Site Selection, Easements and Sites – Guideline

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1. Introduction

1.1 Purpose

This guideline directs the process to be followed, as well as the items that need to be considered in determining selection and sizing of substation sites, washdown sites and easements for transmission lines.

Land assets need to support Powerlink's network requirements at the lowest long term cost. Due to the wide variation in land usage, demand and cost it is not practical to set rigid process that will always apply to the selection and sizing of land assets. There is no attempt to specify the weighting and importance of each of the items as this will vary from case to case depending on site constraints, long term costs and construction costs. Site constraints should also be considered when determining the technology, the layout and the configuration of the works.

Communication sites are considered out of scope for this document as the preference is to co-locate with others where possible.

1.2 Scope

The requirements of this guideline apply to the selection of sites for new substations and washdowns, and easements for transmission lines.

1.3 References

Document code	Document title
A576805	Transmission Line Access Track Guideline

1.4 Defined terms

Terms	Definition
Easements	Legally secured on title, while allowing other compatible landuse to occur
Substation Site	Legally secured land parcel with suitable buffer zones
Washdown	A designated cleandown area that is monitored periodically

1.5 Monitoring and compliance

Monitoring and compliance will occur at handover. Non-conformances will be considered on a risk basis.

1.6 Risk management

The following risk assessment has been completed to summarise issues that can arise from incorrect site selection.

Technical Issues Related Hazards	Risk	Risk Controls (minimum requirements)
Construction and maintenance costs are impacted from site selection	Significant	The site places constraints on construction and maintenance delivery, resulting in efficiencies.
Ground access not available to transmission line or site	Moderate	Documented processes; land asset audits; land inspections; exception reporting; and condition based maintenance.
Spread of biosecurity threats through Powerlink's activities	Significant	Documented processes; investments in joint control measures and washdown facilities; land asset audits; actively engaged with biosecurity management stakeholders; land inspections; condition based maintenance; vehicle hygiene practices; and exception reporting.
High fire fuel loads are present, resulting in a network event	Moderate	Documented processes; investments in joint control measures; actively engaged with fire risk management stakeholders; monitoring active fires; land inspections; and mapping of known risk areas.
Performance Related Hazard	**Risk**	**Risk Controls (minimum requirements)**
Property owner withholds access to land asset	Moderate	Documented processes, including land access protocols; and exception reporting
Constraints are not documented into corporate systems, resulting in non-conformance or lock out	Moderate	Documented processes, including land access protocols; and exception reporting
Weeds are spread as a result of poor location of washdown	Low	Preference to locate on Powerlink controlled land at substations or site offices
Noise complaints occur due to insufficient buffer zones	Low	Landuse is considered with site selection and complaints are investigated
Pollution event occurs due to insufficient buffer zones	Significant	Containment systems are installed. Proximity to waterways is considered in risk management.
Associated Hazards	**Risk**	**Risk Controls (minimum requirements)**
Landholder outrage from site selection	Significant	Documented processes; control measures in place; landholder engagement; and assess risks associated with activities and site conditions.
Damage to Electrical infrastructure from machinery owned by a landholder or contractor	Moderate	Consideration of landuse; documented processes; easement agreements; and contract terms and conditions.
Illegal access to corridors by third party	Moderate	Documented processes; easement agreements; and contract terms and conditions.

2. Guideline

Considerations for site selection can vary between substations, washdowns and easements. The following sections provide guidance on considerations.

2.1 Substation Sites

The following aspects need to be considered when selecting substation sites:

- The network need for a new or extended substation site to be acquired for network development or customer connection. This may involve consultation with Distribution Network Service Providers (DNSPs), generators or network customers.
- The ultimate line diagram for the substation and a general location for the site.
- A preferred switching configuration is determined.
- Any specific site requirements are identified and incorporated into the ultimate development (including any shared usage requirements).
- Electrical safety (e.g. clearances, earth potential rise and transferred potential), Health (e.g. amenities and noise), public safety, risk from external influences (e.g. bushfire and surrounding landuse) and risk of causing environmental harm (e.g. oil containment, retaining contamination on site and weeds).
- A dimensioned layout of the future substation is developed taking the ultimate development into account.
- The footprint should be based on air insulated switchgear (AIS) technology, however, where land costs or physical constraints are significant, consideration should be given to alternative technologies such as gas insulated switchgear (GIS) to reduce the footprint size. Wherever practical, allowance should be made for additional land for rebuilding electrical assets at the end of life on, or adjacent to, the site.
- Site options are considered and evaluated in relation to site requirements. A report is prepared to document findings.
- Site security considerations, including vegetation (see Appendix A-1)
- Site options and feasibility are to be reviewed by the Manager Asset Strategies.
- Scope, timing and estimated cost for acquisition of the selected new site option is determined.
- Site acquisition commences once approval is given.

2.2 Washdown Sites

Washdown sites may be required to enable efficient construction and maintenance of network assets. These need to consider the following aspects:

- Availability of other washdown facilities;
- The acceptance of the washdown facility by the broader community;
- The risks the washdown will mitigate;
- The use and maintenance of the washdown;
- Landownership of the washdown;
- Other potential users of the washdown;
- Washdown standard drawings (Appendix B-1 to B-4);
- Drainage, including overland flows; and
- Safety and environmental factors.

The preference is to have washdown facilities at strategic locations (e.g. substations and site offices) to assist with security and maintenance.

2.3 Easements

Easements for transmission lines will consider a balance of social, environment and economic factors. Easements widths that are recommended for associated built assets:

- Fibre cables buried: 3m either side (6m total)
- Fibre cables overhead: 5m either side of structures (10m total)
- <132kV overhead: 15m either side of centre line (30m total)
- <132kV underground: 5m either side (10m total)
- 132kV overhead: 20m either side of centre line (40m total)
- 132kV underground: 6m either side (12m total)
- 220kV overhead: 30m either side of the centre line (60m total)
- 220kV underground: 10m either side (20m total)
- 275kV overhead: 30m either side of the centre line (60m total)
- 275kV underground: 10m either side (20m total)
- 330kV overhead: 35m either side of the centre line (70m total)
- 330kV underground: 12m either side (24m total)
- 500kV overhead: 40m either side of the centre line (80m total)
- 500kV underground: 15m either side (30m total)

Actual easement widths may vary depending on specific circumstances including for overhead lines the structure hardware arrangements, separation for other circuits, management of earthing and EMF potential, site benching requirements, line layout and maintenance requirements such as helicopter maintenance. Underground assets easement width will depend on cable snaking, cable pit size and location, circuit separation, cable configuration, fibre arrangements, auxiliary systems, management of hazardous earth and co-location with third party assets. It is the responsibility of the certifying engineer to review the nominated easement ensuring that all construction, safety and maintenance requirements are met.

Easement selection should consider the vegetation general arrangement (Appendix A-2 & A-3) and the objective to remove incompatible species, rather than prune them. Retaining incompatible species can add to network and safety risks, which should be reduced as low as practicable through the site selection process.

Easement selections need to consider access track requirements for both construction and maintenance. The aim is to utilise existing access where possible and not disturb the ground cover until required for construction or on-going maintenance. Where access tracks are constructed, the Transmission Line Access Track Guideline (A576805) will be used in the design and placement of tracks.

Where easements and access tracks are being secured by customers, Powerlink will need to review the alignment and condition.

3. Considerations

Generally, site selection is inevitably a compromise with many competing factors to be considered. The following items need to be taken into consideration in determining the suitability and size of the land assets.

3.1 General Location

The general area in which a network asset is to be located is dictated by load location, environmental factors, customer requirements, access and transmission line arrangements for the connection to the grid.

3.2 Development

Site selection needs to allow for the maximum anticipated development, including ongoing maintenance requirements. In general the size and dimensions of the land assets will vary depending on the network asset requirements, including substations, washdowns and transmission lines.

The site size should be adequate to allow for the ultimate development plus an area for an adjacent rebuild. In constrained locations there may need to be several iterations between the designers and the site selectors to reach agreement on the area, its shape and the technology to be employed.

3.3 Physical

Specific consideration needs to be taken of physical and topographical impacts such as;

- soil type (from a resistivity point of view – minimum requirements for step and touch potential need to be met);
- potential for flooding (typically designed for 1 in 200 year flood event – higher for 500kV assets);
- micro-climatic impacts on corrosion, structural strength and ratings;
- water courses or freshwater/marine environment on or adjacent to the site;
- adequate drainage and area for control of storm water runoff and potential soil erosion and sediment control;
- potential fire impacts on the network (special consideration for 500kV assets);
- rocky and uneven terrain;
- extent of earthworks;
- the entry and exit requirements for transmission lines and their terminal towers;
- access to the assets; and
- proximity to other landuse, especially residential areas.

For some activities (e.g. soil and sedimentation control and temporary construction buildings), temporary access agreements for adjacent land use should also be considered where practical.

3.4 Surrounding Land Usage

Surrounding land usage impacts site size and selection both from the impact of the network asset on the surroundings and the impact of the surrounding land use on the network assets (e.g. pollution levels and site security). Sites in residential or environmentally sensitive areas may require additional consideration for buffer zones, landscaping and screening and noise. Sites in industrial areas may need to allow for higher levels of pollution. Powerlink also needs to consider its corporate responsibility by minimising land requirements in areas zoned as urban, residential or having high agricultural importance.

3.5 Accessibility

The site accessibility needs to be adequate for the following:

- Substation sites require “all-weather” road access for maintenance as well as access for heavy machinery for construction, augmentation and major refurbishment. Sites with large transformers require public road infrastructure to be capable of handling large transformer transport vehicles and loads.
- Gravel entry and exit points from the washdown should extend for at least 50m and have drainage that ensure water does not pond on the access.

- For line entry onto easements, compliance with the Transmission Line Access Track Guideline (A576805) needs to be in place once construction activities have been completed.

3.6 Cost

Economic considerations play a key role in determining whether a project is successful and approved. Site acquisition costs are a significant component of most projects and need to be minimised where possible. However, this is in direct contrast with achieving many of the above factors. In practice, site selection and size is restricted by availability of suitable sites and generally a compromise is required to find an available site with a size that meets the minimum requirements of all criteria.

3.7 Customer Requirements

In some instances special consideration is needed for customer or stakeholder requirements.

3.8 Environmental Considerations

An environmental assessment and Environmental Management Plan will be developed for new sites at site selection stage, including a high level assessment to identify potential issues that might subsequently prohibit the development. Issues to be considered include:

- The status of existing vegetation in respect of Local Authority, State Government, or Federal Government constraints.
- Abilities to obtain offsets for ecological characteristics impacted.
- Local water courses and freshwater and marine environments in respect of Local Authority, State Government, or Federal Government constraints.
- Cultural Heritage as part of site selection to ascertain whether the site has Aboriginal or cultural heritage significance.
- Visual amenity requirements may vary significantly depending on the surrounding land use. In residential or urban areas, significant consideration should be given to visual amenity.
- Noise sensitive receptors should be considered.
- Contaminated land should be considered.
- The type of soil on the site, the slope and potential earthworks that may be necessary to level the site for development, the amount of vegetation, and the potential for storm water runoff.

3.9 Community Consultation

If the site is integral with or adjacent to a residential community, consideration needs to be given to the form and extent of consultation that will be needed with that community. As a minimum, the local council must be consulted to ensure they are supportive of the proposal and that it does not conflict with their planning scheme.

Appendix A. Vegetation Management General Arrangement

Figure A-1

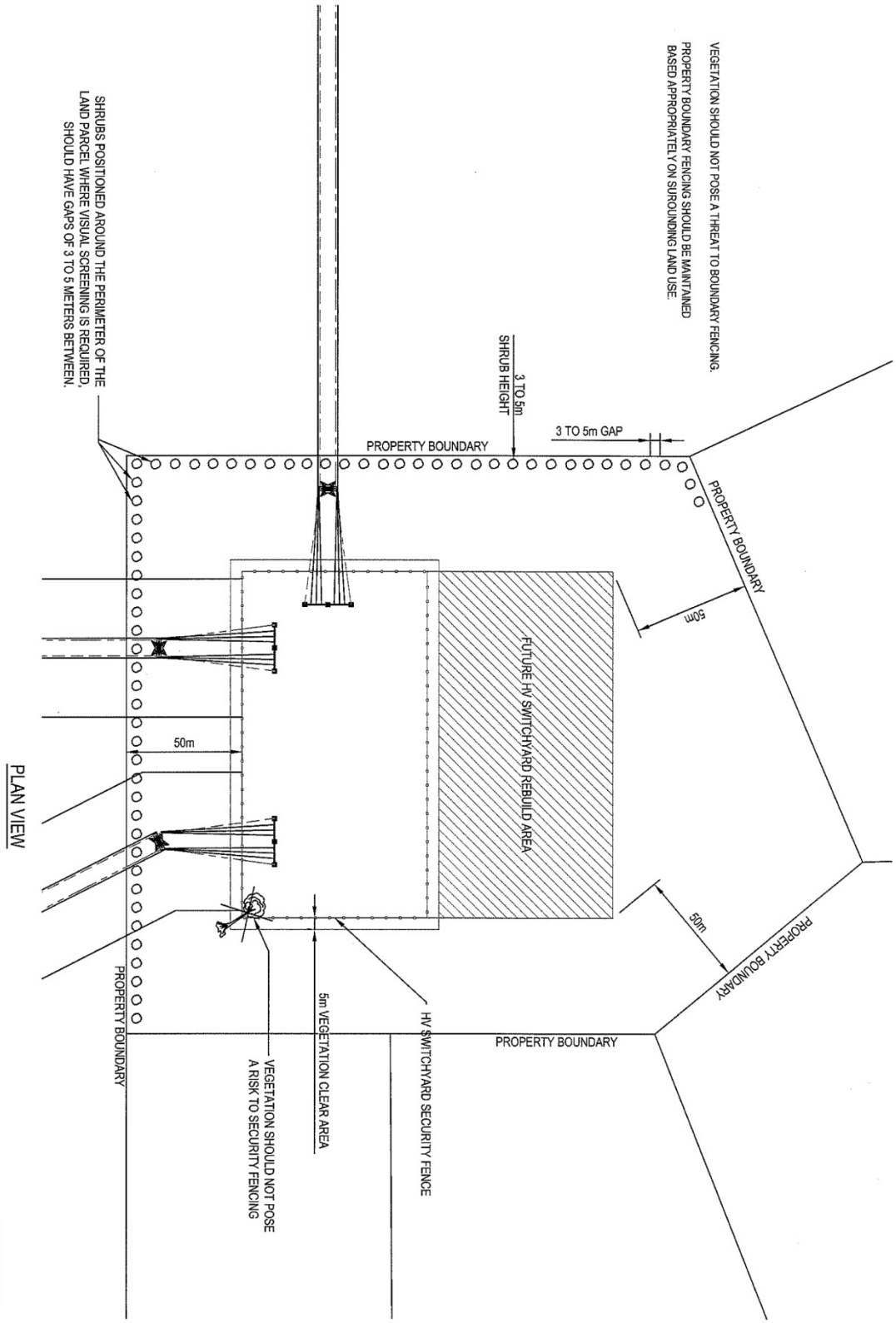


Figure A-2

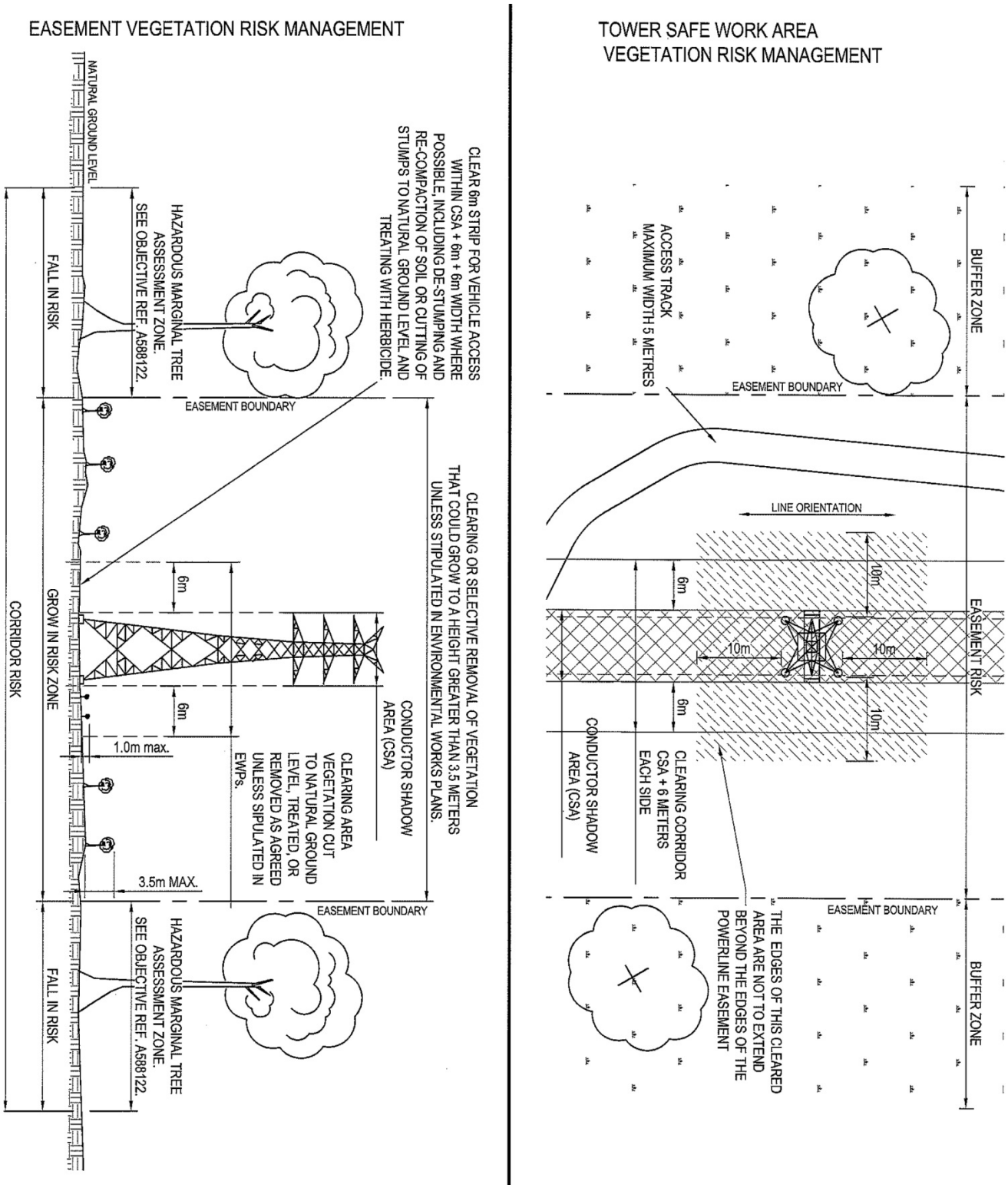
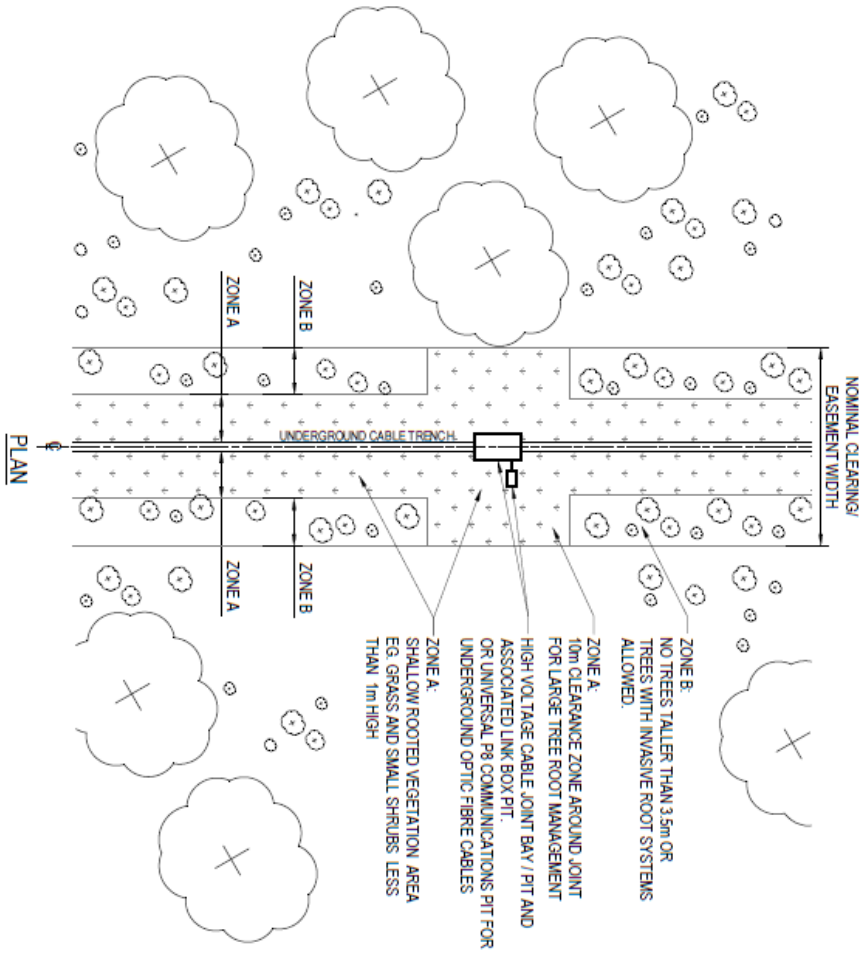

EASEMENT VEGETATION RISK MANAGEMENT
NATURAL GROUND LEVEL
FALL IN RISK
HAZARDOUS MARGINAL TREE ASSESSMENT ZONE. SEE OBJECTIVE REF. A588122.
EASEMENT BOUNDARY
CLEAR 6m STRIP FOR VEHICLE ACCESS WITHIN CSA + 6m + 6m WIDTH WHERE POSSIBLE, INCLUDING DE-STUMPING AND RE-COMPACTION OF SOIL OR CUTTING OF STUMPS TO NATURAL GROUND LEVEL AND TREATING WITH HERBICIDE.
CLEARING OR SELECTIVE REMOVAL OF VEGETATION THAT COULD GROW TO A HEIGHT GREATER THAN 3.5 METERS UNLESS STIPULATED IN ENVIRONMENTAL WORKS PLANS.
CORRIDOR RISK
GROW IN RISK ZONE
6m
6m
1.0m max.
CONDUCTOR SHADOW AREA (CSA)
CLEARING AREA VEGETATION CUT TO NATURAL GROUND LEVEL, TREATED, OR REMOVED AS AGREED UNLESS SIPULATED IN EWPs.
3.5m MAX.
EASEMENT BOUNDARY
HAZARDOUS MARGINAL TREE ASSESSMENT ZONE. SEE OBJECTIVE REF. A588122.
FALL IN RISK
TOWER SAFE WORK AREA
VEGETATION RISK MANAGEMENT
ACCESS TRACK MAXIMUM WIDTH 5 METRES
EASEMENT BOUNDARY
BUFFER ZONE
LINE ORIENTATION
6m
10m
10m
10m
10m
EASEMENT RISK
6m
CONDUCTOR SHADOW AREA (CSA)
CLEARING CORRIDOR CSA + 6 METERS EACH SIDE
THE EDGES OF THIS CLEARED AREA ARE NOT TO EXTEND BEYOND THE EDGES OF THE POWERLINE EASEMENT
EASEMENT BOUNDARY
BUFFER ZONE

Figure A-3



VEGETATION ZONE TABLE

APPLICATION	ZONE A DISTANCE - EITHER SIDE OF CENTRELINE	ZONE B DISTANCE	NOMINAL CLEARING/ EASEMENT WIDTH	NOTES
UNDERGROUND HIGH VOLTAGE CABLE JOINT BAY/PIT	10m IN ALL DIRECTIONS	NOT APPLICABLE		GRASS AND SHALLOW ROOTED VEGETATION ONLY <1m
COMMUNICATIONS PIT	10m IN ALL DIRECTIONS	NOT APPLICABLE		GRASS AND SHALLOW ROOTED VEGETATION ONLY <1m
COMMUNICATIONS TRENCH	1.5m x 2	1.5m x 2	6m	
<132KV CABLE TRENCH	2.5m x 2	2.5m x 2	10m	
132KV CABLE TRENCH	3.0m x 2	3.0m x 2	12m	
275KV CABLE TRENCH	10m x 2	NOT APPLICABLE	20m	GRASS AND SHALLOW ROOTED VEGETATION ONLY <1m
330KV CABLE TRENCH	12m x 2	NOT APPLICABLE	24m	GRASS AND SHALLOW ROOTED VEGETATION ONLY <1m

Appendix B. Washdown Standard Design Drawings

Figure B-1

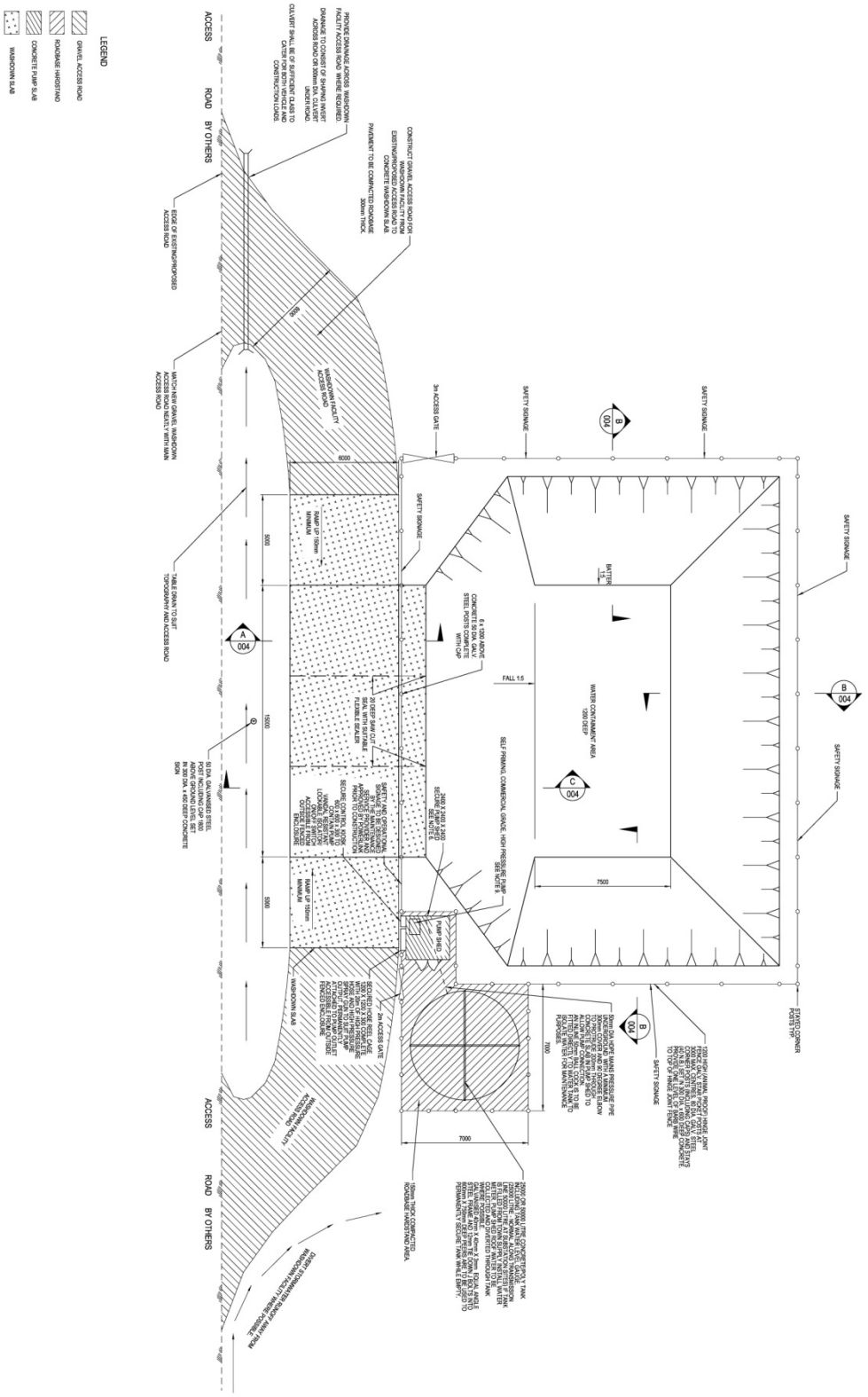


Figure B-2

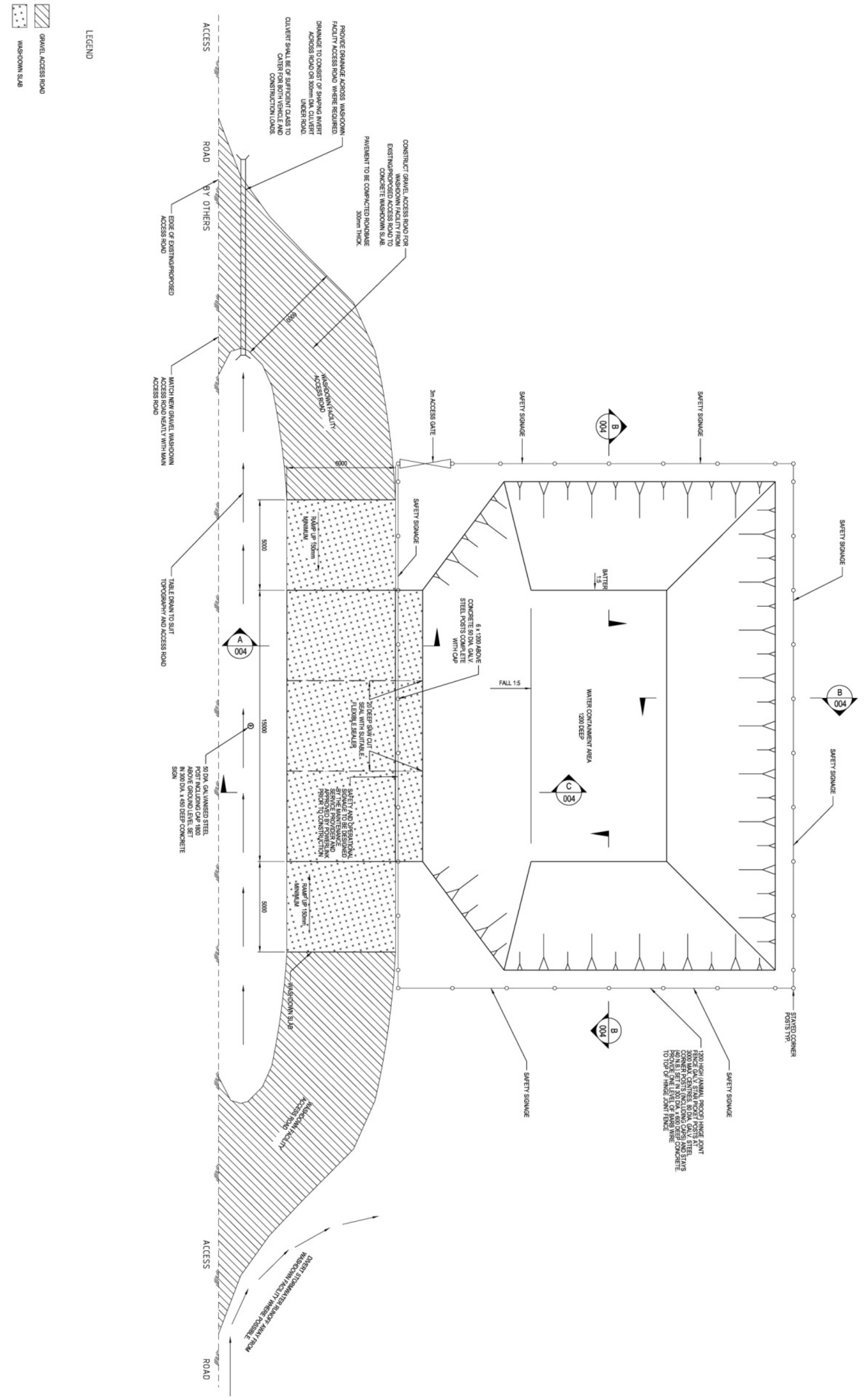


Figure B-3

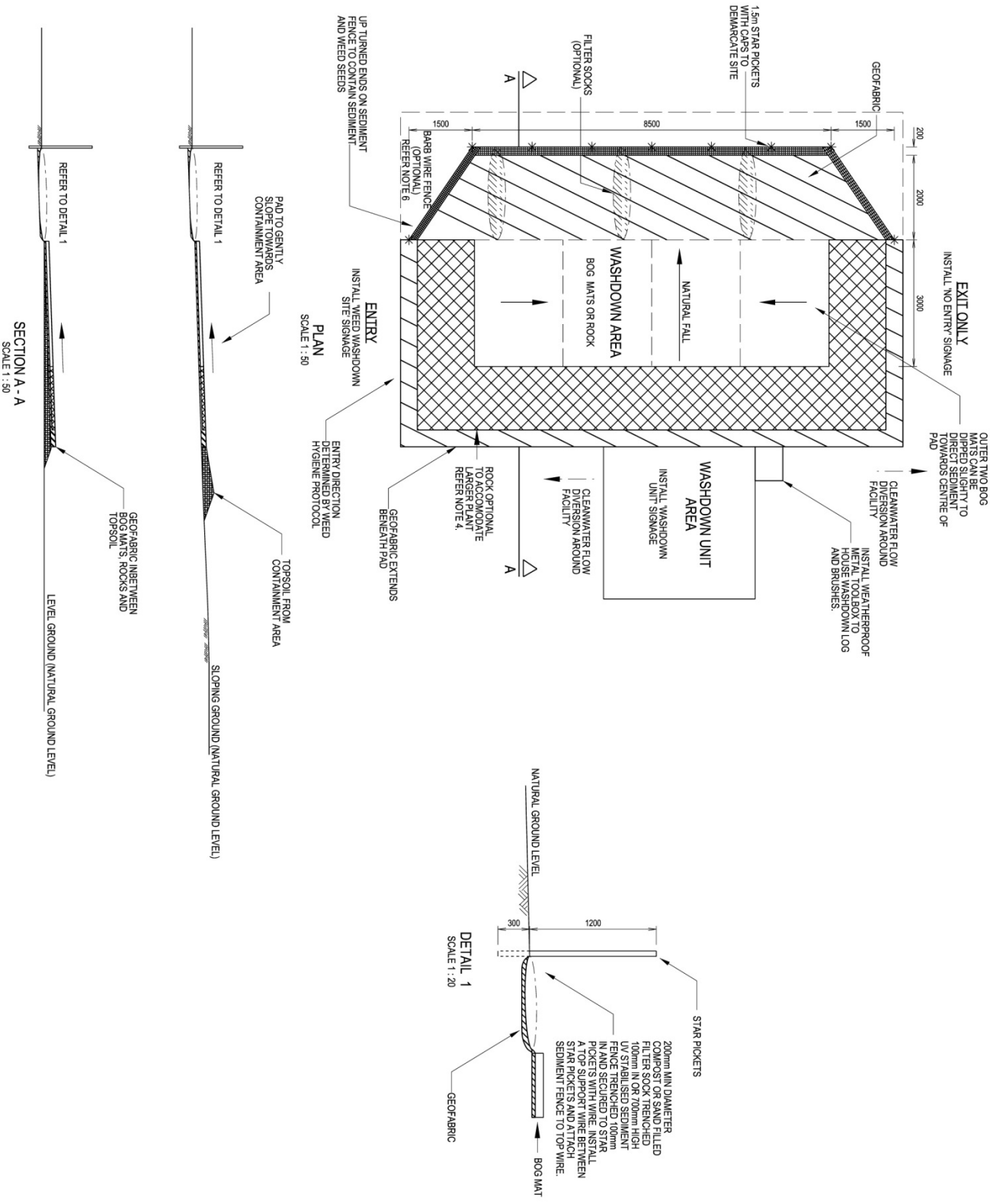
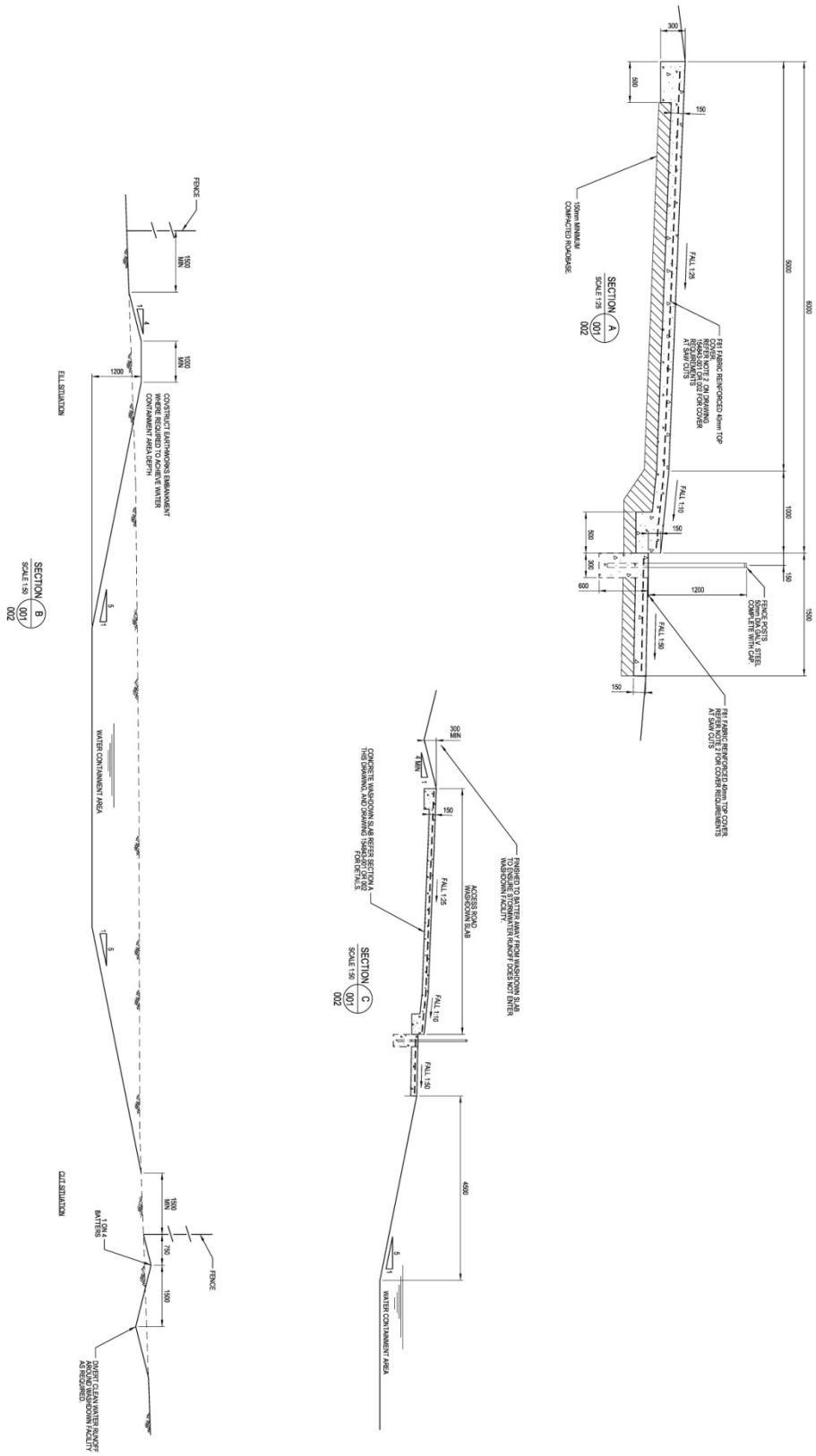

1.5m STAR PICKETS WITH CAPS TO DEMARCATE SITE
FILTER SOCKS (OPTIONAL)
GEOFABRIC
1500
8500
1500
200
2000
3000
BARB WIRE FENCE (OPTIONAL) REFER NOTE 6
UP TURNED ENDS ON SEDIMENT FENCE TO CONTAIN SEDIMENT AND WEED SEEDS
WASHDOWN AREA
BOG MATS OR ROCK
NATURAL FALL
EXIT ONLY
INSTALL 'NO ENTRY' SIGNAGE
ENTRY
INSTALL 'WEED WASHDOWN SITE' SIGNAGE
PLAN
SCALE 1 : 50
OUTER TWO BOG MATS CAN BE DIPPED SLIGHTY TO DIRECT SEDIMENT TOWARDS CENTRE OF PAD
ENTRY DIRECTION DETERMINED BY WEED HYGIENE PROTOCOL
GEOFABRIC EXTENDS BENEATH PAD
ROCK OPTIONAL TO ACCOMODATE LARGER PLANT REFER NOTE 4.
CLEANWATER FLOW DIVERSION AROUND FACILITY
WASHDOWN UNIT AREA
INSTALL WASHDOWN UNIT SIGNAGE
CLEANWATER FLOW DIVERSION AROUND FACILITY
INSTALL WEATHERPROOF METAL TOOLBOX TO HOUSE WASHDOWN LOG AND BRUSHES.
A
A
REFER TO DETAIL 1
REFER TO DETAIL 1
PAD TO GENTLY SLOPE TOWARDS CONTAINMENT AREA
SECTION A - A
SCALE 1 : 50
GEOFABRIC INBETWEEN BOG MATS. ROCKS AND TOPSOIL
LEVEL GROUND (NATURAL GROUND LEVEL)
TOPSOIL FROM CONTAINMENT AREA
SLOPING GROUND (NATURAL GROUND LEVEL)
NATURAL GROUND LEVEL
300
1200
DETAIL 1
SCALE 1 : 20
STAR PICKETS
200mm MIN DIAMETER COMPOST OR SAND FILLED FILTER SOCK TRENCHED 100mm IN FOR 700mm HIGH UV STABILISED SEDIMENT FENCE TRENCHED 100mm IN AND SECURED TO STAR PICKETS WITH WIRE. INSTALL A TOP SUPPORT WIRE BETWEEN STAR PICKETS AND ATTACH SEDIMENT FENCE TO TOP WIRE.
GEOFABRIC
BOG MAT

Figure B-4


SECTION A
SCALE 1:25
001
002
SECTION B
SCALE 1:50
001
002
SECTION C
SCALE 1:50
001
002
FENCE
1500 MIN
1200
CONSTRUCT EARTHWORKS BUNDWALL WHERE REQUIRED TO ACHIEVE WATER CONTAINMENT AREA DEPTH
FILL SITUATION
WATER CONTAINMENT AREA
CUT SITUATION
1.75M H BATTERS
750
1500
DIVERT CLEAN WATER RUNOFF AROUND WASHDOWN FACILITY AS REQUIRED
150mm MINIMUM COMPACTED ROADBASE
FALL 1:25
FALL 1:10
FALL 1:50
F81 FABRIC REINFORCED 40mm TOP COVER REQUIREMENTS AT SAW CUTS
300
500
150
5000
6000
1000
600
1200
FENCE POSTS INSTALLED IN STEEL SLEEVES COMPLETE WITH CAP
1500
CONCRETE WASHDOWN SLAB REFER SECTION A THIS DRAWING AND DRAWING 1546A001 SHT 002 FOR DETAILS
ACCESS ROAD WASHDOWN SLAB
DIVERT TO BUFFER MAIN FROM WASHDOWN SLAB TO ENSURE STORMWATER RUNOFF DOES NOT ENTER WASHDOWN FACILITY
4800