Planning Requirements

Underground Residential Developments (URD)

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TasNetworks
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Tasmanian Networks Pty Ltd

Authorisations

Action	Name and title	Date
Prepared by	B.D'Alton and E.Sherman	Dec 2015
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Review cycle	5 Years	

Responsibilities

This document is the responsibility of the Network Planning Team, Tasmanian Networks Pty Ltd, ABN 24 167 357 299 (hereafter referred to as "TasNetworks").

Please contact the Network Planning Team with any queries or suggestions.

- Implementation All TasNetworks staff and contractors.
- Compliance All group managers.

Record of revisions

Section number	Details

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1 Purpose

The purpose of this document is to provide Developers, who wish to undertake the design and construction of electrical infrastructure in Underground Residential Developments (URD), the information necessary to:

1. understand their responsibility associated with URD design and development of the network;
2. meet TasNetworks planning requirements for the URD electrical supply reticulation; and
3. ensure the ongoing development of the electrical network using 'standardised' arrangements and infrastructure.

The information contained in this document is provided to ensure that Developers understand and are able to comply with the planning requirements of TasNetworks.

2 Scope

The scope of this document is to provide the planning requirements necessary to enable compliance for Developer designed URD's.

3 Applicable Standards

Whilst some standards are explicitly identified in this document the applicable Australian and New Zealand standards are covered in TasNetworks suite of design standards relevant for the design and installation of URD's.

This document should be read in conjunction with the following TasNetworks standards:

1. Distribution Design Standard – Kiosk Substations: Zone R324108
2. Distribution Design Standard – Public Lighting: Zone R350847
3. Distribution Design Standard – Underground Cable: Zone R347411
4. Underground Cable and Design Construction Standard: Zone DS D UG 01
5. Drawing Drafting Standards(TBC).
6. TasNetworks Service and Installation Rules DS I CA 01

4 Background

Historically TasNetworks Pty Ltd (TasNetworks), and before that Aurora Energy Pty Ltd, undertook all development planning, detailed designs and electrical infrastructure construction works for URD's. With the advent of the 'Customer Choice' framework, Developers now have the option to undertake some or all of these activities. Under this framework, the Developer will transfer ownership of all network assets associated with the URD to TasNetworks at the completion of the works.

TasNetworks will retain the responsibility for the quality of electrical power to customers at each point of connection, and the ongoing life cycle costs associated with the installed infrastructure including maintenance, fault repair, upgrade and end of life renewal. To fulfil these obligations it is important that the development of the electrical system for URD's is not compromised by:

- inadequate design configuration and layout;
- comprise of sub-optimally rated infrastructure; or
- prevent economically optimal development of future known or unknown URD stages.

5 URD Development Process

The following sections assume a completed connection application has been submitted by the Developer, and that the Developer has indicated that the design of their development will be undertaken externally.

5.1 Application and Design

The development process for the application, design, installation and transfer of URDs is covered in *Customer Choice Framework*. Developers must refer to this framework for the progression path between the various stages of their connection application and project. The development process enables the initiation and ultimate connection of a Developer initiated URD.

The Application stage and transition into the Design stage represent the concept development phase of a Developer initiated URD where TasNetworks will provide the Developer with the necessary information to comply with TasNetworks planning requirements and enable the Developer to prepare a Development Plan and subsequent detailed designs for their development.

This document specifically covers the planning requirement of URDs that enable the Developer to prepare URD Development Plans, and guide the Developer in:

- the application of infrastructure capacity, configuration, and layout to supply the development (including future URD stages as required); and
- the application of additional infrastructure to be installed within the URD to support future requirements of the distribution network identified by TasNetworks, that are not necessarily required to supply the URD, such as spare HV and LV duct and cable in common trenching.

Conversely detailed design requirements are prescribed within relevant Distribution Design Standards listed in Section 3, where specific asset requirements may need to be considered by the Developer at the conceptual design phase to facilitate an acceptable URD layout and compliant substation location. As such the relevant design standards should be considered throughout the design stages of a URD development.

5.2 Project Scoping

Should the Developer choose to engage an external service provider, TasNetworks will produce two Scopes that will detail the planning requirements and scope or works for the Non-contestable (TasNetworks) and Contestable (Developer) works required to facilitate the URD connection to the network:

5.2.1 Scope 1 – Network Augmentation and Connection works (Non-contestable)

This scope would go to an internal design team to design and estimate the network augmentation works (augmentation or upgrade of the existing HV and LV distribution networks) and connection works (including energisation at the connection point) required to facilitate the URD connection to the existing network, including:

- Upstream augmentation of HV and LV electrical infrastructure;
- Physical connection works of URD extension infrastructure to the existing network.

The Scope 1 document will be provided to the Developer for information along with Scope 2 (refer below). Additionally the completed designs, covering the connection works, will be provided to the Developer once completed.

5.2.2 Scope 2 - Extension and Future works (Contestable)

This scope will contain details of the planning requirements for the development that are not included as part of the Distribution Design Standards , and will set expectations of what would be required in the final design. This document is to allow the Developer to undertake external designs of URDs, and will specifically include details regarding:

- the extension of the High Voltage (HV) and Low Voltage (LV) network within the URD including provision of substations and other electrical infrastructure required to supply the development;
- additional infrastructure to be installed within the URD to support future requirements of the distribution network identified by TasNetworks, such as spare HV and LV duct and cable in common trenching.

5.2.3 Developers responsibility

TasNetworks will prepare and provide Scope 1 (for information) and Scope 2 to the Developer in accordance with the Customer Choice Framework. The information included in the scope of works will enable the Developer to prepare a Development Plan and/or progress the detailed design for their development.

The provisions detailed in the Scope 2 document must be read in conjunction with the TasNetworks planning requirements detailed in the subsequent sections of this document, as well as any relevant TasNetworks Design Standards (refer Section 3 above). This is to ensure the Developer understands and is able to comply with the TasNetworks planning requirements.

It is the Developers responsibility to interpret the scope of works and deliver the Development Plan and detailed design drawings in accordance with the relevant design standards and requirements of Customer Choice Thus it is the Developers responsibility to seek assistance from TasNetwork planning and design staff as required. In this regard, TasNetworks encourages Developers to utilise the Early Engagement workshops, and/or discuss the scope of works requirements with TasNetworks as early as possible during the design stages.

5.3 What is a Development Plan?

A Development Plan is a conceptual layout of the HV and LV infrastructure (including substation locations and LV circuit 'open points') that will be installed within the URD. It will represent the ultimate infrastructure arrangement of the entire URD, and consider both the proposed staging, and future expansion of the distribution network through the URD.

The Development Plan will form a deliverable design that will be prepared in accordance with TasNetworks drawing and design standards, and will include a cable schedule for HV and LV cables.

The purpose of a Development Plan is to enable the development of any underground work to be integrated into an overall strategic vision for the orderly and economic development of the network in and through URD's. Thus the Development Plan has the obvious benefits of allowing:

- prudent investment in network assets;
- avoiding costly re-trenching and reinstatement of roadways and footpaths for subsequent stage development;
- avoiding costly augmentations and premature replacement of assets to meet demand growth and urban development;

The Development Plan need not be a detailed design at this point but a conceptual layout; similar to that shown in Appendix A using the approved drawing standards. The development plan shall be compatible to import into GIS application and also specify all HV cable connections. This plan is to be submitted to TasNetworks as part of the *Customer Choice Framework – Application and Design* process for comment and approval.

As URD's may take years to fully develop, the Development Plan will be kept on file by TasNetworks, and used as a reference for future Developers when undertaking the detailed design of relevant URD stages for construction.

If a Development Plan exists on file for the proposed URD, TasNetworks will provide this to the Developer as an attachment to their Scope 2; identifying any parts of the Development Plan that are either not relevant to the Developer, or need to be confirmed onsite by the Developer to progress their development.

5.4 When is a Development Plan Required?

To ensure the benefits detailed in section 5.3 above are achieved, it is a requirement that all URDs have a Development Plan covering the proposed HV cable networks, substation locations, and LV circuit connections including LV 'open points'.

Below are TasNetworks requirements for the provision of a Development Plan:

1. A Developer is required to prepare a Development Plan for all URDs where future stages of or beyond the URD are known, and owned by the Developer.
2. A Developer is encouraged to prepare a Development Plan that includes any known future stages that are owned by a different Developer.

Section 5.5, outlines the general rules that apply when considering a development plan.

However, there are circumstances where a Development Plan, or parts of, cannot or need not be completed; such as for smaller URD developments, or where the Developer has no information on future stages beyond their own development.

Small standalone URD stage designs will need to follow section 5.6 rules for Stand Alone stage developments. The developer is required to consider provision of transformation supply to their development only (unless there is sufficient transformer capacity from the existing network, as advised by TasNetworks).

Where a Development Plan either cannot be provided, or the developer chooses not to include future stages, the development will be treated as a staged development. In such circumstances the Developer is required to consider provision of HV and LV cables and conduits outlined in section 5.7 staging principles.

The Staging principles in regards to multi stage developments ensure, as can be reasonably expected, that the development of future URD stages can be facilitated economically. TasNetworks will indicate where a Development Plan is not required as part of the Scope2 document.

If the Developer chooses not to include these future stages in the Development Plan, the Developer will consider the staging principles outlined in 5.7.

5.5 General Rules for Development Plans

1. Cabling may connect through public right of ways or reserves where there is benefit to do so. TasNetworks will not allow a connection to traverse private property unless no suitable alternative exists, with a preference for HV and LV feeder routes to be kept to public open spaces or reserves.
2. Low voltage cabling is to interconnect between stages along roads.
3. For Low Voltage reticulation where roads end in a ‘cul de sac’ (up to 15 lots); these do not need to electrically connect with adjacent areas unless there is a benefit to do so.

5.5.1 HV cabling to subdivision boundaries of stages

The cabling will need to extend immediately adjacent to the subdivision/stage boundary where it shall be capped and buried. Where a substation is within a nominal 200 metres of the subdivision/stage boundary, a HV conduit is to be installed instead of HV cable (to limit the future HV cable joints) with the following requirements:

1. Conduits shall terminate immediately adjacent to the subdivision/stage boundary;
2. Conduits shall be temporary sealed at remote ends;
3. all joins are made and sealed;
4. Conduit runs shall be in straight sections and where straight sections are not available ‘turning’ locations shall be provided and be clear of obstructions and other services.
5. Conduit shall not terminate beneath sealed sections such as footpaths, driveways and roads.

5.5.2 LV cabling to boundaries of stages

Where the last connection point (i.e. LV turret) is not located immediately adjacent to the subdivision boundary then a turret is to be installed immediately adjacent to the subdivision boundary to terminate the LV cable for future stage development.

5.5.3 Location of Substation(s)

Substations must be located close to the URD load centre in a location that will allow for adequate egress of LV circuits, such that:

- the number of substations are minimised;
- adequate utilisation of available transformation capacity is achieved;

Substation locations must also ensure that the length of interconnecting LV circuits are minimised, ensuring that alternative supply circuits can be effectively utilised to support adjacent networks. A nominal 200m LV circuit limit is considered practical, however can be higher depending on cable size and load requirements that are location specific.

5.6 Stand Alone Stage

When there is only one stage i.e. it is not part of a larger overall subdivision, then it shall be treated as a Stand Alone stage and the proposed supply arrangement (including substation capacity) is required to meet only the needs of that stage. Stand Alone stage generally applies for smaller URDs of less than 10 lots.

5.7 Staging Principles

When staging of subdivisions occur the detail of the next or adjacent stages may not be known to the degree necessary to provide certainty of requirements at the design phase. The following additional rules have been developed where the necessary details are not readily available.

Note that these principles must be followed for a URD design unless a development plan for the full development has been produced.

1. Where a development has more than one stage, and the other stages are known, then it is not considered a Stand Alone stage. This is regardless whether the stages are being developed by one or more developers.
2. Roads that are 'through roads' to undeveloped areas, whether in the Developer's own development or not, will need to contain at least one HV (or conduit) and one LV cable to the subdivision/stage boundaries.
3. Where a subdivision is not adjacent to an existing system and it requires a substation to meet the needs of the subdivision then a temporary HV supply arrangement may need to be developed. This will be detailed in the Scope 1 document; included in the non-contestable scope of works for augmentation and connection.

5.8 TasNetworks Additional Infrastructure

5.8.1 Network (system) requirements

As part of the URD application process there may be occasions where TasNetworks will require extra infrastructure within the URD to meet external system needs and which are not associated with the internal supply needs of the URD subdivision. These requirements will be specified in the Scope 2 document.

The following are common examples of these requirements however the list is not conclusive:

1. One or more HV cables generally of size 240 aluminium or copper. On occasions this may extend to 300 or 400 aluminium or copper conductor.
2. HV cable routes not in alignment with the proposed internal HV supply arrangement.
3. Undergrounding of existing HV or LV overhead systems traversing the proposed URD.
4. One or more extra HV conduits.
5. Additional HV switches in the kiosk substations.
6. Larger capacity kiosk type substations
7. Additional kiosk type substations.
8. Easements for future requirements.

5.8.2 Developers responsibility regarding additional TasNetworks infrastructure

TasNetworks will specify the requirements for additional electrical infrastructure in the form of a design specification as part of Scope 2. It will be the Developers responsibility to include these requirements as part of both their Development Plan, and detailed designs for their development.

If the Developer is also undertaking the construction component of the URD, the additional TasNetworks infrastructure will be included in this scope of works, and therefore the Developers responsibility.

5.8.3 Cost contribution for additional TasNetworks infrastructure

TasNetworks will meet reasonable costs associated with the installation of the additional infrastructure required by TasNetworks. The reasonable cost contribution for these works will be determined by TasNetworks based on TasNetworks' unit rates, and included as part of the Scope 2 document.

5.9 URD Supply Calculation Factors

5.9.1 After Diversity Maximum Demands (ADMD)

The following are the design ADMDs to be used for residential lots in URD subdivisions.

1. Residential lots have a requirement of 6 kVA per lot.
2. Where it is foreseeable that the ADMD may be insufficient to meet the future need of a particular location an amended ADMD will be advised by TasNetworks.
3. Where lots are to have more than 3 units, a separate 'application to connect' process is to be followed as part of the negotiated connection service.

5.9.2 Design loading of assets

5.9.2.1 Transformers

Loading - Within all URDs the maximum design loading (using the ADMD values in Section 5.9.1) on new transformers shall not be greater than 80% of the transformer name plate rating.

Note: The maximum current unbalance between phases at peak load cannot exceed 10%.

5.9.2.2 HV Cables

Not Applicable - Cable size will be directed by TasNetworks as part of the Scope 2 document.

5.9.2.3 LV Cables

Within all URDs, the maximum design loading (using the ADMD values in Section 5.9.1) on the LV distributor cable sections shall not be greater than 80% of the circuit rating.

Regardless of LV distributor loading, all LV distributors must be designed to operate within the allowable voltage ranges, whilst ensuring a compliant voltage bandwidth is achieved at every point of connection within the URD.

The voltage bandwidth at each point of connection will consider the voltage variations expected under maximum and minimum loading scenarios; including a consideration for solar photovoltaic penetration under minimum load.

Reference document: Distribution Design Standard Underground System

5.9.3 Voltage drop calculations

The Developer is required to undertake appropriate LV load flow modelling covering current flow and voltage drop considerations. The LV voltage drop calculation process is to be undertaken using TasNetworks' approved software. For further details on the LV calculations requirements refer to the TasNetworks Design and Engineering team. The following factors shall be incorporated:

1. Diversity factors and Unbalance factors in accordance with Section 2.10.1 "MD Correction Factors for URD Voltage Drop Calculations";
2. Temperature correction for underground cabling systems.
3. Where water / sewage pumps or other supporting electrical infrastructure are to part of the subdivision then the planning of their electrical loads (and subsequent voltage drops) will be calculated in accordance with :
   - AS/NZ 3000: Wiring Rules ; and
   - AS/NZ AS/NZS 61000.3.5: Limits- Limitation of voltage fluctuations and flicker in low-voltage power supply systems for equipment with rated current greater than 16A.

In undertaking the design calculations it t should be recognised that LV distributor design lengths for substation circuits will be dictated by:

1. The allowable voltage drop / rise appearing on the extremities of the proposed LV network at the Point of Connection.
2. Thermal rating of the LV cable.

3. Impedance(s) of the cables.

5.9.4 Summary of Voltage drop/rise allowances within URDs

Table 1 below summarises the maximum voltage allowances in the various levels of the network within the URD.

Table 1 – Allocation of Voltage drops to system components

System level	**Max. permissible volt drop % of Nominal design value**
HV Feeder	*1.0*
Distribution Transformer	2.0
LV Distributor	4.5

5.9.5 Maximum allowable bandwidth at point of connection (under max and min loading)

The maximum allowable bandwidth at any point of connection within the URD based on maximum and minimum loading scenarios is 8 V.

5.9.6 Power Factor

For the purposes of loading and voltage modelling assessment a power factor of 0.95 is used.

5.9.7 Photo Voltaic considerations

With the ongoing take up of residential Photo Voltaic installations (solar cells) it should be considered by the development designer when undertaking the voltage drop calculation that at periods of high solar gain coinciding with low system demand that voltage rises at the point of connection can be significant and on occasions exceed the 230 V, +10%. The standard low voltage is (400/230V) +10% -6%.

- The average residential PV array is 3.4 kW
- For new residential developments the average uptake of solar PV is 0.5 kW per 1 Lot is considered practical. Under the minimum loading scenario.

5.10 Distribution Substations

TasNetworks has a requirement for the use of standardised padmounted substations in URD’s. The standard substations are known as kiosk type substations and have the formats listed below.

Note: This section intended to provide application guidance to the Developer to prepare the Development Plan in accordance with TasNetworks’ planning requirements, and only providing a general overview of the asset. Further details for design, installation and testing requirements of substations are available in the relevant TasNetworks Design Standards.

5.10.1 Kiosk substations

Available primary winding voltages are 11kV and 22kV.

The most common configurations are:

- HV Cable entry panel, containing a HV cable connection cubicle and a HV Circuit Breaker (CB) for protection of the transformer.

- Ring Main Unit (RMU), containing two incoming HV switches and HV Circuit Breaker (CB) for protection of the transformer.
- 3-way HV switchboard, containing three incoming HV switches and one HV CB for protection of the transformer.

This kiosk can house 500, 750, 1000, 1500 and 2000 kVA transformers. Either the 500 kVA or the 750 kVA provide the flexibility for URD arrangements.

The low voltage board requirements are to have a 3 or 4 main circuit capability. This is commonly known as a 3 or 4 way LV board.

5.10.2 Mini kiosk substations

Available primary voltages are 11kV and 22kV.

These units are different to the kiosk type substation with regard to transformer size and the HV switchboard.

HV control of the substation is not within the mini kiosk substation and relies on upstream protection of the transformer at another substation or bespoke protection at the aerial HV line connection.

Mini kiosk substations are not generally used for URDs, but are available for the Developer to consider. Refer to the Kiosk Design Standard for further information.

5.10.3 Switching stations

Available primary voltages are 11kV and 22kV.

Whilst a switching station is not the same as a substation as it has no transformer, it serves a similar purpose as RMU's for the operation and control of sections of the HV network. Switching stations can contain up to 4 incoming HV panels containing combinations of HV switches and HV CBs.

5.10.4 Prohibited use of HV Pillars in High Voltage networks

HV 'pillars' are not available for use in HV distribution network.

5.11 High Voltage (HV) Network Assets

5.11.1 Standard HV cable sizes and application

HV cables will generally form part of the existing of future backbone of the distribution network. The standard cable type used for the URD reticulation is:

- 240mm^2, 3/c Aluminium XLPE

In rural areas of the network, the following cable type may be used for the URD reticulation:

- 185mm^2 3/c Aluminium XLPE

The use of this cable type will be indicated by TasNetworks on the Scope 2 document.

Where subdivisions occur within close proximity to a terminal or zone substation, other cable types may be required. These will be specified by TasNetworks in the Scope 2 document.

5.11.2 Prohibited use of HV tee joints in underground High Voltage networks

A HV 'tee' joint to enable connection of substations into the proposed or existing network is not to occur. The salient reasons supporting this position are:

- Locating cable faults can be very difficult and time prohibitive;
- There is an obvious detrimental impact upon customers' connected to the faulted substations at times of these faults;
- The longer fault times generally require mobilisation of extra resources and plant, including standby generation;
- Extended duration of outages affecting Customers will incur provisions of the TasNetworks Customer Charter where standard payments to affected Customers will need to be met.
- The impact upon the regulatory reliability frequency and duration indices can be onerous; and
- Adverse environmental impacts arise where important infrastructure e.g. sewage pumping stations are connected to the faulted network.

5.12 Low Voltage (LV) Network Assets

5.12.1 Standard LV cable sizes

When designing extensions to the low voltage distribution system the following standard cable sizes are used:

- 240mm^2 aluminium (stranded) 4 core; and
- 185 mm^2 aluminium (solid) 4 core.

Other cable types may also be used where required to manage loading and voltage restrictions including:

- 400 mm^2 aluminium (stranded) 4 core; and
- 300 mm^2 aluminium (stranded) 4 core.

5.12.2 Standard application principles

400mm^2, 300 mm^2, and 240 mm^2 cables are used for all LV distributors. These cables form the main LV network and must be carried through (not tapered) between interconnecting circuits; including LV distributors connecting to the existing LV network.

185 mm^2 cables are used for short lateral connections to supply groups of customers; including individual turrets.

Cable sizes are designed to meet thermal and voltage regulation requirements. An allowance must be made for future load growth to avoid the expense of upgrades during the life of the cable.

In URDs interconnection is provided via normally open isolators and switches with adjacent LV circuits to provide alternative supply capacity in the event of loss of supply from a transformer die to planned or unplanned interruptions.

5.13 Typical HV Arrangements

The following diagrams show generic connection arrangements for the HV network within the URD and connections made to the existing HV network.

The use of pole mounted transformers is generally limited to subdivision development stages that are adjacent to existing overhead HV lines or temporary supply arrangements where there is non-sequential staging of subdivision developments.

5.13.1 Radial supply from existing overhead High Voltage lines

Figure 1 portrays the subdivision being connected by a low voltage cable to a pole mounted transformer, generally on the edge of the URD. This arrangement can also be used where the adjacent existing system is an underground network.

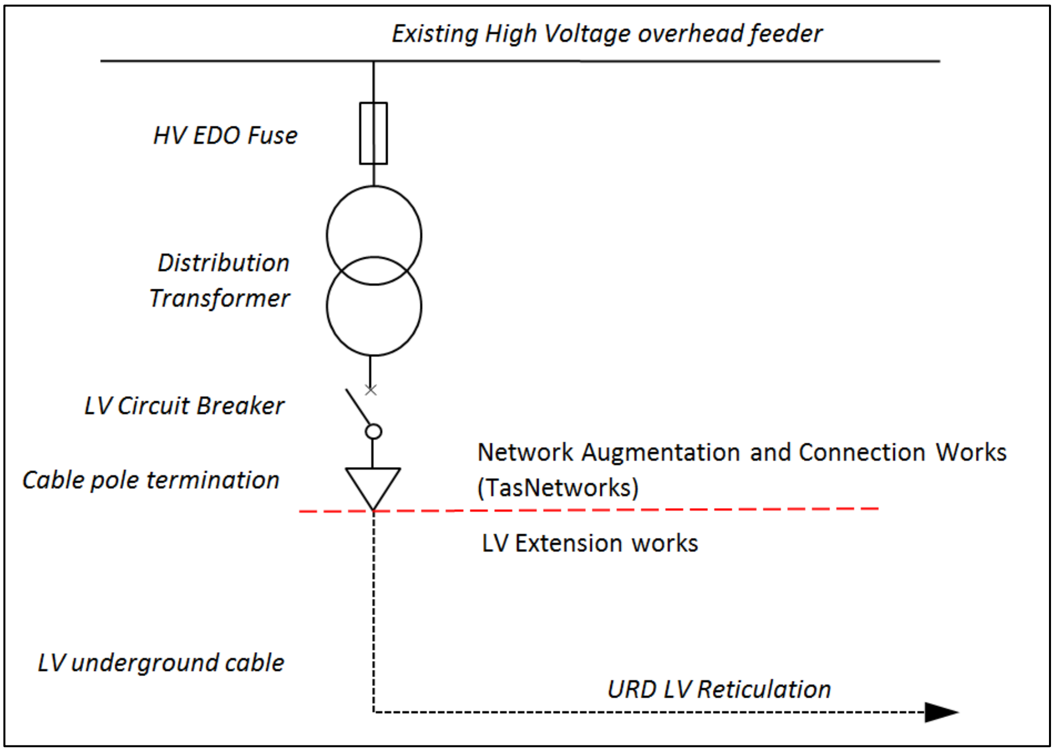

Figure 1: LV connection from pole mounted transformer.

Figure 2 portrays the URD subdivision being supplied from an overhead network via a kiosk type substation within the URD. This particular example uses a cable entry panel and HV Circuit Breaker in lieu of the more common HV Ring Main Unit (RMU). This is used where approved by TasNetworks and where the HV network needs no further development and a single substation can supply the demand of the URD.

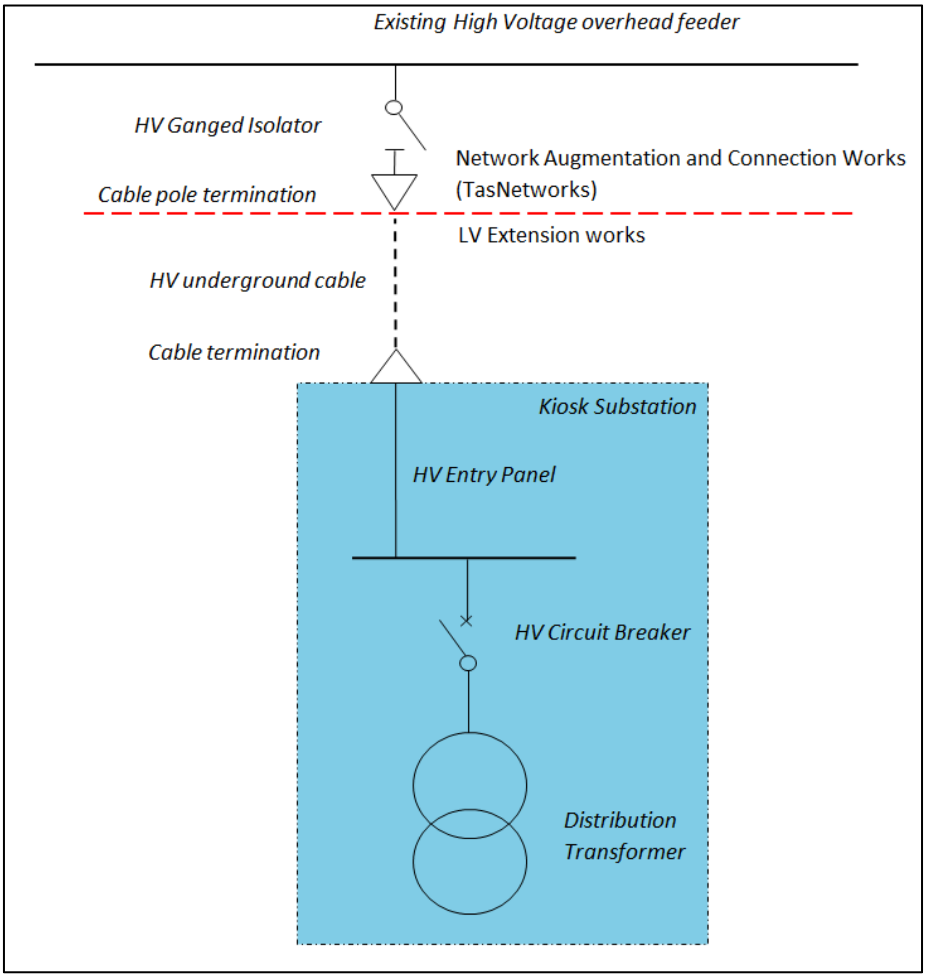

Figure 2: Kiosk connection off an existing overhead system.

5.13.2 HV arrangements with multiple substations

Figure 3 portrays the URD being supplied from an overhead network via two kiosk type substations. In this example the connections between these substations and the network beyond provides a backbone HV supply arrangement that can be readily extended.

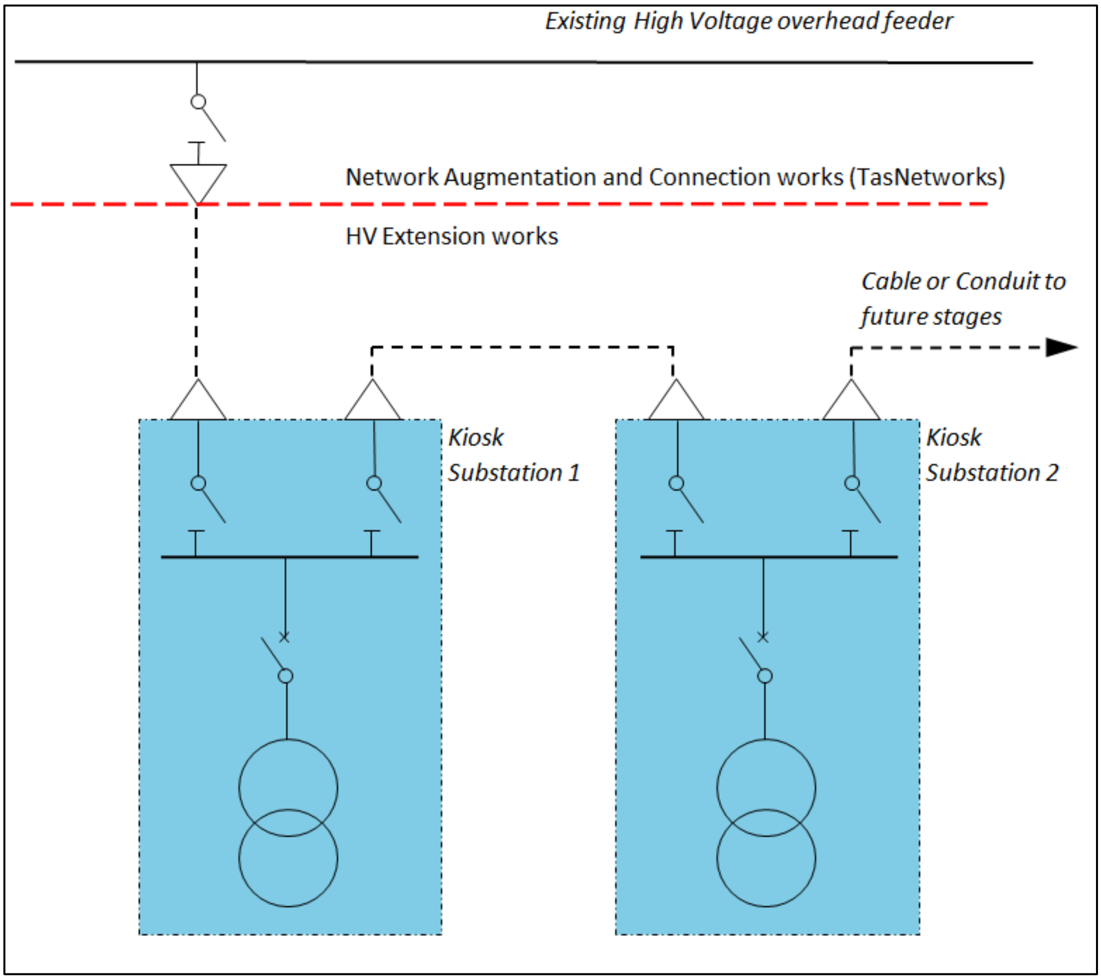

Figure 3: Kiosk connection using a RMU for future development.

Figure 4 portrays the URD subdivision being supplied by a kiosk and mini kiosk substation. In this scenario the kiosk is using a 4 way HV board with 2 incoming HV switches, a HV Circuit Breaker suppling the transformer in the substation and a further HV Circuit Breaker providing HV disconnection and protection to a remote mini kiosk substation.

This is generally required where the additional substation (mini kiosk) has only a low level of connected load. It can also alleviate parallel runs of HV cable to serve the additional substation.

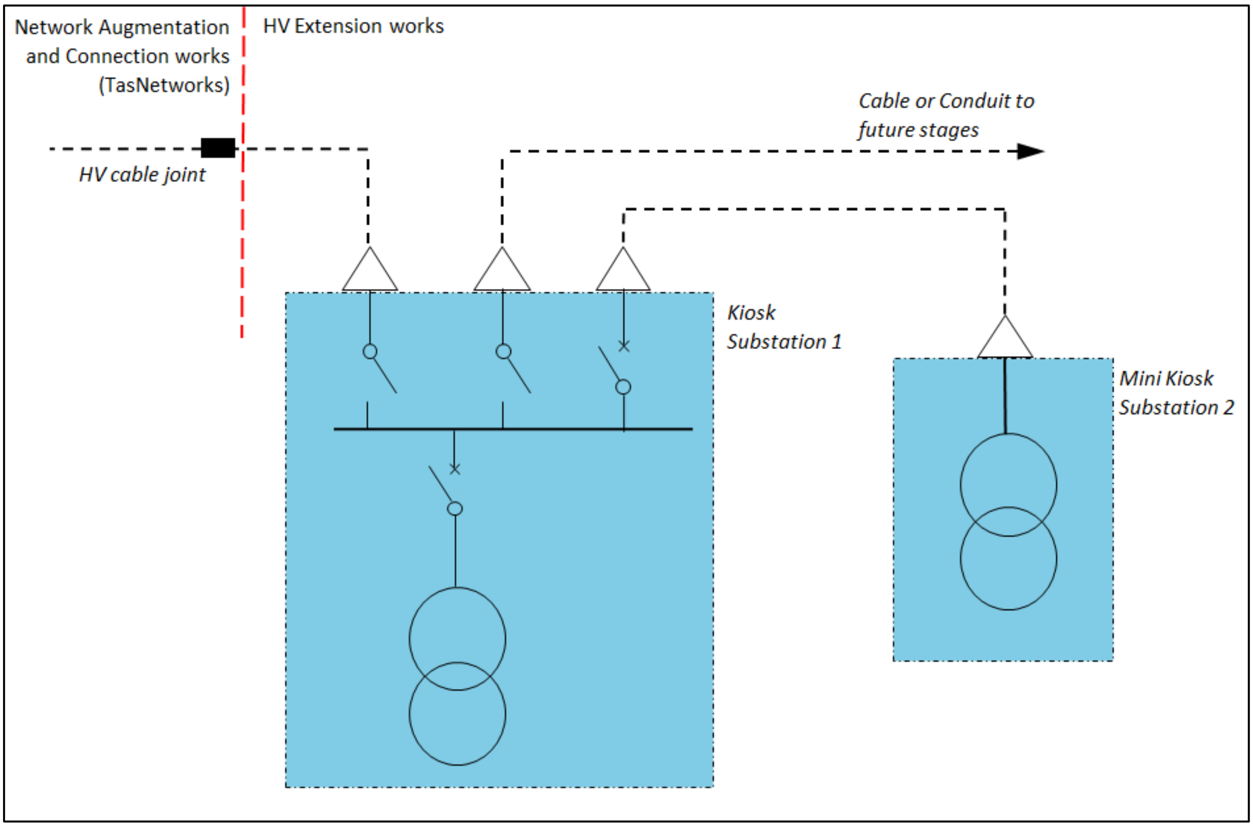

Figure 4: Kiosk connection with remote mini kiosk.

Figure 5 portrays an uncommon arrangement. This is generally required where the additional substations (mini kiosk) have only a low level of connected load. It can also alleviate parallel runs of HV cable to serve the additional substations. However it also shows the flexibility in how multiple HV switches and HV Circuit Breakers can be used.

The URD subdivision is being supplied by a switching station with a RMU and two HV Circuit Breakers for disconnection and protection of two remote mini kiosk substations.

This is an unusual situation and requires a special enclosure for the switching station.

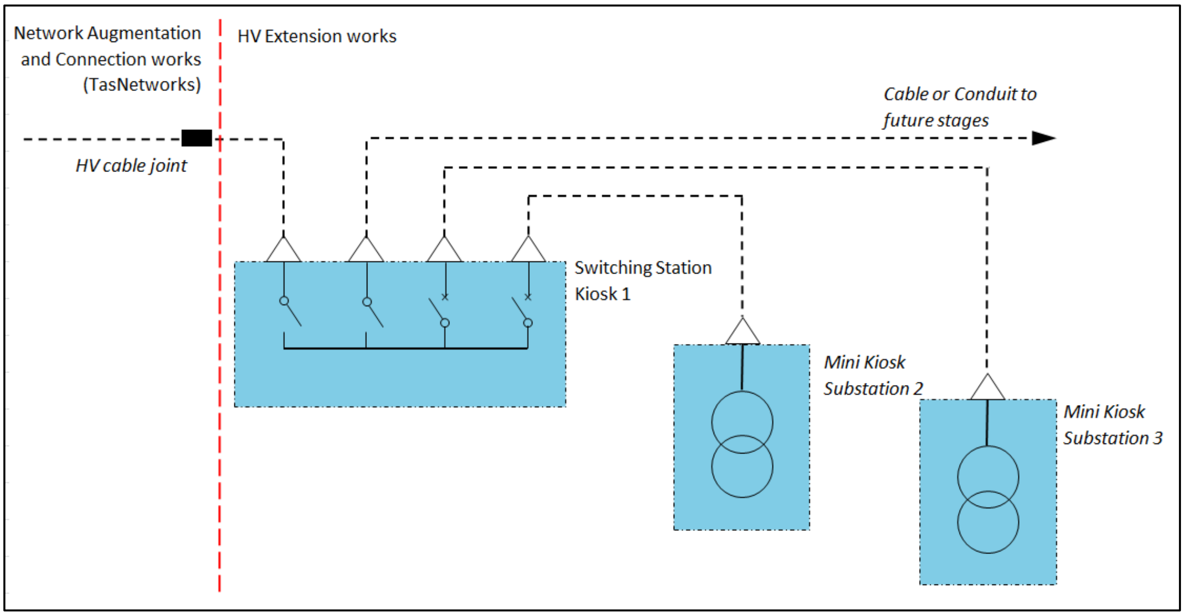

Figure 5: HV switching station with 2 remote mini kiosks.

5.13.3 HV Interconnection

There is a need to incorporate alternative HV connections into the URD from the main HV network for reasons of supply reliability and maintenance of the substations. The HV interconnectors are required where the summated design loading on the substations within the URD are:

- greater than 1500 kVA for 11 kV; or
- greater than 3000 kVA for 22 kV.

Figure 6 portrays a URD subdivision that utilises a three kiosk substations with RMU's and one kiosk with a three way HV switch board including one HV Circuit Breaker unit, to provide an interconnecting HV tie.

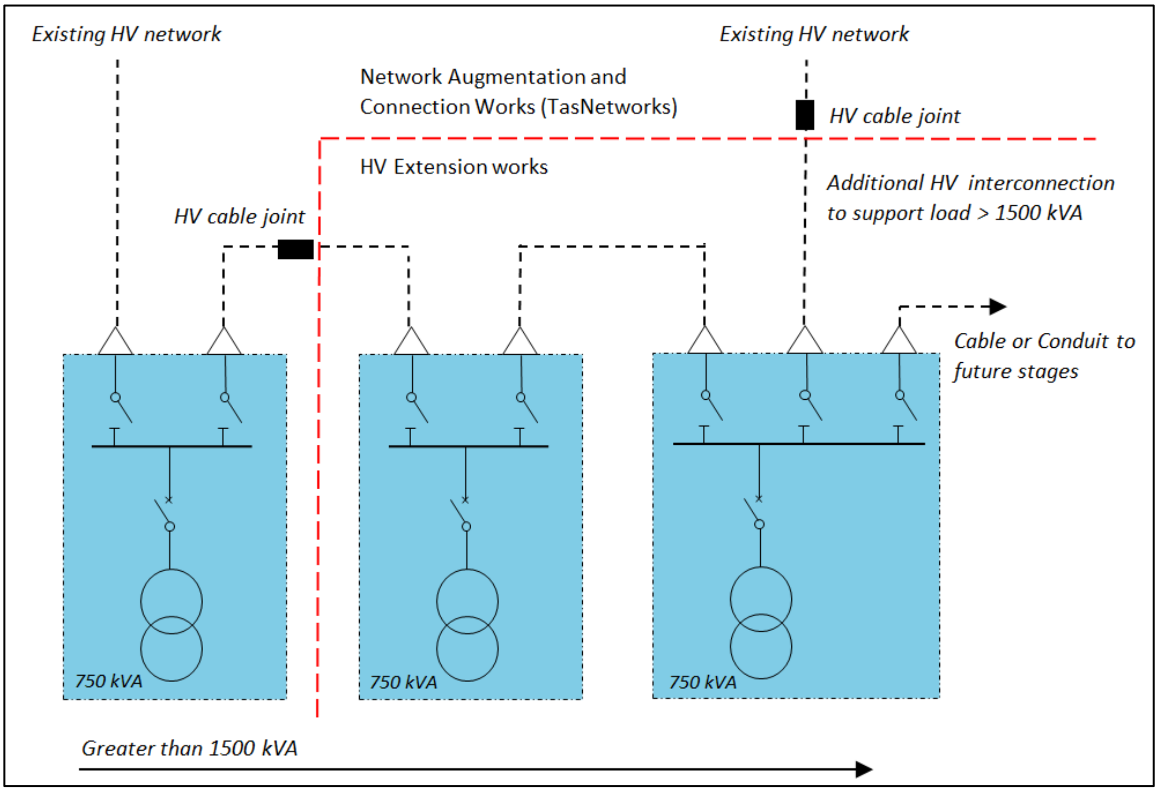

Figure 6: HV Interconnector using a 3way HV switchboard arrangement.

5.13.4 Typical geographic HV connection arrangement

Figure 7 portrays a geographic network that is similar to the schematic provided in Figure 4 above. This example shows 'through roads' that will need to be serviced by HV cables to enable the orderly development of the HV network.

Substation 1 circled shows a common issue with the need to have the flexibility of four HV cables but only being able to have three HV cables, as the substation has to accommodate a HV circuit breaker for the transformer in the fourth HV bay. This is premised upon the 'through road' heading towards the top of the figure being likely to be extended in the future.

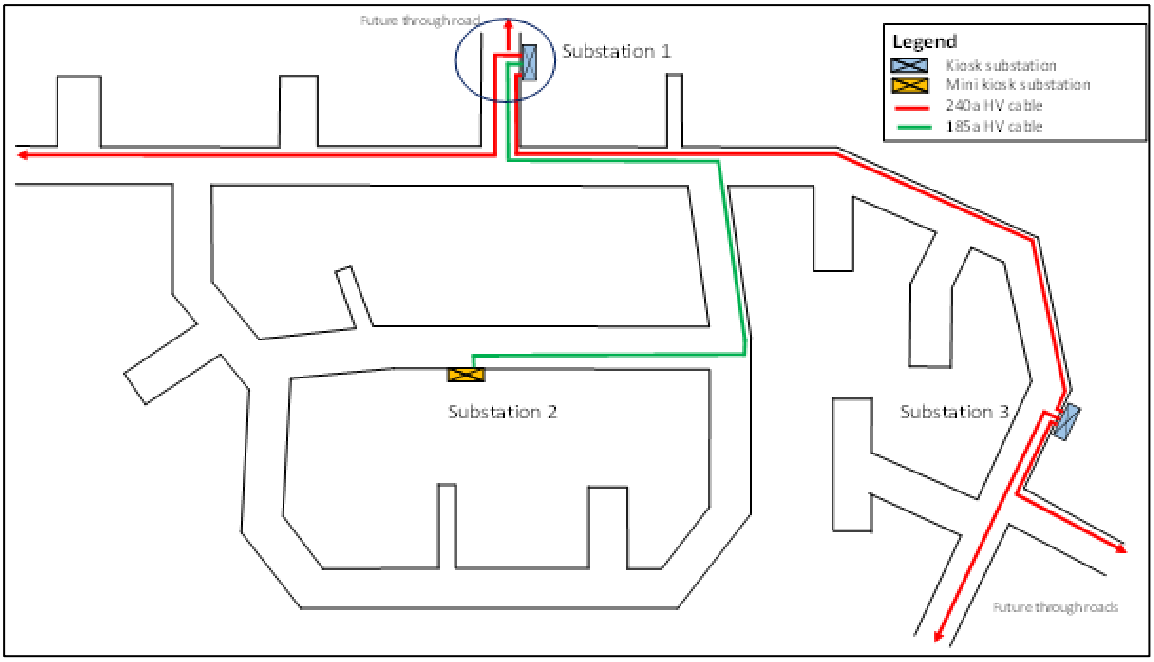

Figure 7: Generic HV network.

There are a number of ways to manage this scenario and these are not limited to the following solutions:

1. At Substation 1, install a HV switching station facilitating the requirement to have three HV cables being controlled by HV switches and installing another substation with a RMU nearby.
2. Make the mini kiosk (Substation 2) a RMU substation and connecting it ‘in and out’ of the HV cable that runs between substations 1 and 2.

At the preliminary phase of the development planning the Network Planning staff at TasNetworks are able to provide advice as to acceptable arrangements.

5.14 Generic LV Network Reticulation

Figure 8 portrays a typical subdivision where a number of substations are required to supply the overall load of the URD. The HV cabling network has been omitted for purposes of clarity.

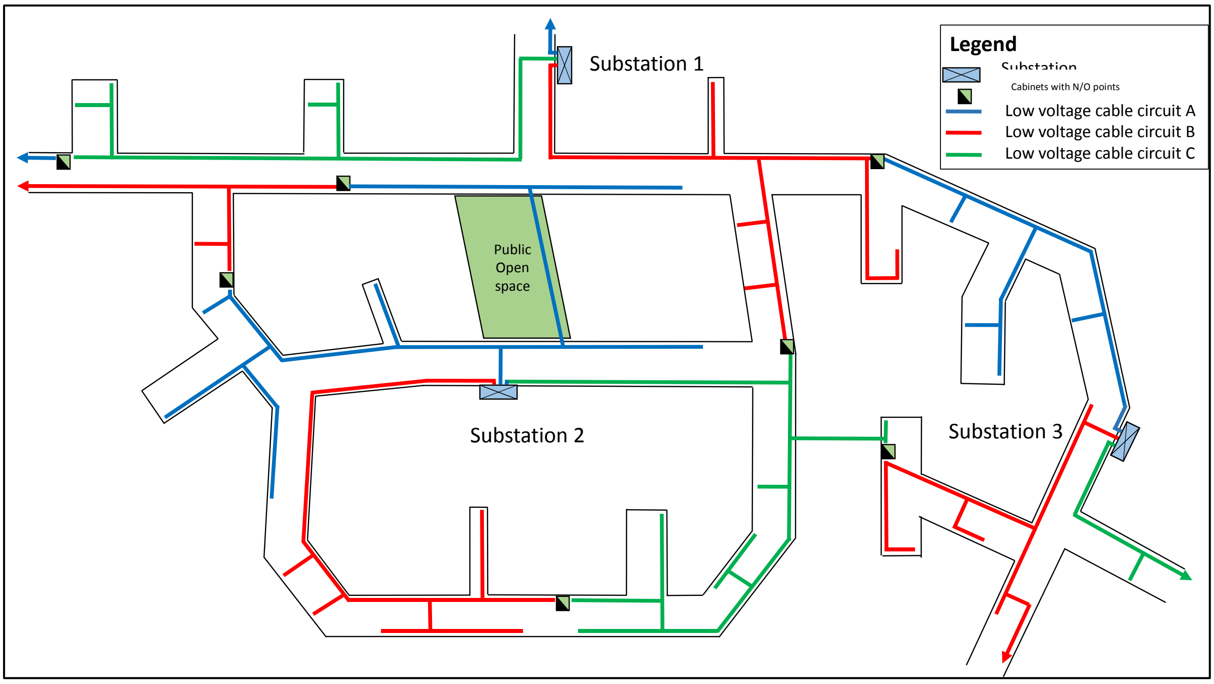

Figure 8: Generic URD showing LV connectivity.

All LV distributors (circuits) originating from a substation need to connect with its own substation LV circuit(s) or other substation circuit(s) via a LV switch installed within a turret/cabinet or similar enclosure. The switch will mostly be in its ‘normally open’ position.

The purpose of this arrangement is to enable substations to be removed for maintenance at period of low demands and the LV network temporarily ‘connected through’ ensuring that customers do not experience a planned interruption. Further, in times of faults on the HV network this ability to ‘through connect’ the network enables fault situations to be managed more effectively. The exception to the through connection arrangement applies to ‘cul de sac’ or equivalent circuits provided the number of lots does not exceed 15 lots.

This example shows an LV cable running between Substations 1 and 2. In this scenario this is only allowable as the land the cable traverses is public open space or public reserve. Cabling running through private property is not to be undertaken without TasNetworks approval due to localised issues of EMF containment, limited access to the cable, high possibility to be unearthed or damaged etc.

Figure 9 portrays a typical detailed arrangement of an LV cable network within an URD. The substation has been excluded for clarity.

Connections to individual customer residences are via a LV turret or similar enclosure on a street frontage and shared property boundary. Customer connection to the system is via a LV fuse inside the turret. The customers’ Point of Connection is at their load terminals of this LV fuse.

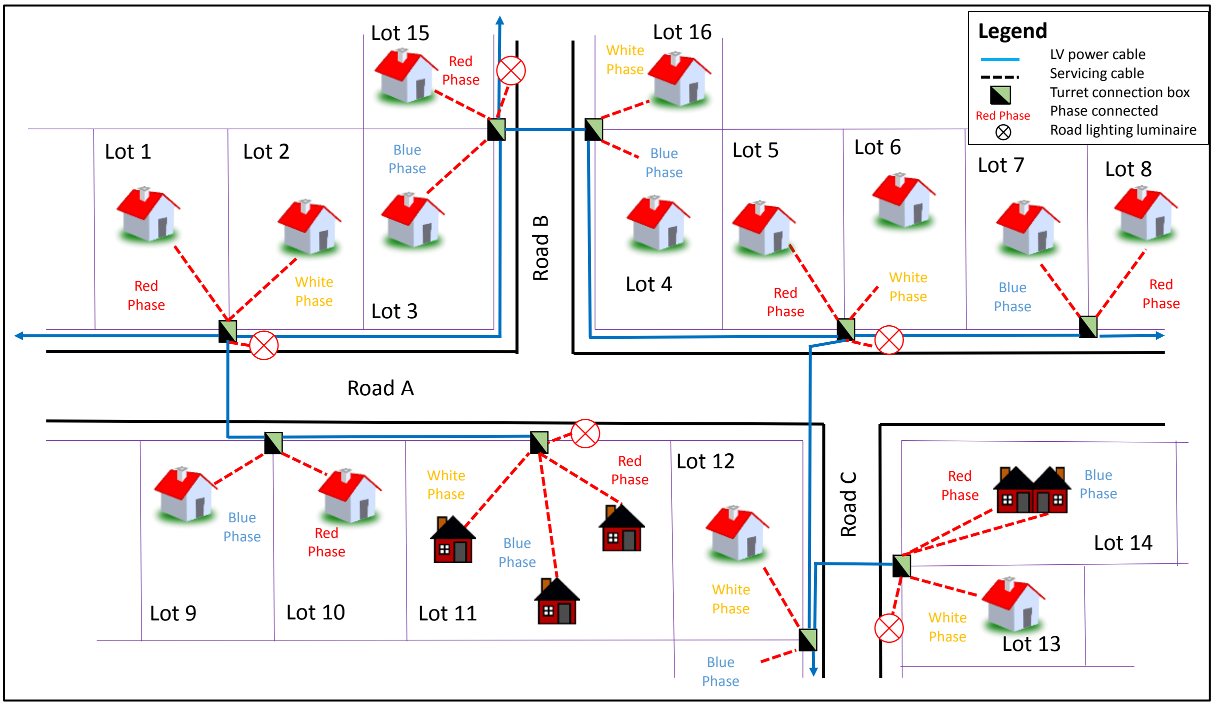

Figure 9: Generic URD detail layout.

5.14.1 Residential phase connections and balancing

TasNetworks preferred LV arrangement is to provide a 3 phase connection to each turret or cabinet. Figure 9 also provides guidance on LV cable phase balancing. The latter is to ensure cable loads are relatively uniform across the three phases. Where load unbalance occurs this has potential for customers to experience either high or low voltages at their Point of Common Coupling. All low voltage design calculations undertaken for voltage drop assume a balanced LV cabling system.

In Figure 9 unit developments are sited on lots 11 and 14. Lot 11 has three units and this allows a connection of one phase per unit (maximum of 3 x 1 phases). Lot 14 has two units and thus requires the connection of one phase per unit – a total of two phases. Doubling up of units on the same phase is poor design practice and will not be allowed.

Appendix A – Scope Content Sample

Underground Residential Development (URD)

Project Detail

Project Name			
Case ID			
Network Planner	*TasNetworks contact details*	**Contact Email**	*TasNetworks contact details*
Developer		**Contact Email**	
Application received (NP)		**Scope Finalised (NP)**	
Asset Tag		**Thread**	*Customer Initiated*
Planning Area		**Parent Program**	*Customer Initiated Subdivisions*
LAM Area		**Work Category**	
Locality			
Existing Development Plan	N/A	**Development Plan Required**	
Reference Drawings: *Previous design if applicable*			

Development Plan notes

Details the specific staging for the scope of works and any background information relating to previous design staging.

Prescribed Assets

List of the applicable assets to include and interface within the staged design.

Asset	Prescribed Assets	Description / Comment
HV Cables		
HV Configuration		
Substation(s) - New		
Substation - Existing		
LV Distributors Cables		
LV Crossovers		

Scope 1 – Non contestable works

Detailed design elements associated with the upstream augmentation works and connection works

Scope 2 – Contestable works

Detailed design elements associated with the network extension works and future works

Connection point details

Connection Voltage			*Description of connection point*						
CP description	*Feeder, pole or substation number*								
Ref. *Fault level*	R1	X1	R0	X0	Length (m)	3ph Fault (A)	2ph Fault (A)	1ph Fault (A)	1ph Angle
Fault Level									

Appendix B – Development Plan Sample