega or Allmach
- Rough- in pipe and fittings to stud walls to be peroxide-cross linked Polyethylene (PE-Xa), with compression sleeve connections. Pipework and fittings shall be equal to Rehau Rautitan/ Auspex. Within masonry walls, pipe and fittings shall be Silver soldered type "B" Copper pipe and fittings.

4.8 FIRE HYDRANT SYSTEM

4.8.1 EXISTING

The site fire hydrant system is serviced by the 150mm Sydney Water water main located on Port Hacking Road. The service extends through a 100mm water supply to the fire hydrant booster fronting Port Hacking Road, located on the East Boundary at Entry 1.

The existing fire hydrant system appears to be an old Ordinance 70 system, servicing external hydrants, through a 100mm copper fire supply, using the pressure available from town's main. As the system currently stands, the current Australian Standards are not met.

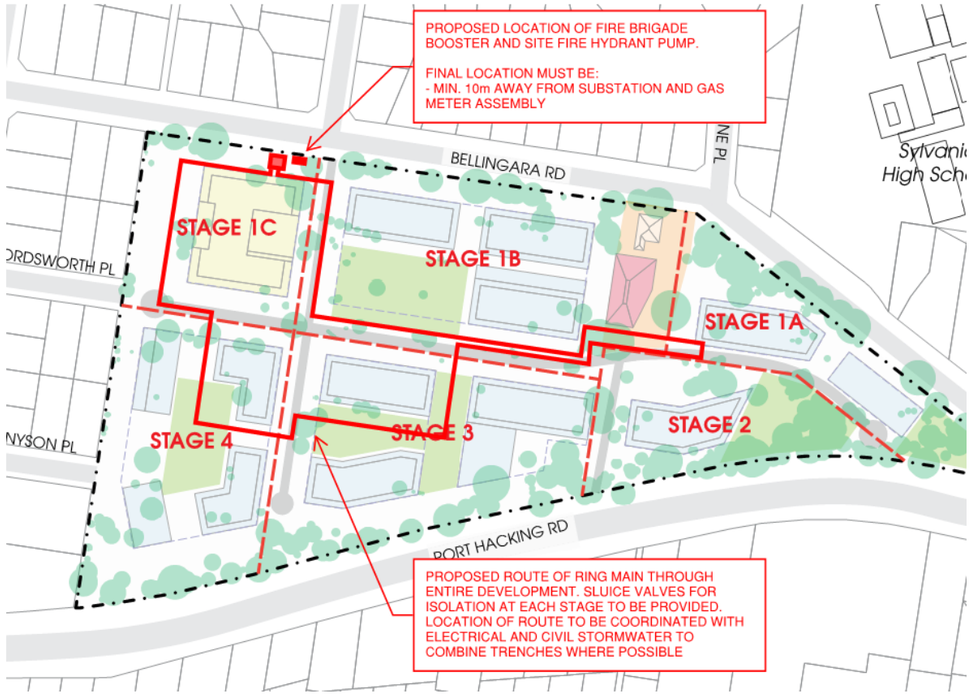
4.8.2 PROPOSED

To service the site masterplan, it is proposed for a new water main connection to be made on the 200mm CICL Sydney Water water main located on Bellingara Road with a new fire hydrant booster assembly to meet current Australian Standards.

The available pressure in the main would not be sufficient to serve the higher levels of the various buildings. As such, a site wide fire hydrant pumpset is proposed to be installed at stage 1, to serve the entire development via a site ring main.

From a staging perspective, capped provisions for future extension of the fire hydrant ring main would be required at strategic points to ensure that the first stage works can be serviced with an operational fire hydrant system, as well as ensure adequate pressures are being provided for the future stages.

The route of the fire hydrant ring main would take into consideration the proposed gas, water, electrical and civil service to realise potential savings in combined trenching. See figure below for proposed location of fire hydrant infrastructure:



Fire Hydrants shall be located externally and also within each fire stair at each level and to provide the required coverage.

The ILUs will be protected with external dual head fire hydrants located not less than 10m of the ILU is protecting and providing hydrant coverage with a 60m length of hose and 10m of hose stream.

4.8.2.1 Fire Hydrant Pipework

Copper (type A-B) or MDPE Red Stripe – In-ground, external to building.

Galvanised Mild Steel – above ground and internal to building.

4.9 FIRE HOSE REELS

Fire Hose reels will be provided to common areas only (non-residential) and

Fire hose reels will be located inside cupboards and within 4m of exits and along the path of travel, the such that a 4m stream of water from the end of the nozzle of a thirty-six-metre fire hose reel will reach all parts of the particular floor area within each building.

Fire hose reels are not be permitted to pass through a fire or smoke door.

4.9.1.1 Fire Hose Reel water supply

Fire hose reels to be served off the potable water supply.

4.9.1.2 Fire Hose Reel Pipework:

Copper – above ground and internal to building.

4.9.1.3 Fire Hose Reel Valves:

Isolating valves and the like shall be in accordance with AS 2441 and AS 1221.

5 APPENDICES

5.1 APPENDIX A – PROPOSED SUBSTATION LOCATIONS