CIVIL WORKS FIELD MANUAL

CHAPTER 2 OF 2

COMPREHENSIVE FIELD GUIDE ON THE CORRECT CIVIL WORKS ACTIVITIES FOR THE INSTALLATION OF EVOENERGY ASSETS.

This manual covers Evoenergy's civil works safety management, asset location, excavation types, clearance, work variation, material, conduit installation, backfilling /compaction and site restoration requirements.

CONTENTS

1. GETTING STARTED

CIVIL WORKS LIBRARY

The Civil Works Manual has been compiled into two volumes: 1. Planning and Design and 2. Civil Works Field manual. The design manual is for internal Evoenergy use only. It is expected that all civil works contractors will have their own contract compliant design and planning processes and procedures. This document is for use by all field civil works workers both internal and external to Evoenergy.

Quick check

ITEM	REACTIVE	BROWNFIELD	GREENFIELD	OBTAINED / COMPLETE
Site drawings, work requests. Standard drawings / unit assemblies		Y	Y	
Contact details	Good practice	Y	Y	
Contact Dial before you dig	Y contact appropriate after-hours centres for advice	Y	Good practice	
Site establishment / approvals	Good practice	Y	Y	
Collect relevant Safe Work Method Statements (SWMS)	Y	Y	Y	
Conduct Job Risk Assessment (JRA)	Y	Y	Y	
Electrical safety rules training	Y	Y	Good practice	
Receive environmental advice and control impacts	Good practice	Y	Y	
VENM Approval	Y	Y	Y	
Site made safe / sit	Y	Y	Y	
Required de energisation applied	Y	As required	Normally not required	

Positive asset location	Y	Y	Good practice
Un earthed facilities / services protected	Y	Y	Normally not required

2. CONVENTIONS USED

	Critical to safety Critical to quality Critical to environment		Flame hot surface, Gas pipe
	Environmental impact		Training
	Electrical hazard / high voltage		Heavy
	Mobile plant		Slips trips and falls
	Documentation required		Hand tools
	Power tools		Hydrovac equipment
	Sharp tools		Unexpected equipment startup rotational risk
	Stored energy		Plan
	Tips		Always Yes
	Never No		Contact details
	Tools Safe Work Method Statements		Positive asset location / identification Inspection
	Stop and check		Variation from plan Inspection test plan
	Stop and get approval, critical steps / information must be followed		Thermal control

	Dial before you dig		Risk, additional activities to mitigate risk
	Material collection		Risk to underground utilities
	Traffic management		Limit mechanical dig

3. SAFE WORK METHODS

Consult Safe Work Method Statements (SWMS) for appropriate work practices and additional instructions

You can find further information at https://www.safeworkaustralia.gov.au

SAFE WORK AUSTRALIA REGULATIONS

A Person Conducting a Business or Undertaking (herein referred to as PCBU) e.g. site owner or principal contractor must manage risks associated with all kinds of excavations at the workplace, no matter how deep. Safe work Australia has a number of regulations around excavations.

You can find further information on risk management of excavations at "Excavation work code of practice". https://www.safeworkaustralia.gov.au/system/files/documents/1705/mcop-excavation-work-v3.pdf

White cards. https://www.accesscanberra.act.gov.au/app/answers/detail/a_id/1103/~/general-construction-induction-card-%28white-card%29

WHITE CARDS

A PCBU must make sure every worker has completed General Construction Induction or "White card" training.

A white card issued in one state or territory or by the Commonwealth is generally recognised Australia wide.

Contact the WHS Regulator in your state or territory or the Commonwealth, for more information about training, cross-border recognition, applications and renewal of White Cards.

JOB RISK ASSESSMENT (JRA)

Prior to performing activities outlined in this document, any hazards associated with prerequisite tasks at the worksite are to be identified and assessed with appropriate control measures implemented and documented in the Job Risk Assessment (JRA).

4. WORKS OVERVIEW

Our aim is to continually improve safety, quality and reliability within our underground network.

TIPS

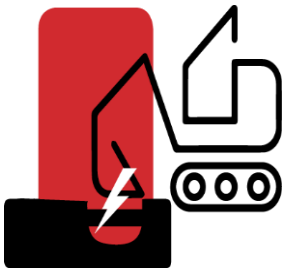
- **The 5 P's, Plan, prepare, pothole, protect then proceed**
- **Obtain approval for all 'out of tolerance' variations and waste soil disposal**
- **Ensure team members have required training**
- **Keep the site clean**
- **Always perform risk analysis**
- **Keep your risk analysis and reaction plans updated**

Works for Electricity network distribution can last multiple lifetimes. The objective of this manual is to illustrate the elements that are important to performing work to the highest standards which builds long term reliability and quality:

- critical to quality
- critical to safety
- critical to the environment

Collating these and other requirements in this one location enables all participants to understand and evaluate the works.

DANGERS ASSOCIATED WITH DAMAGE TO UNDERGROUND CABLES



Injuries that result from damage to live electricity cables are usually caused by the explosive effects of arcing current and by any associated events that may follow when the sheath of a cable and the conductor insulation are penetrated.

This penetration may be by a sharp object such as the point of a tool, or when a cable is crushed severely enough to cause internal contact between the screen and or one or more of the conductors. The resulting arc flash can cause severe burns.

Damaging underground cables increases the risk of electric shock.

Failure to report damage can cause future incidents.

If you encounter an object that looks like a buried cable, treat it as though it were a live electric cable until proven otherwise.

If you are working on or near our assets, then Electrical Safety Rules training is essential.

CONFLICTING STANDARDS

Hierarchy of information is:

a. contract requirements
b. acts and regulations
c. acknowledged standards and specifications
d. “released for construction” works package
e. this document

If you find a conflict, timely notification to us will assist in creating effective processes.

DOS AND DON'TS

ALWAYS

- positively identify assets
- use coloured markings for asset types
- protect and preserve the colour coded site markings
- call for remarking if the colour coded markings are damaged
- monitor for any sign of the asset during the excavation
- obey clearances
- use appropriate fences and barriers
- conduct excavations around assets carefully
- protect and support exposed assets during excavation and then take care while backfilling to maintain support to prevent damage
- have a list of emergency contact numbers available
- have an emergency plan that everyone on the job is educated about

NEVER

- just dig
- assume that an asset runs straight between asset markers
- assume you know where assets are
- assume the depth of an asset is the same depth throughout the entire route
- use a powered excavator within 300mm of an medium voltage electrical asset without approval
- work on a live medium voltage asset unless qualified, trained, and using approved PPE and processes
- dig up grading rings
- bury assets deeper than specified or place in unspecified locations grading rings, bonds or stakes
- assume all asset owners have responded to your location request
- expose the public or workforce to unacceptable risk
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CABLE INSTALLATION

All underground cables are to be installed by either boring or excavating.

Bore pipe conduits are to be proven prior to cable installation see section 22 Conduit (PVC) for proving instructions.

STAGES OF EFFECTIVE CIVIL WORKS

2.1 Safety and management programs

2. Complete all required Job Risk Assessments (JRAs)
3. Develop Safe Work Method Statements (SWMS)

4. Ensure safety plans are in place, including:
5. noise, personal and public
6. trips and falls
7. environmental spills
8. contact with assets
9. fencing
10. Perform required soil testing and deploy excavation measures in line with the soil type
11. Complete required issued for construction works
12. Obtain any Electrical Safety Rules training
13. Plan for the removal or protection of surface encumbrances

2.2 Locating

1. Positively locate the position of each known asset
2. Mark the site using the colour standards
3. White swim lane the work area
4. Check for facilities that are:
    a. misaligned
    b. unidentified
    c. inactive

2.3 Excavating

1. Enact any communications required e.g. informing asset owners of works near their assets
2. Understand clearances to our assets and other authorities
3. Identify if you can excavate without an approved asset observer
4. Protect exposed assets
5. Ensure emergency contact details are present for all utilities / asset owners

2.4 Variations

Have all variations to Issued for Construction works approved before implementation

2.5 Backfilling

Obtain approvals before backfilling e.g. cable hauling and jointing complete

2.6 Reinstatement

1. Use photographs to review what the area looked like before work commences
2. Replace agreed trees, grasses and other seeds
3. Replace street furniture
4. Reinstate paved surfaces
5. Remove protective fencing

CONTACT POINTS / PERSON IN CONTROL

Our contact points in contact plans, for variation requests and general communications is our Person In Control, this is nominally the project manager.

FENCING SIGNAGE LOCATING AND MARKING

5. FENCING SIGNAGE AND PROTECTING TREES

Temporary fencing is to comply with AS 4687 and wind regions AS1170.2

Safety signs for the occupational environment to comply with AS1319

Traffic Management Code of Practice (The code). Traffic control at worksites manual http://www.rms.nsw.gov.au/business-industry/partners-suppliers/document-types/guides-manuals/traffic-control-worksites.html

Roadside barriers are to comply with AS1742.3 and AS3845.1

You can locate the definition for regulated and significant trees on the TCCS website

http://www.tccs.act.gov.au/parks-conservation/trees_and_forests/information_about_tree_protection_on_leased_land#wiapt

Trees within the worksite are to be protected in accordance with AS4970

Worksafe requires construction work to be appropriately signed see

https://www.safework.nsw.gov.au/your-industry/construction

Access Canberra Managing the Work Environment and Facilities Code of Practice

https://www.accesscanberra.act.gov.au/app/answers/detail/a_id/3658/~/construction-site-management

TEMPORARY FENCING

It is the responsibility of the site owner or Principal Contractor to complete a risk assessment and determine the most appropriate fencing systems to ensure public safety. All equipment materials pot holes are to be appropriately fenced.

INSTALLATION

Temporary fencing systems must comply with the Occupational Health and Safety Regulations and the provisions of any relevant Australian Standard.

1.1 Fencing and substations

A non-conductive fence partition / gap exceeding the earth mat and step potential distances must be installed in-between substation and temporary fence

1.2 Fencing and transmission lines

It is recommend that all fencing within or crossing a transmission line easement is constructed of wood or other non-conductive material.

Seek advice from Transgrid and or Evoenergy for any fencing within a transmission easements

1.3 Fences around Padmounts

Conductive fences are to be located a minimum of 2000mm from the Padmount and its associated earthing. Clearances can be found in Drawing 3832-018

SIGNAGE

Appropriate signs are to be located on fences, Safety signs for the occupational environment to AS1319

6. LOCATION BURIED ASSETS / SERVICES

POSITIVE ASSET IDENTIFICATION and LOCATION is essential in preventing accidental contact. With some assets installed over 60 years ago, it is likely that changes have occurred to the surface of the land. Road widening and regrading of surfaces are common causes for inaccuracies in records.

Always check the surroundings for indications of assets that may not be correctly identified on plans e.g. traffic signal power.

APWA Uniform Colour Codes for temporary marking of underground utilities
https://www.alliancepipeline.com/SafetyEnvironment/Safety/Documents/UniformColorCodes.pdf

Tips

Dial before you dig is just one method, Use multiple methods to back up your findings:

-
- Find and expose all underground services and assets before you start excavating
- Adhere to clearance distances, no go zones / envelopes
- Keep a record of notes and all contact with asset owners to demonstrate your duty of care
- Be aware that not all assets / services may be disclosed or in the nominated location
- Check for signs of undisclosed assets / services include pits, markers and drains
- Depths may have altered or the asset may present at a different depth
- There may be more than one asset at the location
- New works may not have reached plans

- Locating can get it wrong, one may be 2 or 3 or more
- If you see something STOP, verify what it is before moving on

Plans, Dial Before You Dig and construction drawings

1.1 Contact information

Have contact names and phone numbers for all known underground asset owners available, including afterhours contact details.

1.2 Construction drawings

Construction drawings showing new construction and existing facilities should be present and utilised during potholing activities.

Construction drawings should be compared to designating / locate paint marks to determine if all facilities shown on the drawings have been identified in the field.

If drawings and paint marks do not match, undertake additional tests to determine accurate locations

1.3 Mis-designated assets

If location paint marks and drawings have improperly designated the location, and the asset is exposed during potholing or other excavation, the asset owner is to be notified so corrective actions can be taken.

For high risk assets e.g. Gas, electricity or major water main, excavation is to be stopped until the asset owner approves works.

Contact the asset owner if the asset cannot be located through potholing used in conjunction with drawings for advice on location / next steps.

1.4 Markings and Colour Codes

Use the Universal colour code to mark asset locations and types.

Markings must always be visible. Don't mark assets in the while line / swim lane space. Re mark any disturbed marks.

COLOUR	ASSET TYPE
	Red – Electric power lines, cables, conduits, lighting cables and traffic lights
	Yellow – Gas, oil, steam, petroleum or gaseous materials
	Orange – Communication, alarm or signal lines, cables or conduit
	Blue – Potable Water
	Green – Sewers and drains
	Pink – Temporary survey marking
	Purple – Reclaimed water, irrigation and slurry lines
	White – Proposed excavation

1.5 Unidentified assets

If the unidentified asset excavated is a high risk e.g. Gas or major water main, excavation is to be stopped until the asset owner approves works.

1.6 Inactive assets / services

In cases where assets / services are no longer being utilised they may be left in-situ and may or may not appear on site drawings.

Until positively proven otherwise any potentially inactive asset / service is to be treated active

Seek advice from the asset owner on its treatment

Marking the work site

Clear marking is a method of reducing damage to underground infrastructure.

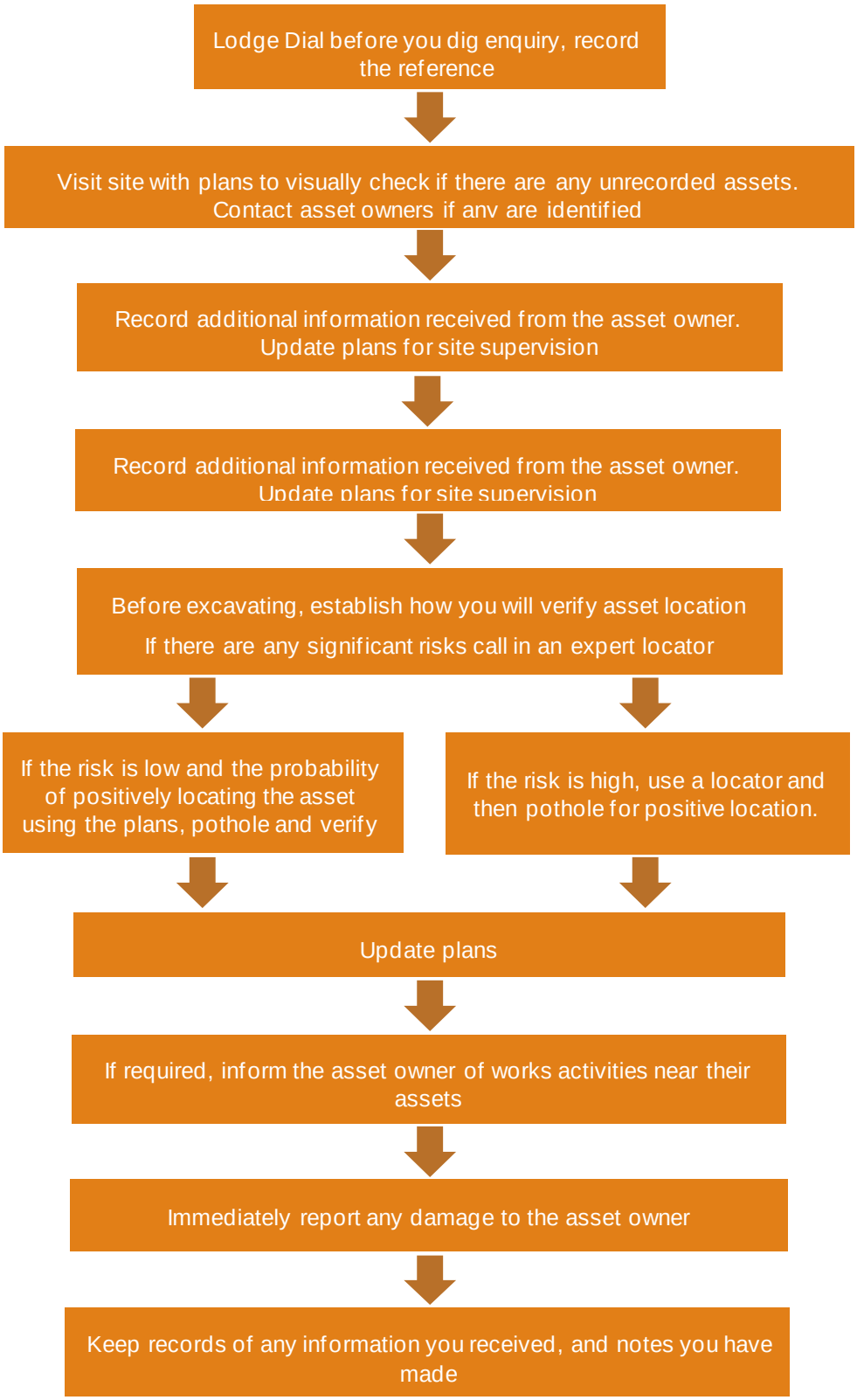
- Use marking that is not oversized
- Avoid placing marking on buildings

1.7 Pre-marking

It is good practice to rough out the worksite and ensure that equipment is clear of the proposed run before positive asset location is undertaken, for example, white paint, flags or white stakes before the locator's arrival.

1.8 The practice of white lining / swim lanes

Know where you are excavating using white lining (Swim lanes) to mark the excavation limits.


Lodge Dial before you dig enquiry, record the reference
Visit site with plans to visually check if there are any unrecorded assets. Contact asset owners if anv are identified
Record additional information received from the asset owner. Update plans for site supervision
Record additional information received from the asset owner. Update plans for site supervision
Before excavating, establish how you will verify asset location
If there are any significant risks call in an expert locator
If the risk is low and the probability of positively locating the asset using the plans, pothole and verify
If the risk is high, use a locator and then pothole for positive location.
Update plans
If required, inform the asset owner of works activities near their assets
Immediately report any damage to the asset owner
Keep records of any information you received, and notes you have made

Q	Identification is the locator's responsibility why do I need to know all this?
A	Location is a human effort, it can have errors. Nothing replaces a keen eye or knowledge of the area.
Q	Can other marking colours be used?
A	Provided they adhere to the standard.
Q	White lining, do we have to do it?
A	With white lining you can check to ensure that you are meeting plan before turning a single sod. It also assists in establishing where ancillary items can be located.
Q	Do I need to pothole?
A	Positive asset location and identification is required before you start earthworks.
Q	Which do I believe, the drawings or the paint markings?
A	Pothole and locate. Inform the project manager of discrepancies.
Q	How far away must an asset be from works?
A	See clearance distances, don't forget envelopes.
Q	Can I just dig out an inactive asset / service?
A	You must obtain the correct approvals to do so from the owner.

Positive asset identification and location significantly reduces the number of asset strikes.

7. POTHOLES

Potholing is the practice of excavating a test hole to expose underground assets and ascertain its horizontal and vertical location.

The practice provides positive asset location and assists in asset identification.

Potholing is accomplished through various types of excavation methods and equipment. This practice covers general methods. Procedures and practices associated with specific equipment should be based on manufacturer's recommendations.

How assets will be identified is the responsibility of the Site Owner or Principal Contractor to establish.

ALWAYS

- monitor dirt colour for changes
- use care when warning stretch tapes or polymeric covers are uncovered
- use nonconductive tools
- have a plan for the disposal of waste soil

NEVER

- be aggressive with excavations
- assume the asset is at a fixed depth
- expose excessive lengths of cable without proper support
- assume that it is not there

SAFETY WHILE POTHOLING

Potholing is an excavation and should follow the same practices. Erect barriers / fences if required. If the material being excavated looks or smells strange then seek guidance. The Unexpected Finds Procedure should be followed in the event that contaminated material is uncovered.

METHODS OF POTHOLING

1.1 Hand excavations

Hand excavating a test hole is the method of excavating a pothole by manual means with hand held equipment such as a shovel. This method is labour intensive and time consuming.

The advantage of hand excavating is that it does not require expensive equipment and is relatively safe for locating most facilities. Practice caution if excavating near hazardous utilities such as electric cables, use insulated tools.

Take care to prevent damage by using a rounded or blunt-edged shovel. Sharp tools like pickaxes, mattocks, pry bars, or pointed spades may gouge or puncture assets, these sharp tools are not allowed within 300mm of our assets (For more information on safe approach distances refer to section 2 of the Evoenergy Electrical Safety Rules)). Start your excavation off to the side of the marked line. Use a gentle, prying motion to break away soil as you approach the line laterally. Never pry against an asset to remove soil, stab at the soil, or stomp on the shovel with both feet.

1.2 Non-destructive digging

Can be with either hand tools (Not sharp tools e.g. pick, Maddox, pry bars) or by using specialised machinery

1.2.1 Vacuum excavation

Vacuum excavation is the preferred method for non-destructive exposure of buried utilities. Vacuum excavation utilises either air or water pressure to break up the soil and a vacuum device to collect the spoil.

1.2.1.1 Air

Air vacuum excavators utilise the kinetic energy in a high velocity air stream to penetrate, expand and break-up soil. The loosened chunks of soil and rock are then removed from the hole using a powerful vacuum. Dry or air excavation has several advantages over water vacuum excavation.

- the air method is faster in most soils
- eliminates the need for mud disposal
- since the soil remains dry, it can immediately be used for backfill

One shortcoming of air units is that they are not effective in all soil types, especially wet, heavy clay and high Limestone content.

1.2.1.2 Hydrovac

Water vacuum excavation systems or Hydrovac excavate the pothole using high-pressure water to reduce and loosen the soil. The wet soil and mud slurry is removed to a spoil tank using a powerful vacuum. The higher density of water produces powerful forces that are effective in most soils including wet heavy clays.

Operational caution is also necessary as high-pressure water systems have the potential of creating static electricity and cutting through cables or damaging pipe if not used with care.

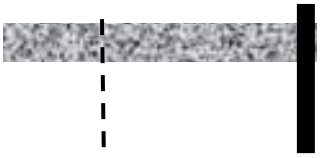
- Check that the setting is 2000psi or less for a rotating nozzle and 1500psi for a fixed nozzle
- Hydrovac nozzle not to come within 200mm of cable
- Earth the Hydrovac unit
- All Hydrovacing and equipment must be within a fenced / barricaded area
- Verify that the Hydrovac operator has Electrical Safety Rules Training

Hydrovac is not to be used on an energised suspected faulty cable.

The Hydrovac system must be adequately earthed.

Check that the boom will not come in contact or near overhead power cables.

Use slot potholing to locate the exiting set



New asset Existing asset

Use running potholes to verify the assets location on a long run

No matter which method is used you must positively locate assets

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1.3 Safety during potholing / locating

Potholes are a hazard, provide adequate trip protection while the hole is open.

The following items should be considered as part of assessing and mitigating hazards on the job site when performing a location.

- Communication between pothole digger and other personnel at the job site
- Pothole digger should be aware of safety requirements and emergency procedures to be followed where applicable or establish his/her own
- Traffic control considerations, including vehicular movement and pedestrian activity
- Trip and fall hazards
- Sources of energy (overhead and underground)
- Environmental factors, waterways and disposal of the pothole spoils / bunded areas for drying out

1.4 Fencing and barricades

If non-destructive digging equipment is used, all the equipment must reside within a barricaded / fenced area where the public cannot enter or touch the equipment.

1.5 Observers

For some assets including water and gas, the size of the asset will determine if an observer is required while you are potholing. Check observer requirements with each asset owner.

Q What method of potholing do you require me to use?

A	You can use whatever method is safe and effective for the job at hand. Hydrovac is a common solution.
Q	Hydrovac should be earthed, is this correct?
A	Yes.
Q	I am having issues with 2000psi, can I increase this to 2400psi.
A	No, the risk of damage is too high.
Q	Can I use the backhoe for exploratory digging?
A	If you have positively identified assets and are operating within approval limits, then yes.

CLEARANCES FOR ASSETS, EXCAVATING AND BORING

8. EXCAVATION CLEARANCES TO OUR ASSETS

Mechanical excavation equipment has a higher probability of damaging an asset or creating a hazard. If you are unsure of your clearance distance, what the asset is or your approval level then excavate no closer than 3000mm.

Information on our electrical safety rules is located at https://www.evoenergy.com.au/developers/electrical-safety-rules

These rules apply to powered and non-powered excavation

To excavate to or directly on our Medium Voltage and Low Voltage assets the following is required:

1. Electrical safety rules training to provide authorisation to dig closer than an ordinary person
2. positive asset location
3. use of insulated hand tools
4. use of non-destructive digging tools
5. approval for the use of powered excavation

HOW CLOSE CAN I DIG WITH A BACKHOE / EXCAVATOR?

Check the Electrical Safety Rules for your clearances.

With approval you can:

- excavate to the approved distance
- you must meet the requirements set out e.g. potholing, digging times or the length of trench that can be exposed at any time

Excavating a trench next to an asset is very different to excavating down to an asset. The rationale is that there are no markings to indicate how close you are to the side of the asset.

You must be authorised to mechanically excavate closer than 500mm to our medium voltage assets (Up to 22kV)

If powered excavation will expose an asset or disturb the protective cover, slab, asset/s or the bedding material around the asset, then approval must be sought.

How do I get approval?

Contact our Person In Control.

External parties must submit an application for miscellaneous electrical works request

What If I don't know where the cable is?

Use potholing methods to positively identify and locate the asset first. If there are any doubts then standard clearances must be obeyed.

How close can I go with a horizontal bore?

If you don't have approval but are authorised, you can only bore to within 1000mm of our medium voltage assets.

Clearances between assets can be found in 3832-018

If you have approval:

- You must perform potholing to verify the drill head location with respect to the asset. The distance between potholes will be contained within the approval, nominally this is every 10 metres.

POWERED EXCAVATION CONTROLS

Table 2.3 of the Electrical Safety Rules:

Safe Approach Distance (mm) to Underground Cables for Ordinary, Instructed and Authorised Workers				
Voltage	Non Destructive Digging		Powered Excavation	
Nominal phase to phase voltage AC	Ordinary person	Instructed person or authorised worker	Ordinary person	Instructed person or authorised worker
LV up to and including 400 V	300	Insulated contact*	500	300mm or to marker tape/hard cover**
HV up to and including 22 kV	300	Insulated contact*	500	300mm or to marker tape/hard cover**
66 kV	2000	300	3000	300mm or to marker tape/hard cover**
132 kV	3000	1800	3000	1800
* Denotes – no picks, crow bars, jackhammers or sharp edged shovel use within 300mm - Hydrovac excavation and hand digging to pothole down the cable itself is permitted				
** Denotes positive asset identification and location must be conducted first				

EXCAVATION AROUND ROCKS

Care should be taken when excavating in rocky ground. Ground hardness should be assessed and determined prior to excavation.

When using power tools to excavate, cut or drill beside or around direct laid cables in rock, a non-conductive barrier must be placed between the cable and the tool to protect the cable.

CLASSIFYING ROCKS

More than one sample should be taken to verify the hardness, qualified geologist consultation is required for absolute determination.

These tests focus on the strength of the rock material, not the rock mass which may be considerably less due to the effects of rock defects. The ease of breaking up the mass must be considered, not just the strength of the material. An example is crushed rock, each piece has a high strength factor, but the pile can be easy broken down with a shovel, Shale exhibits these characteristics.

Hardness	Typical range in unconfined compressive strength (MPa)	Field test on sample	Field test on outcrop
Very soft rock or hard, soil like material	0.6MPa to 1.25MPa	Scratched with fingernail. Slight indentation by light blow of point of geologic pick. Requires power tools for excavation. Peels with pocket knife.	
Soft rock	1.25MPa to 5MPa	Permits denting by moderate pressure of the fingers. Handheld specimen crumbles under firm blows with point of geologic pick. Examples Compacted bedding sand 2MPa. Flowable grout 2 to 5MPa. Wood 5MPa.	Easily deformable with finger pressure.
Moderately soft rock	5MPa to 12.5MPa	Shallow indentations (1–3 mm) by firm blows with point of geologic pick. Peels with difficulty with pocket knife. Resists denting by the fingers, but can be abraded and pierced to a shallow depth by a Sharp point. Crumbles by rubbing with fingers. Examples Dry clay	Crumbles by rubbing with fingers.
Moderately hard rock	12.5MPa to 50MPa	Cannot be scraped or peeled with pocket knife. Handheld specimen breaks with single blow of geologic hammer. Can be distinctly scratched with sharp point. Resists a pencil point, but can be scratched and cut with a knife blade. Example Back of a wall tile Concrete	Unfractured outcrop crumbles under light hammer blows.
Hard rock	50MPa to 100MPa	Handheld specimen requires more than one hammer blow to break it. Can be faintly scratched a sharp	Outcrop withstands a few firm blows before breaking.

		point. Resistant to abrasion with 80 grit sandpaper or cutting by a knife blade, but can be easily dented or broken by light blows of a hammer. Examples Sandstone Shale	
Very hard rock	100MPa to 250MPa	Specimen breaks only by repeated, heavy blows with geologic hammer. Cannot be scratched with sharp point. Example Brick	Outcrop withstands a few heavy ringing hammer blows but will yield large fragments.
Extremely hard rock	Greater than 250MPa	Specimen can only be chipped, not broken by repeated, heavy blows of a hammer. Example Bluestone Granite	Outcrop resists heavy ringing hammer blows and yields, with difficulty, only dust and small fragments.

Excavation using unpowered hand tools

Always avoid making contact with cables. If you must use insulated tools that do not have sharp edges

Take care to prevent damage by using a rounded or blunt-edged shovel. Sharp tools like pickaxes, mattocks, pry bars, or pointed spades may gouge or puncture assets these are not to be used within 300mm of our assets.

Start your excavation off to the side of the marked line. Use a gentle, prying motion to break away soil as you approach the line laterally. Never pry against an asset to remove soil, stab at the soil, or stomp on the shovel with both feet.

The use of pick, pry bars, mattock or other sharp hand tools that are not a round end spade are

- Not to be used within 300mm of a cable
- Not to be used within 300mm either side of orange stretch tape or hard covers

1.1 On top of an asset

On a medium voltage asset or low voltage asset, you can make contact with insulated tools if you are an authorised worker, else the clearance is 300mm.

The assets protective covers and bedding material must be replaced

1.2 Beside an asset

As an authorised worker you can excavate to within contact of the asset with non-destructive digging processes.

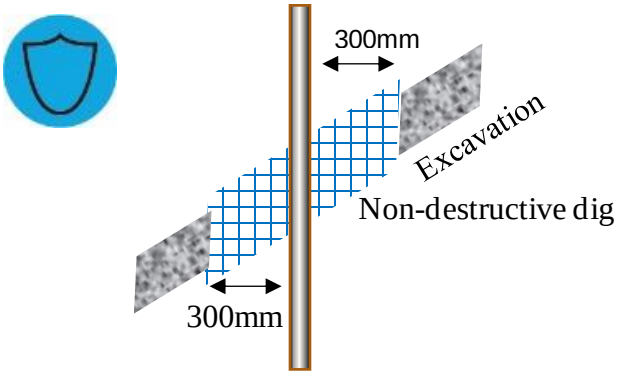
Ensure that you have approval to be within the distance

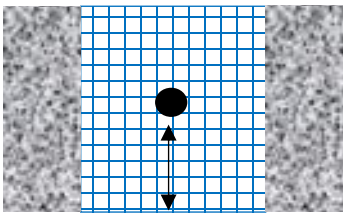
Do not expose more than 25% of the entire asset length at any one time

Replace bedding sand and covers with new materials

Don't use sharp tools

1.3 Going under an asset





Asset clearance + new asset height + bedding

Or

New excavation depth, whichever is greater

When crossing under our MV or LV assets non-destructive digging must be used by an instructed or authorised person to the clearance distance of 300mm either side of the asset.

The following must be observed:

- Even after non-destructive digging is complete an excavator must not enter the area, only non-destructive digging or hand excavation is to be used
- No more than 1500mm of the asset is unsupported
- Under-crossing are to be at right angles whenever possible
- Replacement and compaction of bedding materials is required
- Crossing cannot occur within 1500mm of a cable joint
- For crossing HV cables contact the asset owner

1.4 Going over an asset

Pothole to verify the asset location and ensure clearance to the new asset can be maintained.

Q	Do I excavate to within safe approach distance and then non-destructive dig / Hydrovac the rest?
A	You require approval to excavate within safe approach distances.
Q	How do I get approval to excavate close?
A	When approval to excavate within the safe approach distance is required ask your project manager to organise it.
Q	Is Hydrovac non-powered excavating or non-destructive digging?
A	For the purposes of this document it is non-destructive digging.
Q	When you say 25% of the assets length, what do you mean and why?
A	The length is from joint to joint or termination to termination or termination to joint, whichever is the lesser. This is done to ensure that the cable capacity is not adversely impacted.
Q	I have authorisation to excavate close, it is in a straight line, do I have to pothole every 10 metres?
A	Yes, things change direction underground quite quickly. Your approval may even request closer potholes.

9. EXCAVATING CLOSER THAN THE SAFE APPROACH DISTANCE

Safe approach distances are there to protect both you and the asset. Care must be exercised when you are allowed to excavate closer

If you are excavating a long parallel run to the asset that is within 500mm:

Never excavate and expose more than 25% of the total length at any one time. This is to ensure that thermal capacities are not exceeded.

Never place machinery closer than 500mm or in the trench zone of influence on the asset side to prevent cave in from the original trench site.

Electrical outages may be required.

If you dislodge or remove bedding sand it must be replaced with new bedding sand.

Compaction of that bedding sand cannot occur while the cable is energised.

Excavating closer than the safe approach distance with powered excavation can occur only when approval is granted. Excavation practice for close work requirements may include:

1. obtain approval (Mandatory)
2. electrical safety rules training (Mandatory)
3. potholing (Mandatory)
4. job briefings (Mandatory)
5. fencing / barrier locations / distance from assets and equipment
6. approach distance obtained
7. deploy safety observers
8. de-energising the cable

9. white lining
10. bucket sizes / excavation process

1.1 Obtaining approval

The approval will outline the distance you can excavate. The approval may also include

i. Electrical Safety Rules Authorisation level of workers as per table 3.2 of the Electrical Safety Rules.
ii. switching requirements (de-energising cables)
iii. if a safety observer is required
iv. pothole distances
v. if grade control must be used

Contact our project manager or person in Control for approvals.

1.2 Electrical safety rules training

Only instructed or authorised persons can dig close to our medium voltage assets. Instructed and authorisation requires appropriate training.

1.3 Potholes

Potholes to identify the assets location and depth must be conducted. If the distance between potholes is not provided consider 10 metres between each pothole.

1.4 Job Briefing

The Person in Control of the Site or Principal Contractor must conduct a job briefing with affected workers. The briefing must cover the following:

i. specific hazards with operating so close to an asset including step touch and earth leakage
ii. action plans on if an asset is struck
iii. duties of the safety observer
iv. white line do's and don'ts
v. approved approach distance

1.5 Deploying safety observers

A safety observer may be required when operating this close to our assets.

If required, assign an observer, whose only job is to monitor and ensure safe clearances are maintained and that the excavation is not going beyond the while lines, or too deep or that an asset is close to danger.

1.6 White lining

White lining to indicate the excavation area must be performed. Excavator operators are expected to work solely within the white lines.

1.7 Excavator grade control

Grade control assists in identifying the no dig zones and preventing inadvertent contact. Excavator grade control, unless it is integrated into the hydraulics does not prevent you from excavating too deep or from your bucket slewing and contacting assets.

We recommend the use of integrated grade to control to assist in preventing contact.

1.8 Bucket sizes

It is common practice to in say a 600mm wide trench to use a 600mm wide bucket. When excavating beside our assets, using a full width bucket is dangerous as the bucket may strike a buried object and slew into the asset that you are trying not to contact.

We prefer that the excavation for beside our asset is conducted in two sweeps, the first to the outer side of the excavation (Away from the asset) and the second next to the asset. In this way if an object is struck, the higher probability is that the bucket will slew towards to excavated side.

Even if the cable is de-energised, follow safe working practices as there may be other un-disclosed assets as the site or you may cause damage to assets

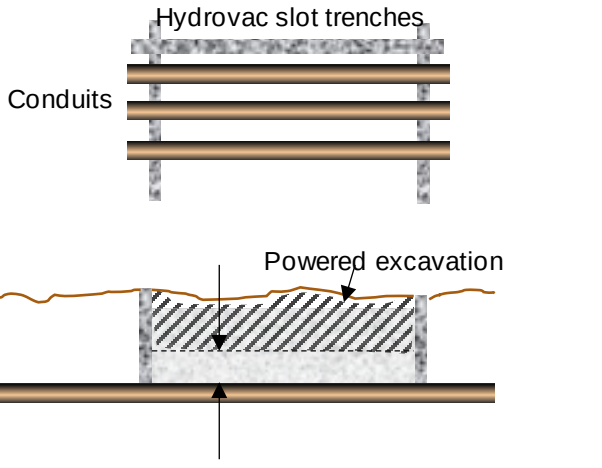
1.9 Exposing an asset

- Polymeric covers or stretch tape is not always in place above the asset.
- Never assume that there is only a certain number of cables / conduits in the stack.
- The depth of the conduit / cable stack can vary over time.

1.9.1 Process

1. Non-destructive dig / Hydrovac down to the asset
2. Non-destructive dig / Hydrovac a slot trench across the assets to identify the number and locations. The slot trench must be as wide as the excavation
3. perform a non-destructive dig /Hydrovac slot trench at the other end
4. verify that no other assets cross the area you wish to excavate, this is best performed by another non-destructive dig / Hydrovac slot trench along the excavation site
5. white line down the other side to mark the box to excavate
6. excavate to the highest asset + the [redacted] approved approach distance.
7. use powered excavation around the [redacted] asset once you are beyond the approved approach distance
8. complete exposing the asset using [redacted] Non-destructive digging

[redacted] If you need use a pick or crow bar, then STOP, use Non Destructive Digging / Hydrovac

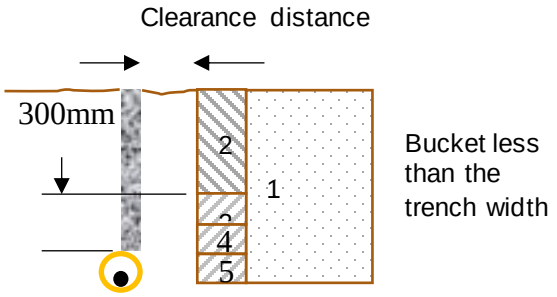


This depth must be by non-destructive digging

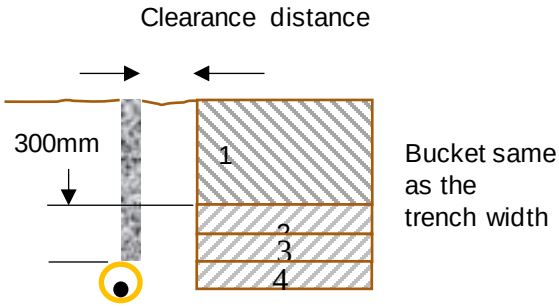
1.10 Trenching beside an asset

- cables and conduits do not run always straight, the may snake
- cables and conduits may be up and down in height
- take care with compression strength on the existing excavation, it may not hold your equipment
- consider having protection set to single shot

1.10.1 Process



Bucket less than the trench width



Bucket same as the trench width

Q	Why do I need to Hydrovac if the dirt is hard?
A	The potential probability to damage an asset and injury to a worker when using sharp implements or powered excavation is high.
Q	The trench is 600mm wide and so too is my bucket, I have grade control so why can I not just excavate in one sweep, it will make a cleaner trench.
A	If you have identified the asset depth and can verify that there are no foreign objects that may cause damage and can dig to your powered excavation limit then yes.
Q	The polymeric cover or tape is not present what distance can I excavate to?

A	Powered excavation to within 300mm of the top of the highest asset, continue to use potholing for positive asset identification and location
Q	The polymeric cover is directly on top of the asset, can I excavate to it?
A	Polymeric covers offer a degree of protection. With careful excavation and as an approved worker you are allowed to dig to them. Be cautious polymeric covers may not be present on all assets or for your entire excavation, continue to use potholing for positive asset identification and location.

10. CLEARANCES BETWEEN ASSETS / SERVICES

Two clearances are important for medium voltage electric cables; the distance between cables, and the distance between the cable and other assets / services.

Designers and installers must be aware that placing cables in parallel to existing assets / services that are closer than the specified distances, may introduce unacceptable risks, particularly to persons who at a later stage may require maintenance access. Approval for such variance is to always be obtained.

Identify clearences required → Mark up plans with clearences for all workers → Monitor that clearences are acheived and maintained

Standard clearances drawing number 3832-018

Shared trench agreement drawing number 393-010

Swimming pool clearances 3832-020

Cable trench details for cable installations not covered by shared trench agreement 393-007

Standard alignments and reservations overhead mains 393-002

SHARED TRENCH AGREEMENTS

Shared trenches require a minimum of 300 mm between our assets and any other asset.

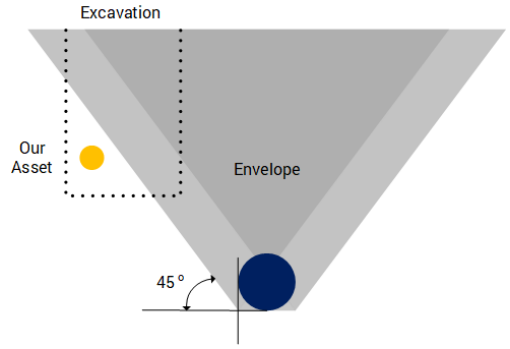
No other assets are to exist on the same alignment. See also drawing number 393-010

EXCLUSION ZONES AND ENVELOPES

There are exclusion zones around many assets such as high pressure gas transmission lines, large water mains and electricity transmission lines. Exclusion zones may also be known as an envelope.

Envelopes often exist around many assets at angles of 45º. Contact assets owners to verify envelope needs.

Our assets are not to exist in the envelope, however excavations to install and service our may enter the envelope if approval is granted by the asset owner.



SEPARATION BETWEEN ASSETS

Not every asset has been installed where drawings indicate they should be.

Where the installation of a new asset is likely to obstruct access to existing asset, then all reasonably practicable measures should be used to avoid this situation.

Our standard clearances can be found at

[redacted]

Always refer to the “released for construction” work package.

Q	Can I reduce the clearance distance?
A	Not without an approved variation.
Q	Can I take the envelope as from the crown of the asset?
A	It is normally from the side of the asset. Confirm envelopes with the asset owner.
Q	Where does the envelope cross our assets?
A	Without approval no part of our asset is to be within the envelope region.
Q	Can I perform earthworks into the envelop area?
A	The asset owner must be informed of the intended earthworks. They will provide feedback if such activities can occur.
Q	The plan has our cables closer together is that correct?
A	The plan “released for construction” works package takes precedence, always check the area / length that it is applicable for.

ASSET PROTECTION AND VARIATIONS

11. PROTECTING EXPOSED ASSETS

Exposed assets can shift or sag if the soil that was supporting and protecting the asset is removed. Protecting exposed underground assets helps ensure that the asset is not damaged and, at the same time protects employees working in the vicinity of the exposed asset.

Exposed assets can shift or be damaged when they are no longer supported or protected by the soil around them.

Protect assets exposed during potholing from foreign debris entering the pothole and against trips

On medium voltage cables, support is required if the unsupported length is 1500mm or greater

Protect the asset from heavy and sharp items falling into the excavation which could crush or cut

Consider methods to prevent accidental contact, even if the exposed section is very short

Don't leave assets unnecessarily exposed, ensure adequate fencing, barriers and signage is in place

Consider a temporary cover of works that are not completed at the end of the day

Heat resistant blankets / shields are to be placed around exposed assets if hot works is being performed in the vicinity

Provide adequate protection to prevent cables from being walked on e.g. sand bags

If you are under passing our asset, consider some form of visual identification e.g. paint markings in the trench.

If another utilities asset is exposed, advice must be sought from that asset owner on what treatments are required.

1.1 Methods of protection

Methods can include:

- Shoring the asset from below e.g. sandbags or by providing a timber support with hangers across the top of the excavation.
- Conduits cut in ½ like a culvert.
- Covering with approved bedding sand.

Instruct workers not to climb on, strike, or attempt to move exposed assets. Such actions could damage protective coatings, bend conduit, separate pipe joints, damage cable insulation, damage fibre optics, or in some way affect their integrity.

1.2 Plugs for crossing assets

Plugs of unexcavated material being left under the pipe or crossing structure. The plug is to run longitudinally (90 degrees to the crossing asset) and extend by 700mm on each side.

Plugs are not to be undermined / removed until the last minute

Where the plug is removed for the purpose of running our assets, it must be reinstated with compacted material extending past the asset by 1000mm

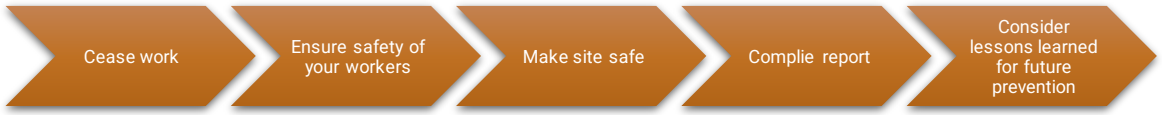
Crossing structures are not to be left unsupported overnight

Consult with the asset owner as to specific requirements to support their assets

WHAT TO DO IF AN ASSETS IS DAMAGED

Sometimes assets are damaged, attempting to repair an asset yourself is not the solution. Taking the proper steps will ensure safety and availability of the asset.

Any asset damage / inadvertent contact must be reported



OUR ASSETS

Should any existing cable or cable joint be damaged stop work immediately and clear all personnel to a distance of at least 8 metres.

1. Guard the site and immediately report to the Person In Control. Under no circumstances are any unauthorised repairs be made to an underground electricity cable.
2. Maintain a minimum clearance of 8 metres

OTHER UTILITIES ASSETS

Immediately report the incident.

Tips include:

- initiate emergency management plan
- keep people away from the area
- preserve the site

- shut off any equipment
- extinguish naked flames
- contact the Person in Control
- contact the asset owner

1.3 Contact with gas assets

Should an incident occur involving gas assets, the following actions should be taken:

All work should cease immediately.

Operator is to shut down the plant or equipment UNLESS this process may provide an ignition source for any escaping gas.

It is essential to leave the cab or operator station, excavation or enclosure and maintain an exclusion perimeter due to the risk of explosion or fire. DO NOT attempt to use any instrument which may provide an ignition source. This may include mobile phones,
two-way radios, etc.

Warn all other personnel / public to keep clear from the worksite and equipment. DO NOT attempt to approach or re-enter or start the vehicle until the relevant authorities have determined the site is safe.

Facilitate first aid treatment and seek medical aid as required.

Advise our organisations emergency contact and request they immediately notify the relevant authorities.

Initiate the emergency management plan and incident investigation process.

1.4 Contact with sewerage

Should an incident occur involving sewerage assets, the following actions should be taken:

- all work should cease immediately
- immediately remove contaminated clothing
- shower or wash down with copious amounts of water
- use eye wash if eyes are contaminated
- if wastewater is ingested, advice from a doctor should be sought immediately regarding prevention of Hepatitis A
- if a person develops symptoms of nausea, vomiting, diarrhoea or fever then a doctor should be consulted immediately
- advise our organisations emergency contact and request they immediately notify the relevant authorities, including the relevant water company
- initiate the emergency management plan and incident investigation process

1.5 Contact with medical waste / sharp objects

If the skin has been punctured or broken seek immediate medical advice

Initiate the incident investigation process

1.6 Contact with optic fibre cables

Do Not look directly into broken Optical fibre ends.

Be cautious of fibre shards entering exposed skin.

If a person develops symptoms of nausea, vomiting, diarrhoea or fever then a doctor should be consulted immediately

Initiate the emergency management plan and incident investigation process

1.7 Contact with communication cables

- preserve the site
- contact the Person In Control
- initiate the incident investigation process

CONTACT WITH PRIVATE PROPERTY

- Review that the activities are in line with the job risk assessment
- Preserve the site
- Contact the Person In Control

PRESERVING THE SITE

If an incident has occurred, the site must be preserved. Our incident process must be followed.

Q How do I know whom to contact?

A The contact information must be on your dial before you dig plan. Asset owners should also be in the general project contact directory or communications plan.

Understanding and controlling variations assists in creating a safe and reliable network.

12. VARIATION FROM PLAN

Even small changes outside the limits set within drawings can have disastrous impacts, from reducing the amount of power that a cable can handle, to creating a potentially dangerous situation during future excavation works.

WHAT IS A VARIATION

There are three types of variation.

1.1 Variation within plan / tolerance

No approval or variation request is required if the works fall within the tolerances marked on the "released for construction" work package.

1.2 Minimal variation

Minimal variations include:

1. selecting a different conduit size or type
2. altering the cable order
3. minor depth variations

These variations don't always change the "issued for construction" design drawing but do require approval as they can impact performance and safety.

The site lead must obtain authorisation for these variations from our Person in Control.

1.3 Redesign variation

A redesign is a major change. This can be locating assets on the other side of the street or changing the conduit stack configuration. These variations require new drawings / revision to be issued.

Contact our Person In Control to establish if other works can continue while the design is being progressed.

1.4 Contacts for variation approval

Contractors are required to pass variation requests via the project manager.

Our staff are to follow the internal variation process.

You cannot implement a minimal or redesign variation without written approval

Q	How long does it take for a variation?
A	It depends on the complexity.
Q	I have verbal approval, that's good enough.
A	No, it is not, there is no tracking of the response to your request.
Q	Whom are these people to contact, can I have them for my contact list?
A	Discuss contact details with your project manager.

EXCAVATIONS, RECOMMENDED PRACTICES AND REQUIRED CLEARANCES

13. EXCAVATING

Conduits and cables incorrectly located relative to required locations and finished surface levels will be rejected.

SAFETY

Shore / shield / bench all excavations greater than 1500mm in depth. Monitor spoil locations.

CHECK POINTS OR HOLD POINTS

ITPs when used with CTQ and CTS assist to ensure safety and reliability of the network.

All hold points (Inspection Test Point, ITPs) and any audit details will be provided as part of the works request packs.

ENVIRONMENTAL

When excavating, strip and stockpile the topsoil for re-use

Implement any sediment controls or water diversions required

Follow any required notification processes if trees require trimming

Ensure you have all required approvals and licences before starting work

Always check activities against the Construction Environmental Management Plan

Breaking of surfaces

The breaking of bitumen, asphalt, concrete, paved or tiled surfaces of footpath and roadways must be in accordance with the requirements of the local authority, and elsewhere in consultation with the owner and us.

Excavations and surfaces should be neatly cut and care exercised to minimise damage or disruption to the surrounding surface.

UNEARTHING CABLES / BROWNFIELD

Exercise care to prevent damage to the asset or the bedding sand around it. The distance you can excavate to will depend on the approval level granted. Never assume that polymeric cover is in the correct location or directly over a cable.

Always positively locate the asset

Never mechanically excavate beyond your safe approach distance without the appropriate approvals

Ensure your mechanical equipment is earthed

Consider using Non-destructive dig / Hydrovac

Ensure cables and conduits are supported every 1500mm

See also Beside an Asset.

GREENFIELD EXCAVATING

Prior to commencement of construction of the underground electrical distribution system, all streets and lanes (or walkways) within which the underground distribution system will be installed should be rough graded to within +/-150 mm of the final grade.

1.1 Excavation depths

Are to be as per the “released for construction” works package

Excavation depths are to be established and checked against the site reference

See 393-007 and 393-010 for our standard trench arrangements

1.2 Excavation width

Are to be as per the “Issued for construction” works package, see 393-007 and 393-010 for our standard trench arrangements

1.3 Keeping excavations clean

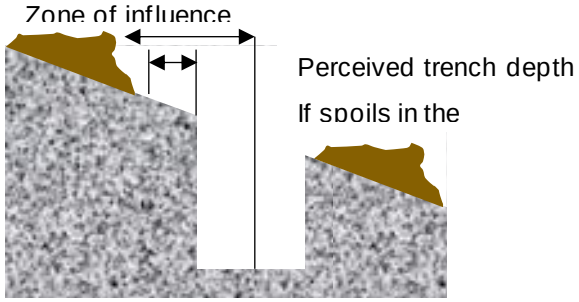
Excavation cleanliness and site cleanliness are marks of quality. Spoils, site rubbish, building materials and rocks can damage cables.

- Ensure site rubbish bins are utilised
- Verify that site grading is to within tolerance levels
- Prevent mobile machinery from traversing near excavations
- Clean as You Go (CAYG), remove and bin cut offs and rubble and excavation rubbish as it occurs

1.4 Spoils and battering of spoils

Spoil is not to be placed in a position where it may damage or affect the operation of existing equipment or assets example light poles, pits fire hydrants.

Spoils are to be located on the high side of the excavation to minimise run off.



Be aware of spoil formation. Placement should be away from the zone of influence. An excavation of 1000mm deep and a spoil height of 500mm within the zone of influences is considered as 1500mm deep.

Rule of thumb, the spoils should be as far away as the trench is deep

Limit spoil height to 1000mm

Place spoils on the high side and have the edge facing the excavation at least 1000mm away to prevent fall in and remove trip and fall hazards as workers walk the excavation while following cable hauls, the recommended space is 1000mm.

Use 45º as the zone angle for spoils unless your geotechnical advice indicates a different angle / distance can be used.

1.4.1 Zones of influence

Understanding the class of soil goes a long way to identifying the zones of influence. It is best to have geotechnical consultation to identify the zone and understand how close machinery can be placed. As a rule of thumb the zone of influence is 45º to the horizontal.

1.5 Slopes

ADHERE TO RECOMMENDED OPERATING RATIOS

Consult and use the equipment's operator's manual for safe operating ratios for working directly on a slope.

Take weather conditions into consideration and adjust ratios accordingly.

2.1.1 Pay attention to track position

When working on a hill, the tracks should be positioned straight up and down the slope. When climbing a hill have the drive sprockets at the rear.

If possible, create a terrace or bench for the excavator to dig from, then position the sprockets inside of the slope next to the hill

.

2.1.2 Smaller is often better

Compact equipment often has a lower centre of gravity.

Compact equipment with a dozer blade allows the operator to lower the blade on the slope and assists in stabilisation.

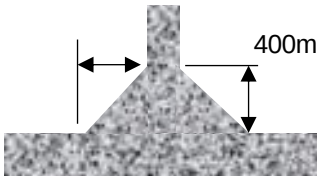
2.1.3 Depths

In non-uniform slopes, excavation depth should be checked every 10 metres.

Over depth, can be simply resolved by increasing the depth of the bedding sand at the low points.

2.2 Chamfers and Tee Junctions

Our cables require large bending radius to prevent damage. Our largest cable has a radius of 1.8m. To facilitate 90 degree
chamfered to 45degrees for 400mm from the natural straight edge



2.3 Road pavement and vehicle crossings

In Greenfields, often road pavement crossings are excavated then conduited. Road and reserve crossings depth, and contents (Conduits / cables) must comply with the "issued for construction" works package we provide, see 393-007 and 393-010 393-002 for our standard trench arrangements.

All conduit installations are to comply with AS/NZS 2032 and AS/NZS 2033

If the cable is direct buried and only conduited for the road crossing, the conduit must extend 1000mm past the kerb or obstruction. Backfilling material and process over the top of the bedding sand will comply with local authorities.

2.3.1 Requirements for all open trench road crossings

1. A minimum of 50mm of bedding sand must be applied and compacted before cables / conduits are installed.
2. A minimum of 250mm of bedding sand above the crown is to be applied and compacted using no more than 18kN centrifugal compactor.

2.3.2 Brownfield road pavement and vehicle crossings

Backfilling material and process over the top of the bedding sand will comply with local authority's requirements.

Compaction limits of the road subbase layers must not exceed the compaction levels set out in Compaction.

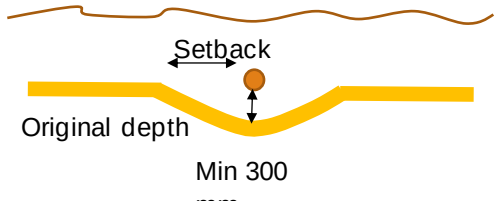
2.3.3 Backfilling / compaction for non-carriageway road crossings

Compaction limits of the road subbase layers must not exceed the compaction levels set out in Compaction.

CHANGES IN LEVELS AND DIRECTIONAL CHANGES

Undisclosed changes in level e.g. to avoid an undisclosed asset are preferred to traverse under the asset.

Changes in depth to avoid a known asset do not require a variation if they comply with the following:



Changes in levels are to have a gradient slope of no more than 100mm for every setback metre. Setbacks are not to exceed 4 metres

REDUCED COVER EXCAVATIONS

Are not permitted unless documented as such on the "released for construction" work package, or a variation has been provided.

Q	It's not easy to remove the bedding sand in an existing jointing pit, can I just excavate around the asset we are targeting?
A	Working on an uneven surface is not easy, it also creates trip hazards and may prevent adequate access and working room which in turn will impact jointing quality. If you are having unique issues then discuss these with our Person In Change.
Q	This is an excavation of an existing jointing pit, do I have to support the cables?
A	A rule of thumb is that the unsupported distance of a cable should be no more than 1500mm. A suitably qualified and authorised person will have to install any support. This can be in the form of sand bags or blocks of wood or mounds of bedding sand.

Whenever an object is encountered which looks like a buried cable, it should be treated as a live electric cable.

Q What if the excavation is for a cable/joint failure?

A Failures are unique situations, Hydrovac could be a better option than hand excavating. You may choose to wait until the cable is de energised before proceeding further. If the cable is damaged contact should not be made with it until it is de energised.
If the cable has been punctured Hydrovac may force water into the cable. The cable has to be left to dry out or a section of cable removed. Hand excavating should be considered if it is agreed that only a joint should be required.

Q I don't have enough room to place the spoils further than the slope of influence / run width.

A This creates trip hazards and the potential for collapse of the side wall. You will need to ensure adequate controls are in place.

14. SPECIAL EXCAVATIONS

Some of our assets require special attention while excavating around or near them, they include:

- Zone sub stations
- Pad mount sub stations
- Switching stations
- Poles

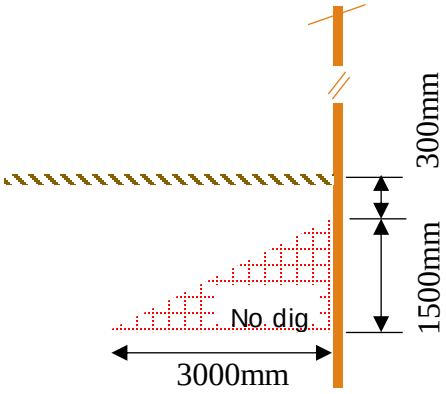
These items include no dig zones

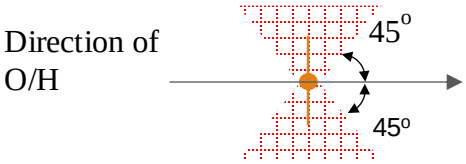
WHAT APPROVALS ARE REQUIRED?

Don't forget Dial before you dig and positive asset location when excavating

Check with the project manager on approvals gained or still required these could include engineering approval and approval to excavate closer than the safe approach distance.

1.1 Excavating to a pole





Avoid excavation in the hatched area

Where possible locate cables to the opposite side of oncoming traffic

Where possible on termination poles the cable should come up on the conductor side and opposite any stays

Excessive excavation at the pole base may disturb the pole foundation. Provide stabilisation if required

Provide polymeric covers

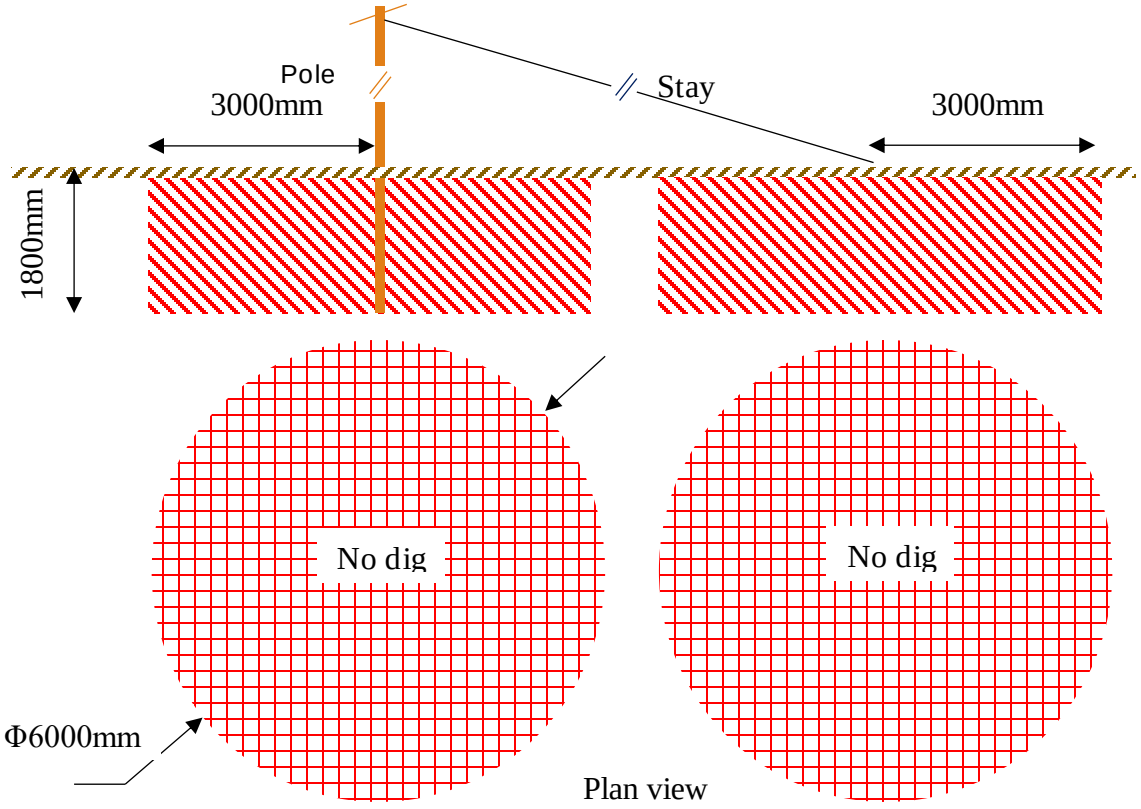
Check for earth cables on the pole or existing cables, use positive asset location practices to mark and identify their locations

Seek engineering consultation if you need to enter the no dig zone

Ensure cable bend radius is not compromised

1.2 Excavations that pass near poles or stays

Excavations that pass near poles and pole stays are not to be closer than as illustrated. Check for earths and other cables that run from the pole. Seek engineering consultation if the excavation must enter the no dig zone.



EXCAVATING NEAR PADMOUNT AND SWITCHING STATIONS

Grading rings surround Padmount and switching substations. Earths must not be broken while excavating.

Mechanical excavation is to cease 1metre before the Padmount and potholing / positive asset location used to identify the grading rings location.

Mechanical digging is not permitted within a depth of 1.5 metres of the Padmount or switching station.

Permission is required to excavate deeper than 300mm within 1 metre of a Padmount. Contact our person in Control.

Standard Padmount excavations can be found at D303-0010, D303-0015 and D303-0019 Drawing D303-0009 provides information on the standard earthing around out Padmounts / Switching stations.

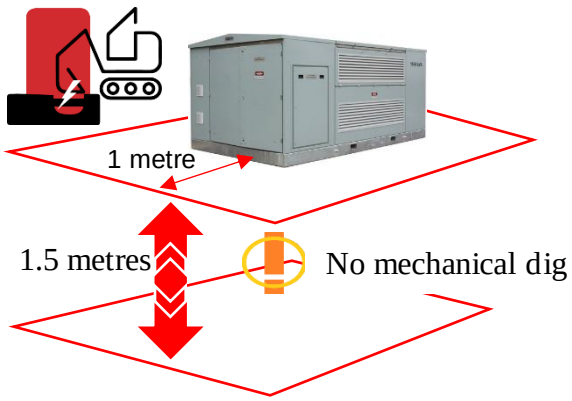
NB The number of earth stakes and locations depends on the site conditions

Contact Dial Before You Dig for earthing location

Never expose more than 300mm of the grading ring without approval.

If you locate a copper cable or strap use non mechanical digging to excavate around the area you need to pass by.

Damaged or broken earth wires and stakes may pose a severe electrical shock risk and must physically contacted. Call our emergency contact 131093 immediately. Remain clear until assistance arrives.



EXCAVATING TO DAMAGED CABLES / SUSPECTED FAULT

Where the location of a fault is known or suspected, the top hard surface (e.g. concrete, tar) can be removed before the cable is de energised.

Where the location of a fault is not known, excavating can proceed as normal prior to de energising.

Should any signs of the fault become evident e.g. smell, heat, noise or signs of cable damage:

Stop work

Withdraw

Consult our Person In Control immediately

Never work on a faulty/damaged cable or joint within 1 metre of the damaged section while the cable is energised.

SUPPORTING EXPOSED ASSETS / SERVICES

See Protecting Exposed Assets.

Have active SWMS in place

15. DEEP EXCAVATIONS

Under NO circumstances may workers work outside the protection of ground support systems.

Deep excavations are to:

Have appropriate Safe Work Method Statements (SWMS)

Signed

Appropriate access controls

Contain clearly marked exit points

Have exit locations not more than 10 metres apart and extend at least 1 metre above the trench

Have a minimum of 2 exit locations (Separate exits by 2 metres or more to provide redundancy)

Affix ladders to trench shields

Use trench shields longer than the trench is deep

Keep plant and equipment clear of the zone of influence

Every part of the trench or excavation where there is a likelihood of a person falling is to be provided with barricades or guardrails as soon as possible after excavation

Where gangways or walkways are required for access across an excavation and where a person could fall more than 2 metres, the gangway or walkway shall be provided with kick boards and guard rails and be a minimum of 600mm wide

1.1 Differences to normal trenches

1. Backfill as you go to limit the open / exposure time for deep excavation
2. With the exception of road crossings compaction of the bedding sand as a separate layer is not required, as manoeuvring a compactor around trench shields is not practical.
3. Normal compaction processes can commence once the excavation depth is less than 1500mm for non-road crossings
4. ITP hold and witness points will be adjusted to suit backfill as you go.

1.2 Deep excavations

All deep excavations must have appropriate Safe Work Method Statements (SWMS).

If benching is used the bench must be ½ as wide as the trench is deep to maintain a zone of influence of 45o only a single step bench is allowed and the trench must not be more than 2000mm deep. Benching is not preferred because of:

a. access / egress issues
b. the amount of fill to be removed is high
c. the width of the works with spoil piles is large
d. it may encroach the envelope distance of other assets

Battering / hybrid trenches can be used as a suitable alternative provided that:

a. the trench section height to the commencement of the battering is less than 1200mm
b. battering is only conducted in virgin soils
c. battering angle is less than or equal to 45 degrees from the horizontal

1.3 Use of trench shields in unstable grounds

If you have used trench shields to provide worker safety, and if qualified assessment indicates that the trench is not stable, we will establish alternative compaction requirements.

Q	Can I bench the trench?
A	It is not our preferred option, but provided it meets the applicable standards and guidelines it can be used.
Q	Can I batter a trench?
A	It is not our preferred option, but provided it meets the applicable standards and guidelines it can be used.
Q	If I use trench shields I don't have to compact, is that correct?
A	Compaction is required for road crossings. Compaction for all other trenches must occur once the depth is less than 1500mm.
Q	I used trench shields because the soil is not stable even for a trench less than 1500mm deep, do I still have to compact?
A	Worker safety is paramount, if qualified assessment indicates that the trench is not stable, then we will identify alternative compaction methods.

16. TRENCH PROFILES

Our standard medium voltage cable and conduit excavation profiles.

Follow AS/NZS 2032 and AS/NZS 2033 for state roads and carriageway road crossings

Follow https://www.tccs.act.gov.au/__data/assets/pdf_file/0006/398463/ACT_TRITS_03_Underground_Services.pdf for TCCS trunk road crossings

Follow AS4799 for crossings under rail ways

Shared trench agreement drawing number 393-010

Cable trench drawing number 393-010 and 3832-018

Standard Alignments and reservations Overhead mains drawing number 393-002

See also “released for construction” work package

NOTES ON DEPTHS

The standard maximum excavation depth is 1500mm. The typical cable or conduit / cable depth is less and measured to the top of the cable or conduit to facilitate ease of measurement, and provide tolerances for site conditions.

1.1 Mixed runs

Medium Voltage cable runs can consist of a mix of conduit, direct buried and bore pipe installations.

Conduits are to rise up to meet direct buried depths. Use the setback ratio of 100mm height per 1000mm in length.

Q The trench drawing, I have been supplied with is different, which one do I use.

A Drawings in the “issued for construction” work package, takes precedence.
If you have any concerns then contact our Person In Control for advice.

17. PITS, DUG AND FABRICATED

Pits must be in the locations specified in the “released for construction” works package

Pit dimensions can be found at drawing number 394-019

For safety and reliability reasons, jointing pits are not to be located within 5 metres of a road.

DUG PITS

1.1 Brownfield jointing pits

Prior to commencing any works on existing jointing pit which contains cables or conduits, precautions must be taken to protect the cables and joints against mechanical damage. Check for existing assets such as gas and protect accordingly.

All cables and associated joints in a pit that is undergoing work are to be supported and protected using non-conductive structures. These structures are to be mechanically capable of supporting the cables and associated joints e.g. Sand bags or bedding sand.

Non-destructive digging / Hydrovac is the recommended method for excavating an existing dirt-based jointing or hauling pit.

1.2 Bedding sand

Bedding sand is to cover the floor of the joint pit to a minimum depth of 80mm. Sand is to be reasonably level and not clumped.

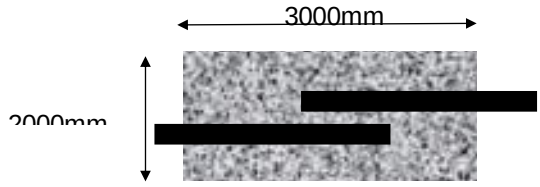
Mechanical compaction of bedding sand in brownfield pits is not required.

1.3 Jointing pit access

Each pit requires either steps or an access ramp, the steps or ramp can be cut into the side or formed using site materials.

1.4 hauling pits

Dug hauling pits are to be dug as per the works drawing.



The pit is to be 200mm deeper than the bottom of the lowest conduit / cable and filled with bedding sand to a minimum depth of 80mm and a maximum of 150mm.

If the pit is 1500mm or more in depth shoring / benching or shielding must be provided. Tolerances are ±50mm

1.5 Dug pit locations

It is preferable that pits are not located in footpaths or walkway areas. As this could limit public access during works.

Cable hauling pits where the conduits are continuous are not to be located within 1.2 metres of a road edge or in driveways.

Cable hauling pits where the conduit is not continuous are not to be located within 5 meters of a road junction.

Pits should not be located at the bottom of hills.

Pits for cable joints are not to be located within >3 metres of a road junction.

Pits are to be located so that temporary fencing can be located around them.

Not to be located with 10 metres of a bus stop

Not to be located within the no stopping / standing zone of a pedestrian crossing (Generally 10 metres)

Pits are to be located so that cable hauling equipment can be safely located.

Pits should not be located within the drip zone of trees.

1.6 Backfilling dug pits

See backfilling

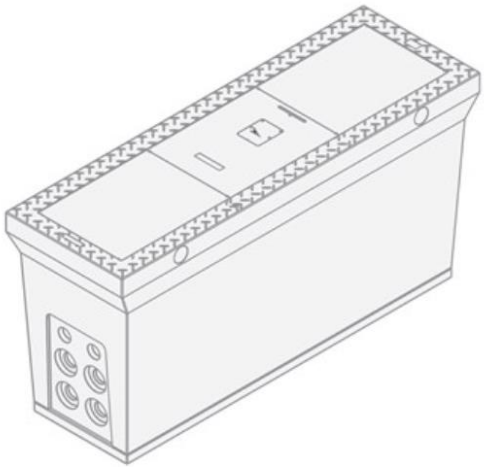
FABRICATED COMMUNICATION AND SERVICE PITS

1.7 Cable hauling and access pits

Pits are to meet and be installed to the following standards:

AS3996 Loading classifications

AS3000 Electrical installations



Pre-fabricated Access pits may be deployed in conduit runs where the run changes direction. Pit placement requirements:

Not to be placed within 1.2 metres of a road edge.

It is preferable that pits are not located in footpaths or walkway areas. As this could limit public access during works and may present tread issues with changes in surface materials.

Cable hauling and jointing pits are not to be located within 1.2 metres of a driveway edge where possible or in driveways.

Pits for cable joints are not to be located within 5 metres of a road crossing. Access pits and hauling pits may.

Installation alignment of the longest edge is to be parallel with footpath and level with finished surfaces.

Pits are to be installed to the site level

Pits are to be located so that temporary fencing can be located around them.

Pits are to be located so that cable hauling equipment can be safely located.

Pits should not be located within the drip zone of trees.

Pits should be positioned to provide natural drainage to drainage holes.

Fabricated pits should not be located outside heritage listed buildings

Fabricated pits should not be located next to structures that may impinge access to the pit

Not to be located with 10 metres of a bus stop

To prevent drive over pits should not be located near existing pits from other assets

Not to be located within the no stopping / standing zone of a pedestrian crossing (Generally 10 metres)

Are not to be located over existing assets

Trafficable pits are to be appropriately rated to AS 3996:

- class B for a footpath / verge
- class C for residential roads
- class D for carriageways

1.8 Fabricated communications pits

Communications access pits placement requirements:

Not to be located within 2 metres of a road edge.

It is preferable that pits are not located in footpaths or walkway areas. As this could limit public access during works and may present tread issues with changes in surface materials.

Pits to be located as per Drawing 3832-018.

Not to be located within 5 metres of a road junction

Are to be located parallel with the cable run or installation alignment of the longest edge is to be parallel with footpath

Are to be level with the surrounding surface

May be used to change communications cable direction

Not to be located over existing assets

Pits are to be located so that temporary fencing can be located around them

Pits are to be located so that cable hauling and splicing equipment can be safely located and appropriate fencing surrounding both the pit and the equipment

To prevent drive over pits should not be located near existing pits from other assets

Pits should not be located next to structures that may impinge access to the pit

1.9 Foundations for pits

Holes are to be dug out a minimum 200 +50mm deeper than the final set height, and filled with road base DGB20 (Gravel) to 200+50mm. The exemption to this rule is where the item is located on rock.

The foundation material should have 150kPa bearing capacity and compacted to 95%

The foundation is to be mechanically compacted with compactors not exceeding a centrifugal force of 18kN

The foundation is to be constructed and compacted in depths not exceeding 100mm

The foundation level is to have an accuracy of within +5mm over the entire length

The shape of the foundation will be judged to be acceptable when the maximum deviation from a 2.4 metre straight edge placed in any position on the surface does not exceed 10mm. Or as per manufactures specifications.

Drawing D302-0016 Standard Construction, Distribution Underground, Low Voltage, SA, Pits,URD Service Pit Footing

1.10 Backfilling for prefabricated pits

Backfilling cannot commence until cable conduits are installed or direct buried cables are in place

Bedding sand is to be placed around cables / conduits to a minimum of 100mm

Voids are to be back filled with clean site backfill to within 150mm of the surface and compacted for every 250mm. Mechanical compaction cannot occur over cables or conduits until the backfill is more than 100mm above these items.

The final height of the backfill will depend on the type of surface reinstatement. 150mm is for a topsoil / grass reinstatement.

If clean site back fill is not available a suitable backfill must be sought see also backfill material

Backfill containing more than 15% clay must not be used so as to prevent sloughing / subsidence.

Reinstatement of the surface must be in line with local authority requirements or as per the works drawings. Ensure that the backfill is to the height that suites the reinstatement material / process.

1.11 Submersible Service Pits

The Submersible Service Pit (SSP) is designed to be installed by experienced civil workers who follow the instructions listed below in conjunction with the Safe Operating Procedures detailed in their own Workplace Health and Safety Manuals.

The SSP and its lid are Class B load rated as per the definitions in AS3996:2019.

1.12 SSP Foundation & Conduit Installation

Determine final SSP positioning in accordance with boundary pegs and install survey markers 1.5m away on either side of the proposed excavation. Refer Evoenergy Shared Trench Drawing 393-011 & 393-012 – Underground Services in Shared Trench Electrical Pit Requirement for Underground Residential Distribution with and without Gas. Also, refer Evoenergy project specific drawings and other utility services & estate development drawings prior positioning the pit foundation.

Excavate a hole adjacent the main trench with minimum dimensions of 1400mm long x 1100mm wide x 820mm deep for the SSP.

Excavate an additional 1m trench from the SSP hole towards the house blocks for 50mm HD UPVC conduit service conduit stubs and install a lead-in 63mm HD UPVC conduit bend (and conduit) in a narrow trench towards the main/shared service trench.

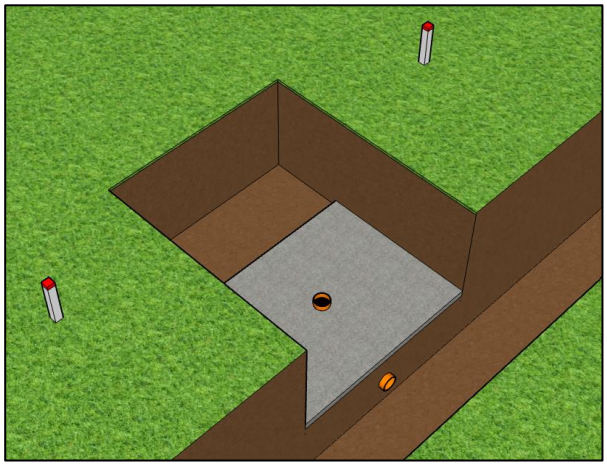
Cut two lengths of 50mm HD UPVC orange electrical conduit at 1m long as service conduit lead-in stubs.

Using a hammer and cold chisel, remove the service conduit knock-out provisions on the house side of pit body, and install the service conduit lead-in stubs into the pit body, protruding up to 50mm HD conduit.

Ensure any disturbed ground underneath the UDP is compacted using a plate compactor or similar.

Pour and level a concrete SSP base to 720mm below Finished Ground Level (FGL).

Allow the concrete to set and harden completely.



1.13 SSP Installation

Trim and deburr the mains lead-in conduit to protrude at least 20mm above the finished concrete level.

Ensure that personnel are clear of the raised SSP during installation.

Using mechanical lifting means, lift and lower the whole SSP onto the concrete slab, using the adjacent survey pegs to ensure that the top of the SSP matches the FGL. If the SSP needs to raise to meet FLG, non-corrosive shims can be used by placing them underneath the corners of the pit body.

1.14 Backfill and Finish Civil

Ensure that the recovered spoil is suitable for backfill material by checking it is compactable granular material with particle sizes not exceeding 5mm in diameter. If not sure, import suitable backfill material.

Backfill around the pit edges at 300mm layers up until finished surface level, using a mechanical plate compactor on each level. Compacted backfill is to be placed in voids between reinforcing ribs on the plastic pit wall. Ensure that a Dry Density ratio of 90% or greater is achieved. Mechanical compaction shall not distort the pit.

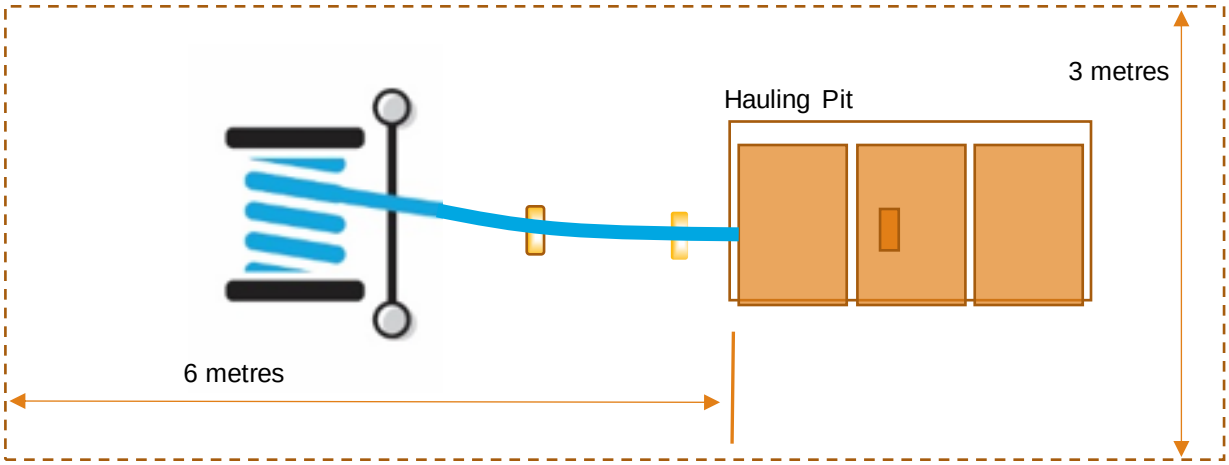
Resurface the surrounding area to match the existing or desired specification.

All spoil removed from the site shall be disposed of in accordance with ACT EPS Information Sheet 10 (Virgin Excavated Natural Material) for uncontaminated work areas, or in line with ACT EPA information sheet 4 (requirements for the reuse and disposal of contaminated soil in the ACT) in areas of potential contamination.

All unattended excavations shall be securely fenced in accordance with Evoenergy civil works manual chapter 2 Appendix G.

CLEARANCE CONSIDERATIONS

Address equipment access and public safety when designing and installing access and cable hauling pits for both dirt and prefabricated varieties.



Q	The design should take care of the spacing and location for hauling pits, why is there a requirement here?
A	This is a check on check. Sites can change quickly, knowing the required clearances assists in creating installation ease and safety.
Q	I have been asked to build a joint pit that is within 6 metres of the cable road crossing, is this not allowed?
A	Sometimes, access and other amenities prevent meeting the minimum distance. If you can identify an alternative then present this to our Person In Control.
Q	Can I provide a ladder for the jointing pit rather than the steps or ramp?
A	Jointers have to often carry heavy equipment and products that require 2 hands, ladders don't allow them to have 3 points of contact whilst carrying equipment and products. Placing equipment at the side of the pit and expecting people to lift items down from above chest height is also an OH&S issue.
Q	Do I have to compact the bedding sand in the pit?
A	Mechanical compaction of the bedding sand on a brownfield pit is not required. On a greenfield pit mechanical compaction of the bottom layer (Prior to conduit or cable installation) is required.
Q	Do I have to chamfer a Tee joint pit?
A	No, the pit is wide enough.

18. FOUNDATIONS FOR PADMOUNTS AND SWITCHING STATIONS

Fire propagation testing and classification of external walls of buildings AS5113

Methods for fire tests on building materials AS 1530

Padmount and Switching station foundations drawing number D303-0010, D303-0015, D303-0019

Our standard Padmount or Switching Station foundation can be found at D303-0010, for single Padmounts and D303-0015 and D303-0019 for multi occupation Padmounts and Switching stations.

Clearances to structures can be found at 4923-01

Asset clearances can be found at 3832-018

1.1 Grading ring benching

Earthing is critical to safety. Earthing design and installation is provided in another document.

Special considerations

For Padmounts

There is a benched area around the foundation pit for Padmounts.

UNDER NO CIRCUMSTANCES are you to dig this out. This is there for the earthing ring and must be at the specified depth for safety reasons.

Always consult the drawing, co-located Padmount substations may have additional requirements.

Special considerations

for switching stations

A bench exists around three sides of a pad mounted switching station.

UNDER NO CIRCUMSTANCES are you to dig this out. This is there for the earthing ring and must be at the specified depth for safety reasons.

1.2 Padmount and Switching Station locations

Padmount and Switching Stations are to be located and orientated as per the "issued for construction" works package

1.3 Dryback

The plinth, Padmount or Switching Station will not be put in place until the dry back moisture content at a depth of 50mm level exceeds 85% when compared to the optimum moisture content of the material. This is to ensure that that moisture will not cause subsidence. It also ensures correct pump out and drying times if the hole has been inundated with water.

1.4 Backfilling Padmounts and Switching Stations

Backfilling can only be conducted up to the earth bench level sides until:

a. the earthing is completed
b. cables are suitably located

To be read in conjunction with Backfilling:

a. Bedding sand is to be placed around cables / conduits to a minimum depth of 100mm.
b. Bedding sand is to fill the void on the cable entry / door side to within 150 of the final surface level. Mechanical compaction cannot occur over cable joints or Bellmouths until the bedding sand is more than 100mm above these items.
c. Only minimal compaction should be conducted on the cable entry sides
d. The remaining sides are back filled with clean site backfill to within 150mm of the surface and compacted for every 250mm.
e. The final height of the backfill will depend on the type of surface reinstatement. 150mm is for a topsoil / grass reinstatement.
f. If clean site back fill is not available a suitable backfill must be sought, see also backfill material.
g. Backfill containing more than 15% clay must not be used.
h. Clean backfill is to be deployed around the grading ring.
i. Reinstatement of the surface must be in line with local authority requirements or as per the "released for construction" works package.

1.5 Final finish level

At the site level +5mm. No trip hazards are to exist from any aspect of the works.

Q I have accidently dug out too much of the earthing bench for a Padmount or a Switching Station, what do I do?

A Inform our Person In Control of the event, refill and compact.

Q I have found rock that is preventing me from creating a 300mm bench what do I do?

A Contact our person in Control for advice.

Q I have to have a setback of just over 4 metres to avoid an asset, do I really have to get a variation from plan?

A Yes, we use this information to improve our requirements.

19. REOPENING AND WIDENING EXCAVATIONS

Shear / stress forces can cause brittle rock to shear off and fall onto excavated cables / conduits or onto workers.

Non-destructive dig / Hydrovac to expose and unearth assets along with potholing and positive asset identification / location. These tools and processes are great for not altering the form of the excavation, however needing to widen a trench or pit presents unique challenges.

The procedure for excavation in rocks is different than excavation in ordinary soils. It requires skilled manpower, specialised tools and equipment for excavating the rocky ground

Notes on tools

1.1 Rock hammers / jack hammers

The use of these requires approval, contact our person in Control. If allowed, they must be used with extreme care, extensive vibration may damage assets. Chemical splitting may have to be considered.

1.2 Rock saws

Rock saws are inefficient in terms of the energy required for the amount of cutting, we suggest that these are not used for more than 100m.

1.3 Excavators

Excavators are inaccurate for close digging, and tend to shoot rocks out sideways from the bucket. Rippers can be used to break rock.

REOPENING, PITS AND JOINTING BAYS

- Positive asset identification and location
- Machine dig to your approved safe approach distance only
- With approval Non-destructive dig / Hydrovac the remaining material around the asset in question
- Authorised personnel to support exposed assets (Use sandbags)

EXPANDING PITS AND JOINTING BAYS CONTAINING ROCK

- Positive asset identification and location, use slots at the end of the pits / joint bays
- White line to the width, including your approved safe approach distance eg new trench width + approved safe approach distance
- Consider using “Crack rock” or a rock expanding products to break the rock
- Blasting is not allowed, however products such as PCF and Cardox will be considered
- Break the rock on the far side first (The side furthest away from the assets)

RE OPENING TRENCHES

- Positive asset identification and location at both ends of the dig and a minimum of every 10 metres in between.
- White line to the width you are going to dig
- Machine dig to your approved safe approach distance
- Non-destructive dig / Hydrovac the remaining earth around the asset that requires exposure

EXPANDING TRENCHES

- Positive asset identification and location every 10 metres
- White line to the width, including your approved safe approach distance e.g. trench width trench + approved safe approach distance.
- Excavate the far side first (The side furthest away from the assets) to the required depth. Recommend that a small bucket width (300mm, 12”) is used.
- If the trench is predominantly rock then consider either a new trench in a new location or a bore (HDD) installation. As there is the possibility of loose rock impacting existing assets. A rock saw could may be used for short runs of up to 100m
- Perform the close sweep machine excavation to within the approved safe approach distance
- If the asset needs to be exposed then non-destructive dig the remainder

20. DEWATERING

This section details the requirements for sediment tank flocculation (if required), pH correction, and water discharge to minimise the environmental impact on receiving waters, and to comply with relevant water quality criteria.

Environment Protection Guidelines for Construction and Land Development in the ACT – (Environment Protection Authority - March 2011)

https://www.accesscanberra.act.gov.au/ci/fattach/get/111749/1478132929/redirect/1/filename/Environment+Protection+Guidelines+for+Construction+and+Land+Development+in+the+ACT.pdf

This document provides guidance on the preferred methods for pollution control design, construction, operation and maintenance.

TRENCHES

Trenches may be dewatered via a sediment trench as described in the Environment Protection Guidelines for Construction and Land Development in the ACT. Consult with the environmental team if sediment trenches are required or if a large volume of water requires discharging.

If sediment trenches are not required, small volumes of water (<50L) may be pumped and sprayed where it can be absorbed by unpaved ground. If there are no soft landscape areas nearby, do not pump water into the stormwater system and contact the Environment team for further advice.

AFTER DEWATERING

Inspect the excavation and reinstate levels to drawing tolerances.

PROCESS

Excavations are to be dewatered by pumping. The pump size is to be appropriate to the quantity of water to be removed. Records are to be kept and made available on request.

RECORD KEEPING

Relevant data on any water release must be kept along with any treatments that where performed prior to release.

LOCATION OF WATER STORAGE TANKS

For water collected in excavations that is to be pumped into sediment tanks.

The location of the sediment tank is illustrated on the Environmental Safety Control Plan for the site (ESCP). Any relocation of the tank will be marked on the ESCPs accordingly.

1.1 Monitoring and field measurements

Water within the sediment tank will be monitored prior to each discharge by field measurements. Water is not to be discharged until approval is received from the environmental team.

1.2 Water treatment

If water is outside the acceptable pH range or contains an oily sheen, advice from an environmental specialist on treatment must be sought. Once the need for treatment has been established, no additional water is to be pumped into the tank until the water has been released.

DISCHARGING WATER

Release of water from sediment tanks or trenches is an ITP Hold Point until approval is given. Approval to discharge treated water will be from the Site Owner or Principal Contractor on the advice of the environmental team. Once water meets all the relevant water quality criteria, approval to discharge will be granted.

Visually monitor water quality at a downstream inspection point once each discharge event commences, to ensure no plume is evident.

In addition, to avoid the risk of discharging flocculated and/or sludgy material, during each discharge event if the minimum pump discharge level is not limited, the water tank is to be monitored or a flotation device is to be employed to ensure the pump does not drawdown water beyond a set level.

If the water quality declines during release offsite (e.g. water treatment may have resulted in layers of varying water quality in tank), the discharge is to cease and additional treatment undertaken.

21. MATERIALS

Materials are to be those supplied by us, approved by us or from an approved supplier.

Appropriate approvals and records are required if more than 100m^3 is being delivered or removed from site.

Environment Protection Act 1997

Environment Protection Guidelines for Construction and Land Development in the ACT – (Environment Protection Authority - March 2011)

https://www.accesscanberra.act.gov.au/ci/fattach/get/111749/1478132929/redirect/1/filename/Environment+Protection+Guidelines+for+Construction+and+Land+Development+in+the+ACT.pdf

STORAGE

General practice:

Store material and equipment away from access areas.

Do not store materials close to the edge of excavations, keep materials out of the zone of influence.

Keep materials clear of contaminated soil.

Store materials for ease of access and deployment.

Stacks are to be no more than 1.5 metres high.

1.1 Aggregates and top soils

Have aggregates such as bedding sand, delivered just in time to prevent contamination. Recommendations for storing aggregates on site:

Store on hard dry and level ground within the fenced site area

Prevent pile intermingling, maintain adequate space or use bays

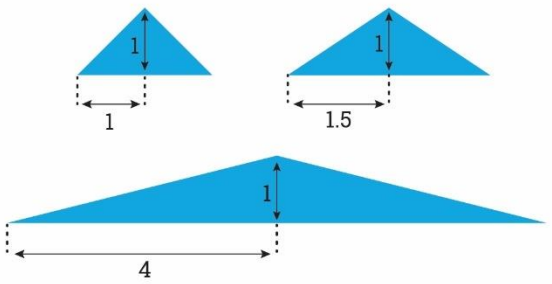
Protect stockpiles from erosion

Don't place stacks where run-off from heavy rainfall may contaminate the product

Keep stacks clear of excavation works 1000mm is our preferred minimum

Stacking of the aggregates should be carried out in regular stacks. The suggested sizes for stacks are as follows:

Clay (dry)..... 1 : 1
Clay (wet)..... 4 : 1
Sand (clean)..... 1.5 : 1
Rock (decomposed).... 1 : 1



1.2 Conduits and other items

Conduits pits and products where cables pass though are to be stored such that no contaminants enter the cable voids. Contaminants that enter must be cleared out prior to installation.

Conduits, while robust, can be damaged by rough handling. Pipes should not be thrown from trucks or dragged over rough ground. The soundness of the pipe joint is dependent on the condition of the spigot and socket.

Plastic pipe becomes susceptible to damage in cold weather. Care should be taken when temperatures are low.

Orange conduits that will not be installed for more than 3 years should be stored in a manner that prevents UV exposure and heat entrapment.

Stack conduits on level surfaces alternating spigot and socket ends. The stack is too high if the pipes begin to distort or bend.

Covering of conduit stacks with items such as black plastic is not recommended as this can greatly increase the temperature in the stack.

Conduits should not be stored close to heat sources e.g. generators or against reflective metal surfaces such as metal fences.

Orange conduits and fittings left exposed to sunlight and heat will fade or discolour within a relatively short period of time. Only products marked with a 'T' in their print label are suited to continuous solar exposure.

Keep conduits stacked and prevent rollway. Loose conduits present a trip hazard.

1.3 Special care with bore pipe

Care must be taken when removing the strapping from coils of bore pipe, as considerable energy is stored in the coil. If this energy is released in an uncontrolled manner it can cause serious injury or death. Follow the manufactures recommendations.

MATERIAL COMPLIANCE

Materials that you provide are to have a certificate of compliance/ conformance that references the required or agreed standard for which the materials comply / conform to.

2.1 Certificate of Compliance

The certificate of compliance must have:

1. date of compliance
2. suppliers name
3. standards that the product complies to
4. standards that the product has been tested to
5. name of the manufacturing company
6. the Batch number, this must be traceable to the plant location, production line, raw materials and tests. If there is no tractability to source of origin, materials and testing process must be identifiable on the certificate
7. declaration that:
    a. the Materials meet the dimensional tolerances and protective coating requirements specified on the relevant drawings.
    b. the Materials have been batch tested in accordance with the applicable standard
    c. the product has been verified that it meets the applicable standard

2.2 Acceptance of soil from other construction sites

The primary contractor / site owner must be aware of regulatory requirements before disposing of spoil off-site or accepting soil on-site, and the applicability to volumes of 100m³ or greater.

The movement of more than 100m³ of soil to or from land in most areas of the ACT requires an Environmental Authorisation. This includes land that is in an area identified in:

- the Territory Plan as Broad acre; Rural; Hills, Ridges and Buffer Areas; River Corridors; Mountains and Bushlands; Plantation Forestry; or
- the National Capital Plan as Broad acre Areas; Rural Areas; Hills, Ridges and Buffer Spaces; River Corridors; Mountains and Bushland.

If the soil is to be accepted at a site other than those listed above, an authorisation is not required. However, the EPA must be notified. Notification is not required if the spoil is to be taken to an approved landfill site.

The illegal acceptance of more than 100m3 of soil may attract penalties of up to $100,000.

Refer to section 8.2 of the Environment Protection Guidelines for Construction and Land Development in the ACT for further details.

INSTALLATION OF RIGID AND FLEXIBLE CONDUIT

22. CONDUIT (PVC)

Conduits must comply with:

- AS 2053 Conduits and fittings for Electrical Installations;
- AS 3000 SAA wiring rules;
- AS 1477 Un-plasticised PVC (UPVC) Pipes and fittings for pressure applications; and
- AS 1074 Steel Tubes and Tubulars.
- AS 3080 Information Technology – Generic Cabling for Customer Premises (Communication Cabling)

All insulating conduits must be coloured light orange.

All metal conduits must be galvanized to comply with AS1650.

Standards:

- ISO 9001 Section 7.3;
- ISO 14001 Section 6.1.2; and
- ISO 45001

All conduit installations are to comply with AS2032 for installation of PVC pipe systems

All plastic electrical conduits are to comply with AS/NZS61386 Conduits and fittings for electrical installations

Trenching & Road Crossing Details 393-003

Clearances 3832-018

GENERAL

- Conduits are not to be placed in water filled excavations
- Conduits in open excavations are to be located in bedding sand
- Conduit fittings will have no burrs
- All cut ends to be fitted with Bellmouths
- All joints and Bellmouths must be glued using approved conduit glue
- All conduit ends and bell mouths are to be stopped with an approved cap or plug
- Plugs or caps are to be fitted such that accidental dislodgement is prevented.
- Where conduit is to be installed on curves, these should be assembled in several lengths before attempting to form large radius bends.

Maximum conduit run length between cable jointing pits is not exceed 600m

All conduit entry points to substations should have fire stopping according to our chamber substation design standard.

2. CONDUIT SIZES

The following are standard sizes and strengths used by Evoenergy:

- 20mm heavy duty insulating conduit orange to AS2053.2;
- 20mm medium duty insulating conduit grey to AS2053.2;
- 20mm medium duty flexible corrugated insulating conduit grey to AS2053.5;
- 25mm medium duty insulating conduit grey to AS2053.2;
- 25mm medium duty flexible corrugated insulating conduit grey to AS2053.5;
- 25mm medium duty galvanized steel tube (water pipe) to AS1074;
- 32mm medium duty flexible corrugated insulating conduit grey to AS2053.5;
- 32mm medium duty insulating conduit grey to AS2053.2;
- 40mm medium duty galvanized steel tube (water pipe) to AS1074;
- 50mm heavy duty insulating conduit orange to AS2053.2;
- 63mm heavy duty insulating conduit orange to AS2053.2;
- 125mm heavy duty insulating conduit orange to AS2053.2;
- 125mm class 9 or class 12 pressure pipe to AS1477;
- 125mm medium duty galvanized steel tube (water pipe) to AS1074;
- 150mm heavy duty insulating conduit orange to AS2053.2;
- 150mm class 9 or class 12 pressure pipe to AS1477; and
- 150mm medium duty galvanized steel tube (water pipe) to AS1074.

Notes:

- AS2053.2 refers to Rigid plain conduits of insulating material.
- Insulating materials include Unplasticized PVC (UPVC).
- Conduits to AS2053.6 – Profile wall, smooth bore conduits are not acceptable.

3. CONDUIT MARKER TAPE

A marker tape must be installed above the following conduits:

- Heavy duty conduits to AS2053.2;
- Class 12 pressure pipes to AS1477; and
- Medium duty galvanized steel tubes (water pipe) to AS1074

The marker tape must be placed at a minimum of 200mm above the conduit, conform to AS2648.1 and be of minimum width 150mm and coloured light orange with black lettering stating

DANGER ELECTRIC CABLES"

4. CONDUIT PROTECTION

Additional mechanical protection must be installed with the following conduits:

- Medium duty conduits to AS2053.2; and
- Class 9 pressure pipes to AS1477.

The additional mechanical protection must be:

- Precast concrete slabs or electric bricks with the word “ELECTRIC” indented in letters 25 mm high and complying with the requirements of AS3000;
- 75 mm of poured 15MPa concrete; or
- Polymeric cable cover strip of a material equivalent to conduit to AS2053.2 and having a thickness not less than 3 mm and installed in accordance with AS3000.

The mechanical protection must be placed not more than 75 mm above the conduit, shall be not less than 150 mm wide and shall overlap the conduit or conduits by at least 40 mm.

Where polymeric cable cover strips are used, marker tape as discussed in Section 3 is not required.

5. MINIMUM DEPTH OF COVER

Depth of cover is measured between the upper surface of the conduit and the finished surface level.

Conduits when laid in a shared trench must have cover depths as per the shared trench agreement drawing 393-010 or 393-011 or 393-012 (as per project requirement).

All other conduits must have minimum depths of cover as shown in Drawings 393-007 ‘Cable trench details for cable installations not covered by shared trench agreement’ and 390-002 ‘Conduit installation – Roadways and driveways’.

At all times the electrical conduits shall pass under gas lines and there must be a minimum separation clearance of 150mm between the electrical conduits and the gas line.

Conduits must not be installed to a depth greater than 1.5 metres without prior approval from Evoenergy’s Design Officer. In no circumstances shall the ends of the conduits be at a depth such that an excavation greater than 1.5 metres is required to install cables into the conduits. This requirement is to avoid shoring of trenches.

6. CONDUITS UNDER ROADWAYS

Conduits under roadways must be designed, as per Drawing 393-003 and continue at least 1000mm beyond kerb, roadway edge, property line and/or obstructions along with bell mouths on conduit. Obstructions include all gas lines, Telstra plant, water mains, storm water mains, pram crossings and footpaths.

7. INSIDE THE PROPERTY BOUNDARIES

Where the conduits are to be laid in a common trench inside property boundaries, including town house developments and battleaxe blocks, this shall be done in accordance with AS3000.

8. DRAW WIRE

All conduits must be provided with a general-purpose synthetic polypropylene filament rope of minimum 6 mm diameter.

9. CONDUIT INSTALLATION

Shared trench arrangements must be as per the drawing 393-010 or 393-011 or 393-012 (as per project requirement).

Metal and PVC conduits and fittings must have no internal burrs. All cut ends shall be deburred.

All joints and bellmouths must be glued using Type N PVC solvent cement. A suitable primer must be used first on both mating surfaces. PVC solvent cement shall then be applied to bond the primed surfaces. All joints must be properly made to eliminate the entry of water and foreign matter into the installed conduits.

Conduit ends must be plugged or capped with a non-perishable cover to prevent the entry of foreign material. The plugs or caps are to be fitted such that dislodgment prior to cable installation is prevented.

All conduit runs between cable jointing pits must be straight as far as possible. Where conduits are to be installed on curves, these must be assembled in several lengths before attempting to form large radius bends (see Section 2.14 Bends and Bending Radii).

Maximum conduit run length between the cable haulage pits must not exceed 200m.

Vehicular access is required to cable jointing pits.

All conduit entry points to substations should have fire stopping according to the Evoenergy chamber substation design standard PO07201 Chamber Type Substation Design and Construction Standard.

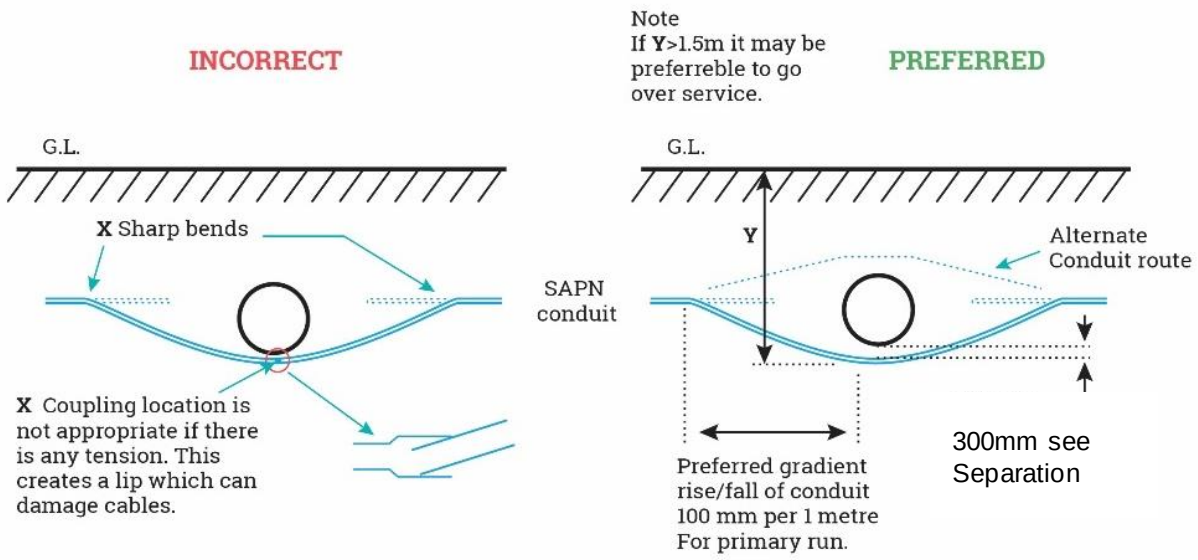
9.1 Recommended Maximum Number of Cables in Conduits

Refer to Appendix P for two matrices detailing the maximum number of cables of varying sizes recommended to be put inside the conduits specified.

9.2 Conduit Passing under structures

Where the conduit passes beneath a load bearing structure such as a roadway or stormwater drain, the clearance below the structure should be as per the "released for construction" works package see also 3832-018

Setbacks are to be no more than 4 meters without variation approval.



9.3 Conduit caps plugs and Bellmouths

Conduits must be capped with an approved cap before the covering of bedding sand is applied.

All conduit ends must be fitted with Bellmouths before cables are hauled though the conduit. Bellmouths must also be plugged.

9.4 Gluing / joints

All conduit joints and accessories bar caps and plugs are to be glued in place using an approved solvent glue. Conduits are not to be glued and then placed into the excavation without adequate drying time, joints are to be supported while the conduit is being moved into place.

9.5 Drainage of Conduits

Where the ground level at the street end of a conduit is above the floor level of the building in which the conduit terminates, a drain shall be provided from the conduit to ensure the conduit is drained and water does not enter the switchboard. One of the following methods shall apply:

- Where the conduit rises on the outside of the building the drain shall be in the form of a 10mm diameter hole in the conduit, arranged to point towards the wall approximately 300mm above ground level so that the entry of water and debris is minimised.
- Where the conduit is not on the outside of the building, a 15mm PVC pipe shall be solvent-welded into the conduit without protruding into the bore. It shall be arranged to discharge to the exterior of the building, approximately 300mm above ground level.
- A special drainage pit may be required in some cases such as an indoor substation etc. Evoenergy's Design Officer is to be contacted in the first instance for details.

9.6 Sealing of conduits entering buildings

Conduits are required to be sealed against a hard surface where they penetrate a building. Two products can be used either Denso 16A or a sealing plug from Tyco.

The product must be installed as per manufactures requirements

Concrete penetration points must cure for 28 days prior to installation

Brick / block walls to have penetrations must cure for 14 days prior to installation

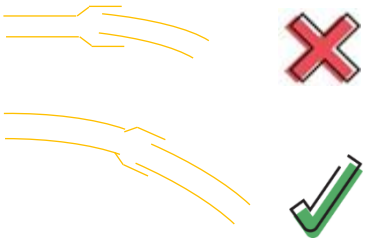
9.7 Bends and Bending Radii

Unless otherwise specified, the sum of conduit bend angles must not exceed 90 degrees in a single run. A common exception is where each end of the conduit is turned up into street lighting columns / poles. This is to prevent sidewall stress on one side only when the cable is being drawn.

Bending radii must not be less than:

- Nominal 32/25 conduit - 250mm.
- Nominal 63/50/40 conduit - 310mm.

Bending radii is to be greater than 1800mm for 100, 125 and 150mm conduit.



Joints in non-manufactured bends or joints that are not ultrasonically /thermally welded are not to be located at the stress points of bends i.e. at the start of a bend. They must be either set back 1000mm from the start of the bend, or located in the bend.

9.8 Conduit location marking

In major private developments and new suburb developments, Evoenergy will provide a drawing or will approve a developer's drawing detailing the numbers, size, location and types of all conduits required together with cable jointing pits if necessary.

For conduits which pass under existing concrete areas such as driveways, curbs, substation boundary fences, an aluminium rectangular plate 150x65mm marker disk shall be fixed to the concrete, e.g. by drilling a suitable hole and inserting a masonry nail, directly above the conduits. Same marking methods should also be used where conduits are installed at less than nominal depth.

Where the conduit contains electrical cables, the disk must have the text "Evoenergy Electrical Cable" stamped on it.

Where the conduit contains an optical fibre cable, the marker disk must have text "Evoenergy Optic Fibre" stamped on it.

Conduits under kerbed roads in new development areas shall have their location marked by means of a 100mm high "E" stamped into the kerb face directly above the centre of the conduit(s).

In Town House style developments, following conduit inspection and subsequent backfilling of conduits terminating at property line or open spaces, a marker peg shall be provided to indicate the end of the conduit. This peg shall be labelled clearly with the letter "E". Prior to the installation of underground cables, the developer shall expose the conduit ends.

9.9 Placement of conduits in excavations

Conduits are to be located in accordance with "released for construction: works package. Medium voltage conduits separation can be found at 3832-018

9.10 Under road crossings

Conduits are to extend a minimum of 1 metre past the kerbside or obstruction. Bedding sand and polymeric covers and stretch tape are required for any open excavation conduit runs.

9.11 Conduit falls

As per "issued for construction" works package. This is applicable for solid and bore pipe conduits.

9.12 Conduit marker tapes and Polymeric covers

Polymeric covers and stretch tape are to be installed as per "issued for construction" works package.

9.13 Conduits crossing bridges or other concrete structures

Conduits that are encased in concrete or a pumpable / setting backfill are to "snake" or have bends with the nominal radii to account for differential expansion before they enter the concrete structure.

CONDUIT INSPECTION

All conduit installations must be inspected by Evoenergy. The Person In Control / project manager is to be contacted regarding arranging any inspections. All conduit installations are subject to inspection by Evoenergy Design Officers. Refer to Evoenergy document PO0792 – Civil Works Field Manual Chapter 1 of 2 for further detail on this process.

A minimum of 24 hours' notice must be provided to Evoenergy's Design or Compliance Officer to arrange the conduit inspection.

Evoenergy will not undertake the installation of underground permanent cables on site until the conduit installation has met with its approval and an "As-Executed" plan or sketch has been provided by the builder/developer detailing the location of the conduit(s). A copy of the plan must also be located within each main switchboard or meter box for each unit.

10.1 Private Developments

Evoenergy's Design or Compliance Officer will inspect the conduit installation and provide a report to the developer indicating whether the conduit installation is in accordance wit

h the Conduit Requirements drawing and these standards or not. This report will also indicate the extent of defects etc.

Subsequent inspection will be necessary until the conduit installation meets Evoenergy's approval.

10.2 Suburb Developments

Upon completion of the conduit installation written advice of this is to be forwarded to Evoenergy so that conduit marks may be inspected and recorded.

Where conduit marks have been omitted the contractor must prove that the relevant conduits exist and shall provide the marks as required.

The developer must expose the ends of any conduits if so required by Evoenergy.

Where excavation fails to prove the existence of conduits the developer must be responsible for the installation of the missing conduit(s) and all reinstatement of the excavated area/s.

If bitumen or concrete surfaces are to be excavated, by Evoenergy, for conduit repairs or to install missing conduits, within the normal 12 month liability period, the developer is responsible for the reinstatement of the excavated surface. The developer is also responsible for all relevant permit approvals.

11. COMMUNICATIONS

Telecommunications services such as telephone connections to the public network, carrier service leased lines, and any other third party carriage service provider network, should be installed in white conduit, and conform to rules and regulations for the Telecommunications industry.

Optical Fibre cables used for the protection, control and operation of the electrical network, which may be installed alongside Evoenergy's electrical cables, are to conform to the following requirements:

- Orange PVC, heavy duty grade, with minimum size, 63mm OD;
- All bends to be long radius bends;
- Installed Conduit size must make provision for an additional cable to be hauled in at a later date;
- Conduits for Optical Fibre cables, which in the future could be used for protection circuits must be arranged below the level of the electrical conductor cables;
- Pits to be installed as per Evoenergy document PO07401 "Telecommunications Pits including Specification and Installation";
- Where the conduit is in a trench by itself it must have a warning marker tape for Optical Fibre Cable, and the tape shall include a stainless steel conductor suitable for use with cable locator equipment. The conductor must be available in the pit next to the conduit for ease of connection to the cable locator equipment. Where the conduit and marker tape crosses under a substation boundary fence there shall be a break in the stainless-steel conductor for a distance of 3 metres to eliminate risk of transferred voltages from the substation earth system;
- All such conduit runs are to be continuous, pit to pit, and fitted with draw wire or draw rope;
- All joints and bell mouths to be glued using Type N PVC solvent cement;
- 100mm communications conduits may be installed with 3 x 32mm subducts; and
- Marker disks must be installed on concrete curbs, substation boundaries,
- edge of concrete driveways etc, with appropriate text on it, as per Section 9.8.

Where the conduit comes out of the ground, e.g., onto cable trays or Gatic style trenches in the substation environment, then the conduit must have “Optical Fibre Cable” marker tape wrapped around the conduit at 3 metre intervals, and other locations where the conduit is visible, and as appropriate.

Conduits holding protection fibre cable will not be made available for third party access and must retain at all times sufficient spare capacity to install an additional fibre cable under fault conditions.

When selecting the conduit to be used for protection fibres from a nest of conduits, the planner or designer will need to consider the future possible electrical build activity, such that the fibre will not be affected by that work. Typically, select a conduit on the side of the nest and second from the top. Conduits holding protection fibres are not to be above the electrical conductors (i.e. cables or electrical conduits must offer a minimum of one layer of cover).

Communications conduits will also be provided by default with HV buried cable or conduit installations. The typical configuration is as shown in Figure 1 below:

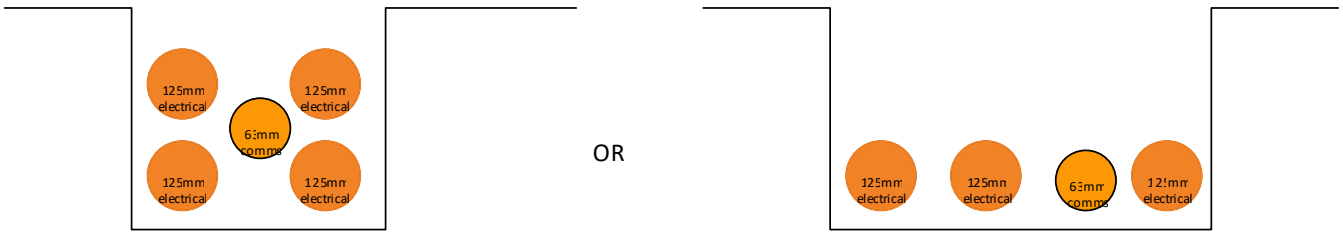


FIGURE 1. TYPICAL CONDUIT INSTALLATION DETAILS

When installing communications conduits for critical protection that requires diversity and is to be installed in the one trench, use two 63 mm orange conduits in the arrangement indicated in Figure 2 below.

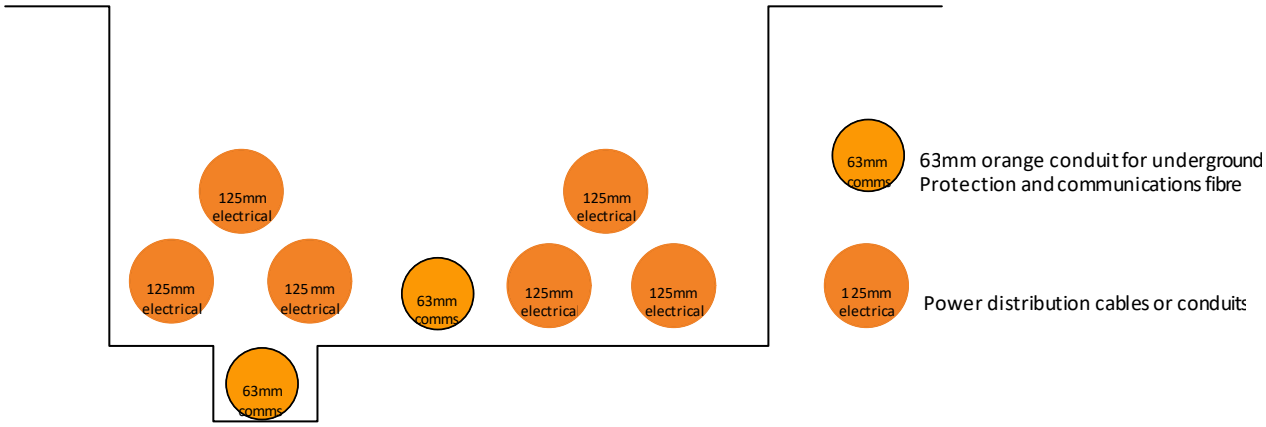


FIGURE 2. DIVERSE COMMUNICATIONS CONDUIT LOCATION IN A SINGLE TRENCH

The key feature of the arrangements is that one is below the feeder and the other is between the feeders. In this way we can mitigate the risk from vertical excavation damaging only one or a horizontal excavation damaging only one, without first coming into contact with the HV cables.

Communications conduits and subducts must be labelled as Evoenergy assets.

Evoenergy communications conduits must also:

- be installed below or between HV cables, as shown above, OR with 900mm cover outside Evoenergy substation fence and 500 mm cover inside the fence; and
- have a bend radius as large as feasible, but not less than 1200mm.

BEFORE YOU CAN HANDOVER TO HAUL A CABLE IN AN OPEN EXCAVATION CONDUIT RUN

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See the appropriate checklist

Before cable hauling conduits must be backfilled to a minimum 200mm above conduits. This prevents the hauling tensions from lifting the conduits out of the bedding material and impacting thermal resistivity.

Backfill must exist above the conduits to prevent uplift from haul tension

Q Do I have to fit Bellmouths to each end of the conduit?

A Yes.

Q Can I use plastic wrap to cap conduits?

A No. A correct plug / cap must be used.

Q	I cannot extend the conduit 1000 mm past the edge of the road, what do I do?
A	The reason behind extending the conduit is provide a safer environment for workers when jointing / hauling cables with a reduced need for barrier / high strength fencing and traffic management. A variation must be sought.
Q	The existing conduits are right next to each other, why do I have to space these at 200mm?
A	We are implementing standard practices.
Q	Why do we put drains on conduit before they enter the building?
A	To drain the water off before it enters the building on conduits that slope towards the building. There are some onion ring style grommets that plug both the bore and the cable preventing moisture ingress.
Q	I am installing a long sweeping bend, there will be joins in it. Can I do this?
A	Yes, on a long bend, ensure that joint glue is set before placing bending stress on them.

Conduits can become blocked or contain sharp edges. Inspection must be undertaken before attempting to perform a cable haul.

PROVING CONDUITS

Conduits must be proven to be clear before a cable is hauled.

If the conduit cannot be visually inspected as clear along its entire length, then a proving run must be undertaken by hauling a proving mandrill through the run. Connect a return hauling line to the other end of the mandrill.

Inspect the proving mandrill before and after hauling for score marks or damage that indicates a blockage or issue in the conduit.

All bore pipe conduit runs must be proven prior to cable haul using proving mandrills only

MANDRILL SIZING

Always verify the Internal Diameter (ID) of the conduit, the mandrill will be a few millimetres less in diameter.

conduit ID	mandrill diameter
100mm	90mm or 96mm
125mm	113mm or 118mm
Bore pipe 142mm	138mm
150mm	130mm or 146mm

CLEANING CONDUITS

If a conduit is suspected or found to contain debris, a wire brush and squeegee combination should be hauled through.

The hauling line with the cleaners must be passed through the entire run of conduit until the conduit is clean sufficiently to pass cable through without damage.

Connect a return hauling line to the other end of the mandrill. Wear gloves while handling the wire mandrill.

Any conduit that has been found to be blocked must be proven via a proving mandrill and squeegee or visual inspection prior to hauling the cable.

Clean the conduit exit points of the debris that has been extracted from the conduit to prevent cable damage.

WIRE BRUSH SIZES

The correct brush size needs to be selected. Always verify the Internal Diameter (ID) of the conduit,

conduit ID	mandrill diameter
100mm	90mm
125mm	113mm
Bore pipe 142mm	130mm

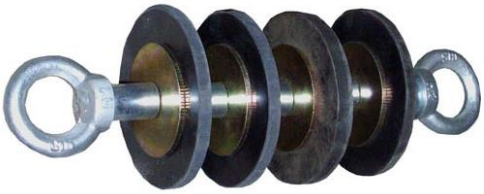
150mm	130mm

SQUEEGEE, LUBRICATION SPREADERS

A squeegee should be placed in front of the cable grip on conduit runs.

The squeegee must be removed from the link at the end of the conduit run to prevent damage from being dragged on the ground.

The area around the conduit / cable exit should be cleaned of any debris that has been drawn out.



SQUEEGEE / SPONGE SIZING

The correct brush size needs to be selected. Always verify the Internal Diameter (ID) of the conduit,

conduit ID	mandrill diameter
100mm	102mm
125mm	125mm
Bore pipe 142mm	143mm
150mm	143mm

Q Do I have to use a mandrill on a bore pipe, I can see through to the other end?

A Yes. Bore pipe has shape issues and may have been spiked to hold it in place.

Q What if the mandrill is marked, what do I do?

A Marked, or mandrills that are hard to haul indicate binding issues in the conduit. Run the mandrill through a couple of times to verify that the sticking point remains.

- If it does not remain, run a cleaning sponge through to collect debris.
- If it does remain, run a wire brush through and test with the mandrill again
- If the obstruction remains contact our person in charge

Q Who is responsible for proving the conduit?

A The Contractor must inform us within an agreed period that this section of work will commence. The work is to be performed under witness of the relevant Inspection Authority. However, work may proceed if the relevant authority is not available at the required time.

Boring produces its own unique risks that need to be evaluated and controlled.

23. CONDUIT INSTALLATION BY BORING

Areas that require addressing when performing conduit installation by boring, a) surface surveys b) subsurface surveys c) mud plans and Dial Before You Dig.

At no time should any part of your person enter the bore.
Always wear appropriate PPE when working with drilling Mud.
If grout comes into contact with your skin wash the affected area immediately.

All conduit installations / sections are to comply with appropriate sections of:

AS2032 for installation of PVC pipe systems

AS2033 for Installation of polyethylene pipe systems

All plastic electrical conduits are to comply with AS/NZS 61386 Conduits and fittings for electrical installations

Installation of bore pipes is to comply with AS2566 Buried flexible pipelines Structural design

Bore pipe under roadways
https://www.tccs.act.gov.au/__data/assets/pdf_file/0006/398463/ACT_TRITS_03_Underground_Services.pdf for TCCS trunk road crossings

GENERAL

Conduits installed by boring do not require a marker tape or additional mechanical protection and must be installed in this Civil Works Field Manual. However, the depth to the top of the conduit must be a minimum of 750mm where high voltage cables are proposed to be installed and 600mm for low voltage and service cables.

Where the conduit passes beneath a load bearing structure such as a roadway or stormwater drain, the clearance below any element of the structure should be increased to 1200mm.

Any bore pipes are to have an internal diameter equivalent to the internal diameter of conduit specified. All relevant conduits to bore pipe connections are to be made in a trade-like manner

using commercially available connectors that ensure a water tight seal is made.

PREVENTING CONTACT WITH ASSETS

GETTING STARTED

Prior to the commencement of site work we may require a pre-start meeting with the Principal contractor and representatives of any other authorities involved.

The meeting is to be arranged and facilitated by the Site owner or Principal Contractor and scheduled to allow sufficient time for all issues that may be raised to be resolved prior to the commencement of site work.

Items to be established include: (but not limited to)

a. surveys
b. the correct conduit alignment, route and variation from “released for construction”.
c. the location and clearances required of other assets / services along the route
d. the number and size of bore pipe conduits to be installed
e. the correct fittings to be used for connection to electrical conduit and the requirement for cable hauling pits

SURFACE SURVEY

The surface survey will be conducted with sufficient extent covering the site area for equipment setup in stages, storage locations, and drill path centreline with offset of +5m. By doing such surface survey, it is targeted to obtain some general information such as:

- Ground features like roadways, footpaths, utility poles, overhead power lines, communication towers and fire hydrants, etc.
- Culverts, open channels, manholes, creek crossings and road crossings etc.
- Structures such as buildings, storage tanks swimming poos bridges, dangerous goods stores, etc.
- Protected / registered trees, heritage areas
- Geotechnical features such as man-made slopes, retaining walls and natural terrains, etc.
- Passes under roadways or waterways are not adversely impacted (No cavities are produced)
- Creation of a mud map of bore, equipment locations, launch and receive pits, site materials etc.
- Machine placement plan. Ensure that the soil can take the required pegging stress to hold the machine in place
- Hauling sites for drawback and hauling the bore pipe
- Spill kit location

SUBSURFACE SURVEY

The subsurface survey identifies any potential features that may impact or be impacted by the bore design ore bore works.

1.1 Ground Investigation

A general geological review will determine the ground conditions likely be encountered in the vicinity of the bore alignment.

The design stage should determine if directional drilling is practical and establish the most cost-effective scheme to accomplish the bore.

With a comprehensive ground investigation, key design parameters for soil can be determined such as:

a. soil classification

b. shear strength

c. soil density

Standard Penetration Test (SPT) values; for rock, other parameters such as rock characteristics, quality, unconfined compressive strength, hardness and abrasiveness can be obtained.

The geotechnical survey must indicate if filling of the bore void is required (Grouting) and the strength of the fill.

1.1.1 Hydrographic surveys

Groundwater a hydrographic survey indicating water levels should also be undertaken if:

1. the bore passes under waterways
2. springs, hydrological flows are known to exist in the intended alignment
3. the bore passes within 10 metres of a body of water

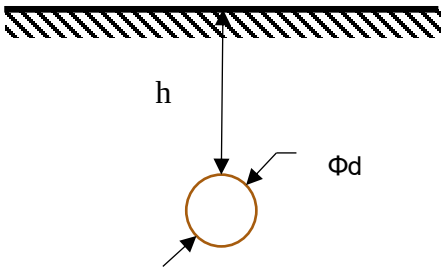
1.2 Bore diameter to depth

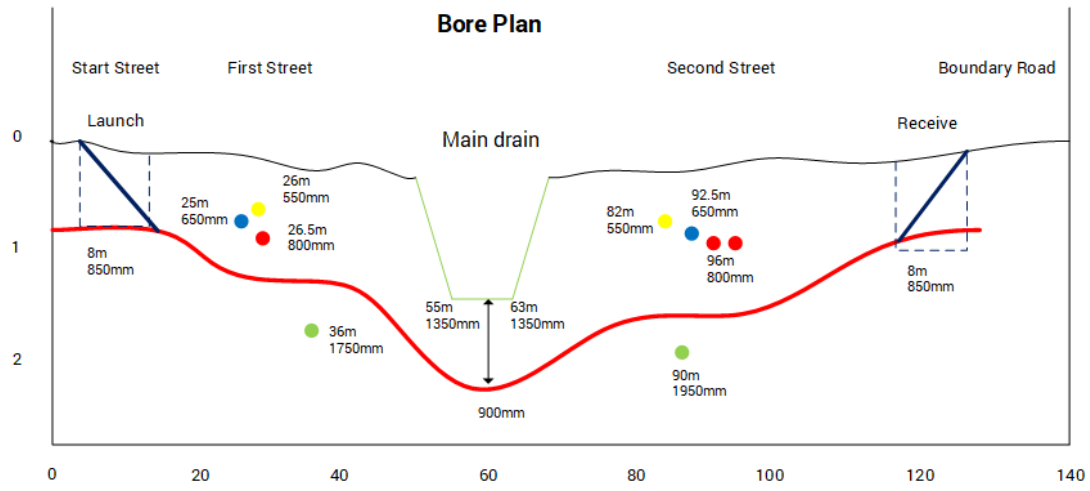
A bore in dirt does not remain open, the sides of the bore collapse around the conduit. For multi occupational bores where there is a significant ratio of conduit to unoccupied space, if the bore is not grouted surface subsidence can occur.

If the bore diameter to depth ratio is too small surface subsidence can also occur.

Always seek geotechnical advice on ratios

As a rule of thumb the ratio of depth to diameter should be greater than 3.5:1.





Asset checking information (Dial Before You Dig) is important for planning, designing and implementing bore works.

1.3 Alignment Design / drilling plan

To optimise the bore alignment, the primary concern is to minimize the drilling length and avoid underground assets. Other factors to consider are the availability of working space at both entry and exit locations and geological conditions along the drilling path and local authority's requirements.

Once these factors are fully addressed, the design path is subject to the configuration details which include:

a. penetration angles
b. radius of curvature
c. directional accuracy and tolerance
d. vertical depth of cover
e. identified asset locations

These items are to be included on the Bore plan.

Penetration Angles

The entry angle at the launch pit s governed by the equipment capability which is generally designed between 8º to 20º with consideration of safe operation at the site.

Exit angle at the receive pit is to be designed to facilitate the break over bend of the pull section. The break over support can be minimised by adopting a low exit angle. Generally, the exit angle is within a range of 5º to 12º.

The position of the equipment and size of pits must be considered, along with the number of conduits being hauled.

Pit lengths should be designed to facilitate pull / let down of the conduit to prevent pooling / support adequate conduit falls.

Typically it takes 11 metres of drilling to level out to a depth 1200mm

Hole diameter

The borehole diameter is to be agreed with the drilling contractor in consultation with a geologist.

The bore run is to remain unconditionally stable from subsidence throughout environmental conditions including 1 in 50 year floods events.

a. If grouting is required then the bore hole should be a minimum of 1.5x the diameter of the bore pipe/s to be installed.

b. If no grouting is required then a borehole diameter of 1.2x the diameter of the bore pipe/s to be installed can be considered.

GENERAL CONSIDERATIONS AND MUD PLANS

1.4 Drilling near waterways

Bunding

The works area is to be bunded to prevent movement of soil and water into waterways.

Turkey nests

Use subsoil from the borehole to create a Turkey nest to allow for the potential storage of contaminated water in site if storage facilities are not available.

Mud separation

Keep mud from the borehole separated from other soils.

1.5 Drilling fluids / mud plans

Bentonite or mud as it is known while common is not our preferred fluid in rock or hard soils, clean up and disposal in urban areas can be difficult and it creates possible void formations.

Our preference is foam for rock which can be cleaned up with defoamer or an anti-foaming agent. It can also improve drill life and penetration rates in rock.

The type of fluid is to be agreed before drilling commences.

Following pipeline pullback, there are usually large quantities of drilling mud and cuttings

Contractors are required to provide disposal plans and approvals for this material

Inadvertent control plans

Drilling mud can sometimes surface elsewhere through natural cracks or voids in subsurface soils or if a higher mud pressure was required. This is an unintended release of drilling mud referred to as inadvertent return. These releases if they occur are to be monitored and cleaned up.

Contractors are to provide inadvertent control plans.

We are to be contacted immediately if an inadvertent release occurs

The plan must contain:

1. method of slurry containment
2. methods of recycling fluids and spoils if applicable
3. method for transporting drilling fluids and spoils off site
4. drilling spoil handling
5. drilling fluid pressure
6. measures to contain and clean the affected area of an inadvertent return of drilling or hydraulic fluids
7. location of drains and culverts where an inadvertent or spill may flow or need to be blocked to prevent flow
8. process of communication if inadvertent return occurs
9. measures to adequately clean up surface seepage of drilling fluids and spoils
10. where spill kits are stored
11. whom is to be contacted
12. fluid measurements such as
    a. pH
    b. viscosity
    c. fluid weight
    d. water hardness
    e. calcium content

1.6 Radius of Curvature

The alignment radius of curvature adopted in our bore path is greater than 50 times the outside diameter (OD) of the bore pipe.

1.7 Directional Accuracy and Tolerance of the bore

The pre-determined path will serve as a reference line against the downhole survey data for field correction. Allowable deviations from the pre-determined path are radial and longitudinal accuracies of ±100mm and +1000mm at the pilot hole exit location respectively.

1.8 Bore logs

Bore logs must be kept and provided to the Person in Control. The log is to be neat and legible, presented in tabular form. Information provided is to include as a minimum for each bore:

1. site location details and dates
2. contractors details
3. bore number
4. size and number of conduits installed
5. depth below finished surface level to the top of the bore at approximately 3 metre spacing (Or rod lengths) with reference to Stromlo or AHD datum

6. bore pressures aligned with drill head RPM and travel rate in metres per minute
7. pull back pressures and axial loads

1.9 Other information considered necessary

Environmental or culturally sensitive site may require additional information to be provided by the bore operator.

1.10 Boring direction

It is preferable to bore downhill in terms of containment of inadvertent return as the mud should remain within the bore. If uphill boring is performed the mud pit must be large enough to hold all the mud when pumping stops.

1.11 Bore pit locations

To prevent water coursing and flooding during rain events, pits at the bottom of hills should be avoided.

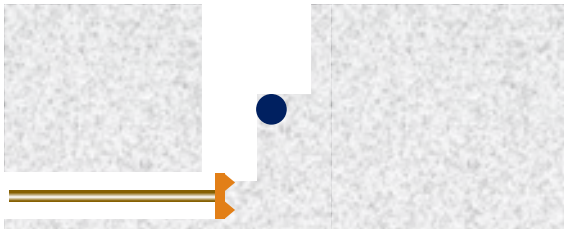
1.12 Type of boring

When boring in rock, modern boring machines can deploy percussion heads.

Percussion boring is not to be used within 2 meters of any underground asset

1.13 Crossing other assets

Expose assets at the crossing point / depth. Visually monitor the bore head until clear of the asset. Check clearances, validate that they are within tolerance for the completed bore diameter.



1.14 Bore depth monitoring

Depth trackers should be used, they should be within calibration.

Depth should be checked every 3metres and verified every 100 metres (this can be achieved either at asset crossings, or at drill end points), the level accuracy between the tracker and measured is to be within ±5%.

1.15 Parallel alignment clearance

After all asset locates and depths are established, review your bore the plan, adjust bore locations if required to increase clearance on parallel runs with other assets as necessary.

1.16 Stored energy

Care must be taken when removing the strapping from coils of bore pipe, as considerable energy is stored in the coil. If this energy is released in an uncontrolled manner it can cause serious injury or death. Follow the manufactures recommendations.

1.17 Pullback

Extreme fluid pressures may be required for horizontal directional drilling.

During pullback, it is reasonable to assume that the borehole remains stable and open and that the borehole is full of drilling fluid.

The pullback operation involves pulling the entire pipeline length in one segment (usually) back through the drilling mud along the reamed-hole pathway. Proper pipe handling, cradling, bending minimisation, surface inspection, and ultrasonic / fusion welding are required along with installation of bull line and break link/s.

The axial tensile stress due to the pulling force should not exceed the pipe's safe pull load.

Axial tension force readings, constant insertion velocity, mud flow circulation/exit rates, and footage length installed should be recorded. The pullback speed ranges usually between 0.3 and 0.6 metres per minute.

1.17.1 Bending stress

Crossings are to incorporate radii-of-curvature, which allow the bore pipe to cold bend within its elastic limit. These bends are to be long in radius as to be well within the flexural bending capability of bore pipe.

1.18 Tolerances

The bore pipe is to be installed in accordance with the horizontal and vertical alignment as shown on the "released for construction" works package subject to the following definition of tolerances:

Horizontal: The position of both the inlet and outlet of the conduit should be within ±100mm.

Vertical: The tolerance at the inlet/outlet of the conduit where installation commences should be within ±100mm.

Grade: To prevent pooling, the average grade of the conduit should comply with the grade as shown on the Drawings. Or 1 in 10000 if no grade is provided.

To ensure no stress on joints from the bore pipe:

- The conduit alignment at all joints to other non-bore pipe products will be true with a tolerance of ±25mm deflection in any direction at 1.5m from the joint.
- Or the bore pipe is to be suitably pegged in place

1.19 Jointing bore pipe

All linear joints are to be ultrasonically / thermally welded.

1.20 Polymeric covers

Conduits installed by boring do not require cable covers. However, where cables are exposed, pits etc. they must have polymeric covers and stretch tape installed.

1.21 Bore pipe shape memory

Bore pipe often attempts to return to its coiled state when it is left free. These bends can cause cold flow on cables or stress when connecting to a solid conduit, Bellmouths amongst other remediations are required to prevent this.

1.21.1 Pegging bore pipe

Pegging using cement may be required if the length of bore pipe exposed in non-virgin soil is greater than 1000mm.

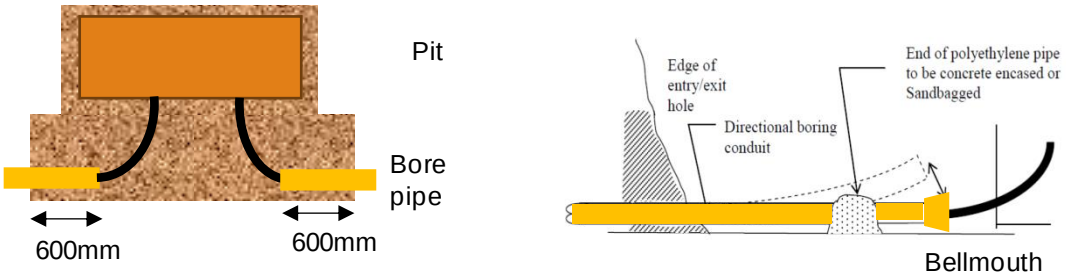


FIGURE 3. MAX NON-VIRGIN DIRT LENGTH FOR BORE PIPE

1.22 Multi occupation bores

Spacers if required will be called for on the "issued for construction" works package, or via a variation. The design will identify if spacers are required and how they are to be assembled.

Spacers if used are to be plastic. They are to be selected and spaced appropriately to hold the conduits together and maintain spacing of the conduits for the full length of the bore.

Spacers are not to hinder the flow of grout.

1.22.1 Pull back

Individual break links / grips are expected for a multi occupation pull.

1.22.2 Multiple bore hole separation

Where it is necessary to bore more than one hole along a cable alignment, a minimum separation of 300mm from the outer edges of the bore is to be maintained between different bore holes.

Every hole must be regarded as a new hole and independent of any other adjacent holes.

Before you can handover to haul a cable in a bore pipe run see the bore pipe checklist.

Grout is set

1.23 Bore depths

Our target bore depth is between 900mm and 1500mm in depth. Bores that are deeper than 1500mm for more than 25% must have cable capacity appropriately de-rated.

1.23.1 Passing under a road

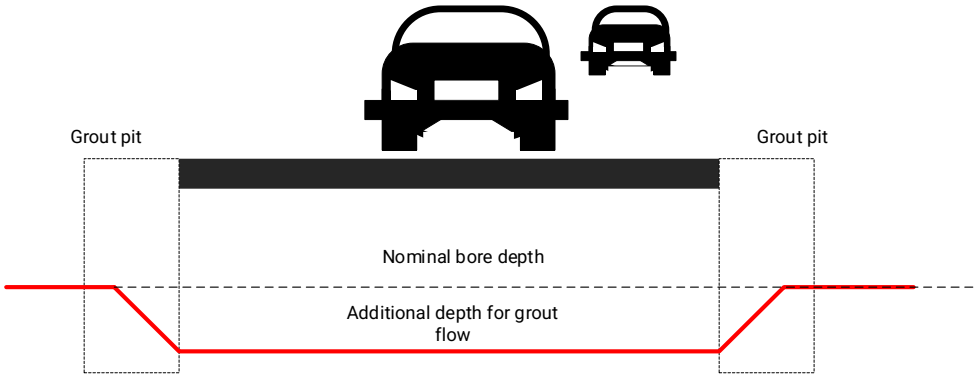
Bores are to cross the road at 90º ± 4º Road.

See
https://www.tccs.act.gov.au/__data/assets/pdf_file/0006/398463/ACT_TRITS_03_Underground_Services.pdf
for TCCS depth and grouting details

Consider diving down at the road and returning to the nominal depth on the other side to assist in flowing grout if it is called for in the design.

1.23.2 Grout pits

Grout pits are suggested as a method of enabling grout installation under roads. Appropriate Safe Work Method Statements must be in place. Grout can be poured into the pit and allowed to flow to the other side, eliminating the need for pumping. A tremie pipe can be used to direct and feed grout into the bore if required.



1.24 Works As Executed (WAE)

Evoenergy expect to be provided with the sub surface route plan with the following information:

a. launch end
b. landing end
c. planned drill depth
d. actual drill depth
e. drill Pressure at that location
f. left / right correction
g. direction

CONTINGENCY PLAN FOR REMEDIATION OF POTENTIAL PROBLEMS

Drilling is a unique practice, it can offer up situations that you may not have thought of, e.g. broken in borehole drill, lost communications with the drill head. This document should outline the standard operating practices that you will deploy for a unique or rare event.

Events that should be in the plan include:

1. loss of head communications
2. broken drill head
3. fuel spills (May be part of the environmental plan)

4. hydraulic fluid leaks (May be part of the environmental plan)
5. subsidence
6. inadvertent shutdown (e.g. mud pump stopping or drill machine stop)
7. rain / flooding of the bore hole
8. broken bore pipe / bull line breaks
9. broken drill strings
10. loss of communications with the drilling operator
11. drill head collision course with asset detected
12. drill off course
13. error detected in drill plan
14. high drill thrust pressure detected
15. inadvertent release (May be part of the environmental plan)

It is expected that this is a living lesson learned document. It can contain either or both

- The intended actions to resolve / contain the situation.
- The outline and activities that you performed to recover the situation.

CHECKLIST OF REQUIREMENTS FOR BORING

Horizontal Directional Drilling (HDD/ Boring) is a specialised activity, the following is a checklist of the requirements and activities expected for successful HDD

1. SWMs
2. surface survey and site plan
3. subsurface survey.
4. Dial before you dig
5. inadvertent control plans
6. mud plans
7. environmental plans (fuel spill etc.) and approvals (if relevant)
8. emergency procedures
9. tracking calibration
10. contingency plan for remediation of potential problems
11. communication / daily documentation list
12. bore pipe weld testing / inspection
13. grout evaluation / test method

Q Do I have to do the surveys / plans?

A Yes

Q My drilling machine does not measure pull back or thrust pressure, what do I do

A These pressures are important for measuring the amount of rock, and ensuring that you have not created voids or overstressed the conduit or inadvertently stuck a submerged asset. You must offer an acceptable alternative solution.

Q Can I drill deeper than 1500mm?

A For avoidance yes, this should have been picked up in the sub surface / utility survey before you started drilling. Else a variation will be required.

Q Why do I need to complete the as installed documentation?

A So that we and the public (through DBYD) know where our assets are.

Q I am boring uphill and don't have the room for a large mud pit?

A You need have an effective solution in case of failure, this could be secondary mud pump, or a bunded area or a downhill drill.

Q I have had an inadvertent release what do I do?

A
a. enact your plan
b. stop drilling works if safe to do so
c. contain the spill
d. contact appropriate authorities / persons in Control
e. prevent mud from escaping into drains or water ways
f. use Hydrovac to clean up large spills. Deploy sand / gavel bags and hay bales as required
g. establish what went wrong and why before any works recommencement

Q There is not enough staging area to roll the bore pipe out. What do we do?

A We are open to your suggestions, this could include performing staging at another location, altering the staging direction, performing a shorter or longer drill run.

Q The bore pipe has got stuck or has come out flat during the haul.

A Common causes for this are:
a. low grade bore pipe with a less than required Modulus of Elasticity
b. poor mud pan
c. bore hole collapse

The cause must be identified and corrected before the bore can be accepted.

Q Why does the surface sometimes lift why drilling or during pull back?

A This occurs if the cuttings are allowed to build up in the hole, usually because of improper flow rates or the wrong drilling fluid mix.
Bore hole collapse due to changes in geotechnical conditions can create this issue.
Check the mud plan.
Verify that you have not created a void.

Q	What is a Contingency Plan for Remediation of Potential Problems?
A	Drilling is a unique practice, it can offer up situations that you may not have thought of. This is the plan for how you handle unexpected events, the steps you take to corral the issue and then mitigate, remediate and move back into drilling.
Q	Do I need to supply and Equipment Layout Plan?
A	Yes, it helps to ensure a clean and tidy site with enough room to safely move and store equipment and materials.
Q	Do I have to calculate the Maximum Allowable Drilling Fluid Pressure for each and every site
A	These calculations assist in ensuring inadvertent reduction and reduces voids in the bore hole.
Q	My contingency plan does not cover the event that occurred what do I do next?
A	Use this as a learning event to build and improve the plan. Do not commence restart until you are confident and can demonstrate that the event is controllable.
Q	Do I have to pressure test the bore?
A	No.
Q	Do I need to submit a separate safety plan?
A	HDD is a specialised activity, using specialised skills dedicated equipment and materials. The equipment alone creates high pressures, forces and is a high torque rotational item, a dedicated safety plan along with required SWMS should be produced or included into your site safety plan and SWMS.
Q	Am I required to create / deliver an as built bore profile?
A	Your profile must be not just as built, but as agreed with variation approvals and variances within tolerance
Q	Do I need a break link in the bull line?
A	If your machine has pull tension that is greater than the yield modulus of the conduit then yes. The break link prevents the conduit from being damaged and dangerous situations occurring if the haul gets stuck.
Q	We are boring with landing and launching zones that naturally have a rise and will cause pooling. What action do you expect?
A	We expect a push down on bore pipe to level it out, this will create a trench about 2500mm in length.

BACKFILLING AND SITE RESTORATION

Correct depth of bedding sand is important for cable performance and reliability.

24. BEDDING SAND

Bedding sand removes the heat generated from the cables. Incorrect bedding sand, compaction or depth all impact the cables performance and ability to reliably deliver electricity.

Installation AS2566.2 Buried flexible pipeline.

Quarry products

GENERAL

Bedding sand is specified in our quarry product requirements see Quarry products

We have a preferred supplier for bedding sand. If other suppliers are sought, the bedding sand must undergo compliance testing.

Bedding sand extracted from site cannot be utilised as bedding sand again. It is permissible as backfill material on top of bedding sand and must remain more than 150mm below the top surface.

1.1 Using bedding sand

Bedding sand surrounds the cable / conduit i.e. it is also the haunch product.

1.2 Rationale behind bedding sand

Native material may contain the following:

Rocks, gravel, building rubble or metal may damage the cable insulation

Clay that becomes hard when it dries and it becomes difficult to expose the cables without damage

Clay shrinks and swells as it dries and wets up and can impose stress on the cable insulation

Native soil may contain large levels of organic material that may rot creating voids and thermal hot spots

Native soil may not be consistent in thermal grading causing hot spots on the cable. Hot spots may lead to premature cable failure.

DEPTHS AND COVERAGE

All depth requirements are provided on the "issued for construction" work package the information here is a guide for minimum coverage. High capacity sites e.g. at sub stations may require alternative bedding sand or flowable backfill requirements.

1.3 Under the cable or conduit

The base of the excavation is to be covered with bedding sand and compacted to a minimum of 80mm for greater than 90% of the length. Typical depth is 100mm.

Bedding sand depth is to be consistent across the width of the excavation

The depth of the bedding sand sets the depth to the top of the cable or conduit from the finish level. See standard excavation drawings for details.

At no point is the compacted bedding sand be less than 50mm

Verification of depth should be taken prior to any further works

1.4 Over and around cables

Once the cables are in place the cover layer of bedding sand can be applied and compacted as follows:

The bedding sand is to be a minimum of 100mm above the top of the cable.

Compaction using a maximum 18kN centrifugal plate compactor can commence once more than 100mm covers the cable.

The bedding sand height should be consistent across the width of the excavation.

1.5 Over and around joints

The bedding sand is to be a minimum of 300mm above the top of the joint

No mechanical compaction can be performed within 300mm of an installed joint

1.6 Over and around conduits

Once the conduits are in place the cover layer of bedding sand can be applied and compacted as follows:

Bedding sand is to be a minimum of 100mm above the top of the conduit.

Bedding sand height is to be consistent across the width of the excavation.

For conduit stacks specific "issued for construction" works package drawings may be provided.

1.7 For bore pipe

Bedding sand is not used in bore pipe runs.

MAXIMUM HEIGHT DROP

Material is to be dropped from heights no greater than 500mm once the asset is installed.

COMPACTING BEDDING SAND

Compacting for conduits will be in accordance to AS/NZS 2566.2

Where the bedding sand is covering cables or conduits compaction will be with compactors not exceeding a centrifugal force of 18kN.

Mechanical compactors are not permitted directly on top of joints. Compaction must stop 300mm before cable joints.

A minimum bedding sand thickness of 100mm on top of the cables must be present before compacting over cables.

Compaction level thickness is not to be more than 200mm. See also jointing and hauling pits.

Excavations less than 2 metres in length e.g. reactive works do not have to be mechanically compacted.

Compaction is to be performed on the bottom layer before cable / conduits are installed in trenches.

With the exception of road crossings bedding sand compaction is not required for deep excavations that use shields.

1.8 Jointing and hauling pits

For reactive works in dirt-based jointing / hauling pits, safety and ease of access are the overriding requirements. Bedding sand is only required to be compacted once full coverage over the cables / conduits is achieved.

In Greenfield dirt-based hauling / jointing pits bedding sand is to be compacted on the bottom layer prior to placing conduits / cables.

STORAGE ON SITE

See Materials.

VERIFYING BEDDING SAND DEPTH

Bedding sand depths are to be measured at the intervals shown.

EXCAVATION LENGTH	Number of samples
Less than 10 metres	1
Less than 100 metres	3 a minimum of 4 metres apart
100 metres or more	1 every 30 metres

SPACERS

All conduits and cables are to be separated by compacted bedding material. Spacers may be used to maintain separation between conduits. Approved spacers don't have to be removed prior to bedding material compaction.

It is common and accepted practice to use small farrows of bedding sand to hold cables / conduits in place while the main bulk of bedding sand is deployed.

STEPS FOR THE USE OF BEDDING SAND

1.9 For conduit and cable installation

1. Lay down bedding sand to required depth

Damage to buried cables is costly and inconvenient.

2. Compact
3. Inspect depth and lay more if required
4. Install conduits / cables
5. Lay down covering bedding sand
6. Compact
7. Inspect

1.10 For bore pipe installation

Only required where cable exits the bore pipe e.g. jointing pits and hauling pits.

Q	Can I use a different bedding sand?
A	Yes, if you have it type tested / approved and has appropriate certificates of compliance.
Q	Can I use existing bedding sand / sand that has been extracted from the trench?
A	Only for backfill, new bedding sand must be deployed.
Q	Does bedding sand have to be used?
A	Yes
Q	Do I have to machine compact bedding sand?
A	In trenches yes, before conduit / cable placement and after placement. In brownfield / existing hauling and jointing pits compaction is required after full sand coverage In new hauling / jointing pits compaction is required on the bottom layer (Same as a trench).

25. CABLE POLYMERIC COVERS AND MARKER TAPE

Damage to buried cables can not only be costly and inconvenient, but very dangerous. Polymeric covers both identify cable location and provide a physical barrier to protect against future damage.

Shared trench 393-010

Cable trench 393-007

Polymeric cable covers are to comply with AS4702

Stretch tapes are to comply with AS2648.1

Polymeric cable covers are to be located on top of the bedding sand above conduits and cables.

Cable covers must conform to AS4702

Be of minimum width 150mm.

Coloured light orange with black lettering stating “DANGER ELECTRIC CABLES”

Polymeric cable covers are to be located centrally over the conduit / cable

Polymeric overs are generally to be placed within 100-200mm of the top of conduits see 393-007 and 393-010

The number of cable covers used is determined in the “issued for construction” works package. If not documented, it is to be one for each MV conduit / cable stack.

Polymeric covers are to extend 40mm beyond the edge of the cable / conduit

Polymeric covers are to be located over joints.

Polymeric cover joins are to overlap by 300mm

Polymeric cable covers are to be replaced / located over any reactive works.

1.1 Marker tapes

Marker tapes (Stretch tape) is to conform to AS2648.1

Stretch tapes are to be placed a minimum of 200 mm above polymeric covers and be deeper than 200mm below the site level (Top of the excavation). Rule of thumb, tapes should be ½ way between the cable and the surface. See 393-007 and 393-010

The number of marker tapes required is determined in the "issued for construction" works package. If not documented, it is to be one for each MV conduit / cable stack.

Stretch tapes are to be located over joints

Stretch tape joins are to overlap by a minimum of 300mm

Stretch tapes are to be located centrally over the conduit / cable

1.2 Reactive works

Where existing warning markers / covers on any cable are disturbed or removed during excavation, these markers and covers are to be replaced appropriate.

Where existing cables without warning markers or covers are uncovered during the course of excavation, marker tape and polymeric covers are to be installed over the exposed section.

Q	I have been working in a jointing pit and there are 4 cables, do I need to put polymeric covers on all of them?
A	Yes, every cable must have a polymeric cover, then the stretch tape.
Q	I know that there are other cables in the pit, do I have to uncover them and place polymeric covers?
A	The entire pit should have been excavated for the works. Only place covers and tapes on the exposed cables / conduits.
Q	The cables are close together, what do I do?
A	A cover is required for each cable, polymeric covers and stretch tapes can overlap.
Q	This is a vertical stack of cables; how many polymeric covers are required?
A	Polymeric covers and stretch tapes are to indicate the existence of cable under it while excavating. You only need one for each vertical stack.
Q	The Australian standard says that only stretch tape is required why are we using both?
A	Stretch tape is just an indicator, polymeric covers increase cable / conduit protection.

Following the correct process of backfilling is critical for safety.

26. BACKFILLING

‘Slough-in’ can cause safety issues for the public. Backfilling refers to the material and process used to fill the excavation on top of bedding sand.

GENERAL

Road crossings are to be backfilled to TCCS requirements

Methods of testing soils AS1289 E5.7.1

Complete backfilling as soon as practicable after the installation of cables and or conduits to reduce the potential for vandalism and improve safety.

Backfill for cables and conduits goes on top of bedding sand i.e. backfill is not to be placed in direct contact with cables or conduit

1.1 Requirements

Agreement / acknowledgement of all required cable works at that location have been completed must be sought before backfilling.

Remove any surplus jointing materials, waste materials, all rubbish including timber, foreign material, free water and slurry before backfilling.

Application and compaction of bedding sand over cables and conduits

Backfill material is not to be placed in any excavation containing free water or slurry

The excavation must be clean and completely free from all fibrous and vegetable matter and other material, which may attract termites.

Excavated material may be used as backfill (above the bedding sand), to 150mm of the final set level

If you have removed the top layer and set this aside, it can be used to complete to the final set level Excavation in footpaths are to be backfilled to meet local authority requirements. Typically backfilled in layers not exceeding 250mm and compacted to achieve 98% of standard maximum dry density obtained in accordance with AS1289 E5.7.1.

Roadway excavations are to be backfilled to meet local authority requirements. Typically backfilled in loose layers not exceeding 250mm and compacted to achieve 98% of standard maximum dry density obtained in accordance with AS1289 E5.7.1.

Excavations in areas other than footpaths and roads e.g. private property or Greenfield will be backfilled in loose layers not exceeding 250mm and compacted to achieve 95% of standard maximum dry density obtained in accordance with AS1289 E5.7.1.

1.2 High risk backfill is not to be used, including material which may contain asbestos fragments. High risk backfill material

Risk factor	Potential response
High plasticity heavy clay soils (soils which can be formed / moulded into delicate shapes)	High level of plasticity. Not suitable as backfill. Obtain engineering advice if this is a road crossing or trafficable area Obtain engineering advice if moisture content of clay exceeds the plastic limit, or is more than fifteen percent (15%) If it must be used compact in thin layers (i.e.: 100 to 200mm loose layers)
High rock content or large rock fragments (Does not pass a 50mm sieve)	Do not use this backfill unless sieved.
Very low backfill moisture content	Keep trench open time short. Consider adding moisture to keep dust levels low.
Very high backfill moisture content	Not suitable for compaction until dried / drained.
Low strength surrounding soil (AHBP < 50 kPa) or close to other assets	Do not use high levels of compaction consider only plate compactors Consider the use of easy to compact material (Bedding sand) in conjunction with low force compaction equipment and or compact in 50 to 100mm layers.
High ground water (Monitor when combined with high permeability soils)	Consult a geotechnical engineer for suitable backfill options.
Variable or unknown backfill material	Check the material regularly and compare it against known material (Golden sample).
Backfill material contains metal and or rocks	Usable if 1. The amount of metal and rocks is less than 20% of the material (by volume). 2. The metal and rocks pass through a 50mm screen.
Poor excavated material is defined as having large stones or clay that has hardened or high thermal resistivity (i.e., organic soils, peat, black loam, sods, straw).	Not suitable.
Frozen material	See backfilling from frozen ground.
Asbestos-contaminated material	The environmental team should be contacted for advice. This material should be removed from site and disposed of as asbestos waste.

GREENFIELD BACKFILLING

In a Greenfield site, the backfill material will normally be the excavated soil, except where poor existing soil conditions are present.

Another acceptable backfill can be substituted if the existing backfill is poor.

BACKFILLING FROM FROZEN GROUND

The main problem with frozen material is not related just to excavating frozen material out of the ground, but also includes the excavated material which has frozen by the time backfilling is performed.

If the soils taken out of the ground has any moisture content, the backfill heaps can freeze quickly.

When excavations are necessary in frozen ground, or if the backfill freezes after excavation, special precautions must be as follows:

Bedding sand must not be frozen prior to its installation.

Spoil piles should be managed to maintain the soil in the centre of the pile in a non-frozen state.

All backfill immediately above the top layer of sand and polymeric cover is to be extracted from below the frozen surface of the backfill spoil heaps.

If no unfrozen material exists in the pile and frozen must be used, then the frozen lumps on top of the sand / polymeric covers must be power compacted to within 150mm of the top of the excavation.

Where possible “berm” (build up the fill above the natural surface depth) above the excavation line to minimize the void if sloughing does occur.

MAXIMUM HEIGHT OF BACKFILL MATERIAL DROP

Place backfill in uniform lifts not exceeding 1000 mm per lift.

LEVELLING

Level surfaces with respect to the nominal site levels / datum. In Greenfield applications, the Site Owner or Principal Contractor is responsible for levelling to the levels on site drawings. The levelling process is to be such that sloughing is prevented. If needed “Beem“ the fill (Overfill to allow subsidence).

BACKFILL MATERIALS

Road crossings and water mains have specific backfill materials that must be applied. Consult the asset owner for current requirements.

Q	Can I just compact at the end?
A	You are responsible for subsidence.
Q	I have never had to seek advice on moist soil / clay soil before why now?
A	Our aim is to assure the architectural look of our assets and the Canberra environment.
Q	Do I really need approval to backfill?
A	Yes, there needs to be handover to you to backfill.
Q	What does that approval look like?
A	It is part of the ITP process or comes from our Person In Control.
Q	What if there is no requirements for backfill on a road crossing?
A	Requirements for ACT Roads can be found on their web site.

27. GROUTING AND FLOWABLE BACKFILL

Grouting serves two primary purposes a) to assist in taking heat away from the cable b) prevent surface subsidence

Flowable backfill may be used to replace conventional compacted granular where conventional placement and compaction equipment is not possible.

ASTM D 6103 Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)

TCCS Trunk road infrastructure services section 3 (Grouting under roads) https://www.tccs.act.gov.au/__data/assets/pdf_file/0006/398463/ACT_TRITS_03_Underground_Services.pdf for TCCS details

GROUTING

The purpose of the grout is to:

1. improve thermal conductivity
2. avoid subsidence
3. remove longitudinal saturation lines

Grout is not always required, it may be requested at the design phase, or after a Geotech review.

Grout, if it is a setting variety should have the following characteristics:

i. Thermal Resistivity of 1.1K.m/W or less when fully dried.
ii. Compressive strength to suit the ground conditions (typically 1.5 - 5MPa after 28 days of curing).
iii. High pumpability to ensure all air voids are filled.
iv. Low heat of hydration, to avoid deformation of conduits/pipes while drying.

Cellular cement grouts are not acceptable as they provide insulation. Aluminium cements are not recommended because of cost and chemical interaction with lime.

The proposed grout mix design and characteristics are to be reviewed and agreed prior to use

For runs of less than 10 meters bentonite may be used as the grout.

1.1 Grout mixes

All grouts and batches should be evaluated for pumpability / flowability. The addition of Superplasticisers is not for water reduction or to increase performance, but to assist with flow and workability.

TCCS may have specific grout needs for when passing under a road, the mix is nominally 3:1 bentonite to sand, consult part 3 of the Trunk road infrastructure specification.

Grouting installation can be either pumped for long longitudinal runs, or slush fill for short runs e.g. under a road

1.1.1 Bentonite / soft grouts

Bentonite may not be suitable as a grout in areas where the hardness of the local water / ground (K pa) is greater than 500ppm or chloride content is greater than 1500ppm

TCCS mix

Pre-treat mixing water with Soda Ash (sodium carbonate) to reduce total hardness to less than 100 mg/l and to raise pH to 8.5-9.5

Mix the bentonite and water first. Mix for at least 10 minutes to ensure hydration.

Mix the sand in quickly, do not overmix. Place into bore immediately.

- 150kg sand
- 50kg bentonite
- 120 litres water

Yield 193 litres, 60% solids, 1.6kg per litre

1.1.2 Setting grouts

Mix 1

- 20kg Portland cement
- 11.7lt water
- 45kg sand (Silica, less than 30% to be larger than 150µm)
- 250 grams Bentonite
- 350ml of Superplasticiser (Rheobuild 1000)

Yield 35 litres. Sets to 8-10MPa thermal resistivity 0.6 to 0.8

Mix 2

- 20 kg Portland cement
- 10 kg Fly ash
- 12.5kg Sand (Silica, less than 10% to be larger than 150µm)
- 14 lt Water

Yield 25 litres. A Super plasticiser can be added to improve flow. Sets to 8-12MPa, thermal resistivity 0.7 to 0.9

Mix 3

- 20 kg Portland cement
- 47kg Fly ash
- 470 kg coarse sand
- 60 lt water

Yield 325 lt. NB This mix is best for conduit thermal grouting / pumpable backfill it is not recommended for bore grouting as it is not a high flow solution. Sets to 5MPa, thermal resistivity 1.1. Do not increase the level of fly ash in this mix.

Some grout mixes may be used as a pumpable backfill. A slump of 100mm to 150mm is suitable.

1.2 Pumping grout

Processes to ensure no voids are present are to be provided, these may include:

i. Grout volume calculations and monitoring
ii. Over pumping
iii. Reducing the viscosity of the grout
iv. Pumping at high pressures

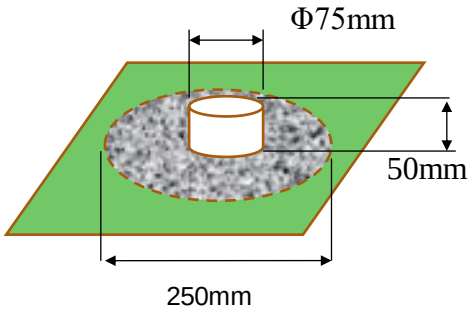
The grout should be tested for pumpability as the fines may cause adhesion between the grout and the pump walls. If such is becoming an issue a coarser sand may be required or the use of a larger delivery pipeline.

1.2.1 Measuring flowability

Slump rate measurements tend not to deliver consistency. A flowability test provides a better measure, see ASTM D 6103 for further information.

A pipe 75mm in diameter and 50 mm long is placed upright on a flat surface and filled with the grout. The pipe must be held firmly to prevent leakage.

The pipe is then lifted, and the diameter that the grout covers within 5 seconds is measured. A good flowable grout will cover 250mm, the minimum is 200mm.



1.2.2 Segregation test

Should not be required as the mix contains fine particles and will not take the weight of a penetration test.

1.2.3 Adding more water

It is common practice to add more water at the jobsite to ensure pumpability. Do not add more than 5lt per cubic metre.

If a superplasticiser is added, don't increase the content above 0.5%.

1.3 Using drilling fluid as grout

The drilling fluid and cuttings may be acceptable as a grout. The fluid must be evaluated for sharps, large cuttings and its settling state and the percentage of solids must be greater than 58%.

Potential issues:

a. Voids may not be filled the fluid is generally not pressurised
b. The expansion / contraction of the Bentonite as it swells and dries can cause high stress loads
c. Sharps from rock cuttings may damage conduits
d. Voids may be created by a build-up of spoils in front of the bull line
e. Pullback will be slow to allow the fluid to remain around the bores
f. If gypsum has been used, it cannot be used as the grout as it contains calcium and will react with the bentonite

FLOWABLE BACKFILL

Most commercially available flowable backfills have a strength between 0.5 and 3 MPa. If flowable backfill is required a typical strength grade required is 5MPa.

Lightweight pipes or other lightweight embedment may need to be anchored to avoid flotation

It needs to be confined to the area being filled until setting has taken place

Cold or wet weather conditions may prolong the product's setting time

Other utility lines such as gas, water and telephone may require a protective cover prior to pouring

Deeper applications may require pouring in stages to prevent excessive heat build-up or lateral pressures exerted and the formwork

Settlement may take place during the plastic state particularly where mixes are overly wet as the material self-consolidates

Slush installation or pumping are the preferred methods

GROUTING AND FLOWABLE BACKFILL PLAN

Grouting and flowable backfill plans establish what and how you will mix, pump and monitor grout and backfills

Impeller style pumps should be avoided if the grout contains Bentonite, as cavitation will accelerate dehydration and reduce flow.

Q Do I have to submit a plan?

A If grouting or flowable backfill is requested, yes.

Q Does grouting or flowable backfill have to cover the entire run?

A The areas of grouting or flowable backfill will be included as part of the "released for construction" works package or the variation. As base rule, grouting will either be

- Only under roads
- The entire run

Q Can I just leave the drilling fluid left behind after pull pack as the grout?

A If grout is not required and the drilling mud does not contain sharps then this may be acceptable. Consult out Person In Control for further advice.

Q	Whom designs the grout or flowable backfill?
A	We will work with you to identify a suitable mix where required.

Over compaction can damage cables or conduits.

28. COMPACTION

Vibrating plate mechanical compaction is not to occur within 100mm of cables and 300mm of joints.

Compactors not excessing 18kN centrifugal force are permitted directly on top of empty conduits for the purpose of compacting bedding sand. Increasing the bedding sand coverage to 100mm or fitting a pad to the compactor will improve results

Compactors excessing 18kN centrifugal force are permitted on top of direct buried cables once the cover is greater than 100mm

Where cables and/or conduits are beneath other buried assets / services, ensure that the backfill beneath the services is adequately compacted so that no voids detrimental to the cable rating occurs or damage to other buried assets / services due to inadequate support.

1.1 Compaction general

Compact in uniform layers

Maintain the Optimum Moisture Content (OMC) moisture content to facilitate compaction

Unless otherwise permitted, no filling is to be placed against concrete bridge abutments, wing walls or retaining walls within fourteen days of casting.

1.2 Compaction process

For assets that are not ours consult the asset owner for specific details

1.3 Vibrating rollers

Check other asset requirements for the use of vibrating rollers

As a base rule vibrating rollers should not be used within 600mm of a cable / joint.

1.3.1 Rise up deflection

Compaction can cause rise deflection. If this occurs either increase the level of cover or decrease the level of compaction.

1.3.2 Compaction density

Due to the nature of PVC conduit it is difficult to achieve more than 85% compaction on the crown of the conduit run.

For construction purposes only, Single conduit or cable			
Compactor type	Conduit diameter	Height above conduit crown	Limitations
15kN walk behind plate compactor	125mm 150mm	0 mm	Will cause rise in the conduit Suggest the use of a pad when on top of conduits Must not have cable installed
18kN walk behind plate compactor	125mm 150mm	0 mm	Will cause rise in the conduit Suggest the use of a pad when on top of conduits Must not have cable installed
18kN walk behind plate compactor	CABLE COMPACTION	100mm	100mm must exist above a cable before machine compaction can commence
35kN static roller greater than 1500mm wide	125mm 150mm	100mm	Will case rise in the conduit, suggest that cover is increased to 200mm
35kN static with 70kN vibrating capacity greater than 1500mm wide (105kN)	125mm	300mm	Not suitable to 150mm conduit
35kN static with 70kN vibrating capacity greater than 1500mm wide (105kN)	150mm	320mm	Minimum for passing over 150mm conduit
35kN static with 130kN vibrating capacity greater than 1500mm wide (165kN)	125mm	420mm	Not suitable to 150mm conduit
35kN static with 130kN vibrating capacity greater than 1500mm wide (165kN)	150mm	520mm	Minimum for passing over 150mm conduit
68kN static roller greater than 2100mm wide	125mm 150mm	150mm	Will case rise in the conduit, suggest that cover is increased to 200mm
68kN static roller with 135kN vibrating capacity greater than 2100mm wide	125mm	420mm	Not suitable to 150mm conduit
68kN static roller with 135kN vibrating capacity greater than 2100mm wide	150mm	500mm	Minimum for passing over 150mm conduit
68kN static roller with 230kN vibrating capacity greater than 2100mm wide	125mm	500mm	Not suitable to 150mm conduit
68kN static roller with 230kN vibrating capacity greater than 2100mm wide	150mm	550mm	Minimum for passing over 150mm conduit
Excavator compactor wheel			Seek approval Not suitable for brownfield installations

			Can be used without approval on the bottom layer of bedding sand only

For construction purposes only, 2 or more conduits or cables in a flat stack			
Compactor type	Conduit diameter	Height above conduit crown	Limitations
15kN walk behind plate compactor	125mm 150mm	0 mm	Will cause rise in the conduit Suggest the use of a pad when on top of conduits Must not have cable installed
18kN walk behind plate compactor	125mm 150mm	0 mm	Will cause rise in the conduit Suggest the use of a pad when on top of conduits Must not have cable installed
18kN walk behind plate compactor	CABLE COMPACTION	100mm	100mm must exist above a cable before machine compaction can commence
35kN static roller greater than 1500mm wide	125mm 150mm Or cable	450mm	These limits can be altered if a setting backfill is used.
Excavator compaction wheel			Seek approval Not suitable for brownfield installations Can be used without approval on the bottom layer of bedding sand only

MACHINE WEIGHT ON OUR ASSETS

Machines / dead weight with no greater than 5 tonnes per axle can be placed directly on top of a direct buried cable / conduit that has been fully compacted and buried at a depth greater than 800mm. Engineering approval is required for all other situations.

Q My compactor is 20kN, that's OK isn't it on top of a cable or conduit?

A No

Q My vehicle is 6.5Tonne per axle when loaded, that's OK on the cables is it not? It is only just over and will save us significant time.

A No

Q	I accidently left the vibrator on when I crossed the cable, what do I do?
A	Complete an incident form.

Leave a site in as good a condition to that when work started.

29. CLEAN UP AND REINSTATEMENT

The process considers the 3 areas of:

- rehabilitation
- restoration
- reinstatement

Applicable standard: ACT municipal infrastructure standards (Part 25)

Applicable standard: ACT municipal infrastructure standards (Part 24)

Applicable standard: ACT municipal infrastructure standards (Part 23)

Applicable standard: ACT municipal infrastructure standards (Part 7)

Applicable standard: ACT municipal infrastructure standards (Part 6)

Applicable standard: ACT municipal infrastructure standards (Part 3)

REHABILITATION

Site rehabilitation is to ensure that all disturbed areas caused by construction and maintenance activities are restored, leaving a stable environment that is conducive to the establishment of landscapes characteristic to the area.

Remove all waste material, ropes conduit off cuts, cable markers, glue bottles, paperwork, fencing, signs etc.

Any product that has been in contact with ground should be disposed of

Remove unused materials, consider returning any unused materials that are in original condition to the appropriate stores.

Level out any vehicle tyre marks

Any trees removed that have to be replaced, are to be replaced with agreed species. See also ACT municipal infrastructure standards part 25.

RESTORATION

The aim of restoration is to return the site back as close as possible into the condition prior to works commencing e.g. top dress, seed, driveways, paths etc.; refer to photographs.

1.1 Topsoil and seeding

Backfill to required municipal or parks standards. In general backfilling is to have a minimum of 150mm of topsoil (The soil set aside from the top surface of the excavation) at the surface and provide for an even surface in the future.

Areas of grassland that have been disturbed are to be reseeded, seeds are to contain less than 1% weed seed.

The topsoil is to be raked in place to a depth of at least 25mm covering existing undisturbed areas. Either hand sowing or spray seeding is to occur with 24 hours of the application of topsoil.

Check if specialised native grasses are required at the site. Transport Canberra and City Services (TCCS).

See DESIGN STANDARDS for URBAN INFRASTRUCTURE section 23 PLANT SPECIES FOR URBAN LANDSCAPE PROJECTS.

1.1.1 Levelling

The surface must be left in a condition as not to constitute a hazard and is to be the same as the original unexcavated land.

1.2 Vegetation / flora

It is good practice to minimise the extent of disturbance to existing vegetation during construction activities. If disturbance has occurred vegetation must be restored.

1.3 Signage

Where ever possible, existing signage removal or the obstruction of existing signage is not to occur.

Before removal appropriate authority authorisation must be sought. Where sign removal has taken place, they are to be put back in the same location, using the same footing / support structures.

REINSTATEMENT

Permanent reinstatement of surfaces is to be carried out as soon as practical after backfilling, the surface level and finish will match as near as possible the surface prior to excavation and be to the satisfaction of the local authority or owner and us as applicable.

The reinstatement of concrete crossings and slabs is to include the drilling and doweling of adjoining concrete surfaces where deemed required during the reinstatement work.

Pavements are to meet the requirements of ACT municipal infrastructure standards (Part 3), A reinstated pavement is to be in line with the original in terms of thickness, width and grade.

Crossings are to meet the requirements of ACT municipal infrastructure standards (Part 3). It is preferable for full replacement of residential crossings rather than patching. Industrial crossings are to be evaluated on a case by case basis.

Any street furniture removed or damaged is to be replaced meeting ACT municipal infrastructure standards (Part 20) or where required heritage guidelines.

Any drive ways are to be reinstated to ACT municipal infrastructure standards (Part 7). Also, be aware of TCCS, Traffic and Roads Section specifications.

Verges are to meet ACT municipal infrastructure standards (Part 6)

Any vegetation that is to be replaced is to be in line with ACT municipal infrastructure standards (Part 25)

Any landscape changes are:

- agreed / approved to be implemented
- in line with ACT municipal infrastructure standards (Part 24 and Part 23).

1.3.1 Subsidence

Where settling of the backfilled component is expected, a temporary hard surface e.g. cold tar should be used, and permanent reinstatement is to occur after a period, nominally 28 days.

30. SPOIL MANAGEMENT

Environment Protection Act 1997

Environment Protection Guideline for construction and Land Development in the ACT – (Environment Protection Authority - March 2011)

https://www.accesscanberra.act.gov.au/ci/fattach/get/111749/1478132929/redirect/1/filename/Environment+Protection+Guidelines+for+Construction+and+Land+Development+in+the+ACT.pdf

VIRGIN EXCAVATED NATURAL MATERIAL (VENM)

Virgin excavated natural material (VENM) is natural material (e.g. clay, gravel, sand, soil and rock) that is free of any other waste including asphalt, road base, building rubble, and fill material and vegetation waste. VENM is excavated from areas that are not contaminated with manufactured contaminants as a result of industrial, commercial, agricultural, or other activities.

An approval certifying waste spoil as VENM is required to facilitate the disposal of the waste at licenced landfill facilities.

For planned civil works projects, potentially-contaminated land should have been identified and included in the CEMP. A VENM certificate should be included for the disposal of spoil excavated from areas outside of the identified potentially-contaminated areas.

For non-planned (reactive) works, a VENM request should be sent to the Environment team. All VENM requests should include:

- the street address of the site
- the block and section of the site
- details of specific assets (i.e. pole or substation numbers)
- a drawing or aerial photo of the location of the excavation in relation to surrounding features (i.e. back yard, front yard, road verge, etc.)
- note that the request is URGENT.

All VENM certificates are subject to the following condition:

- All excavated material, including hydrovac material, must be free of asphalt, road base, building rubble or other man-made materials, fill material and vegetation waste;

CONTAMINATED SOIL

1.1 General and Chemical Contamination

Control. If visual or odorous signs of contamination or fill material are identified during excavation works, all works should cease and the Unexpected Finds Procedure should be followed. The

environment team should be contacted for immediate advice. Indicators of contaminated soil may include:

- Oily soil, oily sheen
- Soil that smells like fuel or rotten organic waste
- Visible landfill waste including building and household waste

All potentially-contaminated material that requires disposal must be stockpiled/bunded on-site and assessed in accordance with ACT EPA guidelines, particularly the information sheets linked below. EPA approval will be required prior to the removal or disposal of potentially-contaminated material from the site.

Depending on the significance of the contamination, the EPA may need to be notified.

Environment Protection Contaminated Sites Information Sheet 4 – Requirements for the re-use and disposal of contaminated soil in the ACT, last updated October 2016.

https://www.accesscanberra.act.gov.au/ci/fattach/get/130521/1487627267/redirect/1/filename/Information+sheet+4+%E2%80%93+Requirements+for+the+reuse+and+disposal+of+contaminated+soil+in+the+ACT.pdf

1.2 Asbestos Contamination

The identification of material suspected to contain asbestos should be confirmed by an asbestos assessor licenced to undertake work in the ACT. If the material is confirmed to contain asbestos, Worksafe ACT should be notified of the find immediately and a licenced asbestos removalist engaged to provide removalist services.

Any soil excavated from the area of the find should be considered asbestos-contaminated and disposed of as asbestos waste. The soil must not be used for backfilling.

List of licensed asbestos assessors:
https://www.accesscanberra.act.gov.au/app/services/licence/#/asbestos-assessor

List of licensed asbestos removalists:
https://www.accesscanberra.act.gov.au/app/services/licence/#/asbestos-removalist

Environment Protection Contaminated Sites Information Sheet 5 – Requirements for the transport and disposal of asbestos contaminated wastes, last updated October 2016.

https://www.accesscanberra.act.gov.au/ci/fattach/get/130523/1487627389/redirect/1/filename/Information+sheet+5+%E2%80%93+Requirements+for+the+transport+and+disposal+of+asbestos+contaminated+waste.pdf

Evoenergy and its contractors are responsible for:

- managing any contaminated material uncovered or generated during works;
- remediating any contamination caused as a result of works;
- ensuring that works are undertaken safely around the contamination; and
- ensuring that the site is made safe at the completion of works.

However, it is not their responsibility to delineate, assess or remediate broader contamination issues that exist on the site prior to the commencement of work, such as an existing landfill or leaking underground fuel storage. The site owner should be notified of the unexpected find of contamination, and referred to the Environment Protection Authority for further information.

APPENDIX

QUICK REFERENCE GUIDES

This Appendix contains critical section summaries of this manual

APPENDIX A – BACKFILLING

Site rehabilitation is to ensure that all disturbed areas caused by construction and maintenance activities are restored, leaving a stable environment that is conductive to the establishment of landscapes characteristic to the area.

Requirements

Remove any surplus waste materials, water and slurry before backfilling

Application and compaction of bedding sand over cables and conduits

Excavated material may be used to backfill to 150mm of final set level

If top layer was set aside it can be used for final set level

Roadway and footpath excavations must meet local authority requirements

High risk backfill material is not to be used

Greenfield sites will normally use excavated soil as backfill unless of poor quality

Backfill Materials

Road crossings and water mains have specific backfill material requirements

Consults asset owner for specifications

Grouting

Will not always be required

Requested at the design phase or after a Geotech review

Grout mixes can be references in this Civil works Manual Chapter 5 Section 4.1

Reinstatement of fixtures, crossings or surfaces must be in accordance with ACT municipal infrastructure standards. Refer to this Civil Works manual.

This page is to be used as a guide only. Detailed information can be found in the main part of this document

High Risk Backfill Material

Risk factor	Potential response
High plasticity heavy clay soils (soils which can be formed / moulded into delicate shapes)	High level of plasticity. Not suitable as backfill. Obtain engineering advice if this is a road crossing or trafficable area Obtain engineering advice if moisture content of clay exceeds the plastic limit, or is more than fifteen percent (15%) If it must be used compact in thin layers (i.e.: 100 to 200mm loose layers)
High rock content or large rock fragments (Does not pass a 50mm sieve)	Do not use this backfill unless sieved.
Very low backfill moisture content	Keep trench open time short. Consider adding moisture to keep dust levels low.
Very high backfill moisture content	Not suitable for compaction until dried / drained.
Low strength surrounding soil (AHBP < 50 kPa) or close to other assets	Do not use high levels of compaction consider only plate compactors Consider the use of easy to compact material (Bedding sand) in conjunction with low force compaction equipment and or compact in 50 to 100mm layers.
High ground water (Monitor when combined with high permeability soils)	Consult a geotechnical engineer for suitable backfill options.
Variable or unknown backfill material	Check the material regularly and compare it against known material (Golden sample).
Backfill material contains metal and or rocks	Usable if 1. The amount of metal and rocks is less than 20% of the material (by volume). 2. The metal and rocks pass through a 50mm screen.
Poor excavated material is defined as having large stones or clay that has hardened or high thermal resistivity (i.e., organic soils, peat, black loam, sod, straw).	Not suitable.
Frozen material	See backfilling from frozen ground.
Asbestos-contaminated material	The environmental team should be contacted for advice. This material should be removed from site and disposed of as asbestos waste.

TABLE 1. CHAPTER 10 SECTION 3.2 1194 CIVIL WORKS

Bedding sand removes heat generated from the cables. Incorrect bedding sand, compaction or depth can impact a cables performance

APPENDIX B – BEDDING SAND & SPACERS

The following is a guide only for the installation of bedding sand. Further instructions can be found in this Civil Works Manual

Under Cables and Conduit

Typical depth 100mm

Compacted to a minimum of 80mm

The depth of the bedding sand sets the depth to the top of the cable or conduit from which the finish level.

Over and Around Cables and Conduits

Minimum cover of 100mm above the top of the cable

Compacted once more than 100mm in place with a maximum plate of 18kN

Height consistent across the width of the excavation

Over and Around Joints

Minimum of 300mm above joint

No mechanical compaction within 300mm of joint

Reactive Works

Excavations less than 2m in length do not have to be mechanically compacted

Safety and ease of access are of utmost importance in dirt-based jointing / hauling pits

Jointing/hauling pits bedding sand is only required to compacted once full coverage over the cables/conduits is achieved

Spacers

Cables/conduits may be spaced by compacted bedding sand

Approved spacers do not have to be removed

Farrowing of bedding sand maybe used for spacing whilst main bulk of bedding sand is deployed

This page is to be used as a guide only. Detailed information can be found in the main part of this document

APPENDIX C – CABLE POLYMERIC COVERS AND MARKER TAPE

Damage to buried cables can not only be costly and inconvenient, but very dangerous. Polymeric covers both identify cable location and provide a physical barrier to protect against future damage

Polymeric Covers

To be installed on top of bedding sand above conduits and cables

Are to be placed within 100-200mm if the top conduits

Are to be located over joints

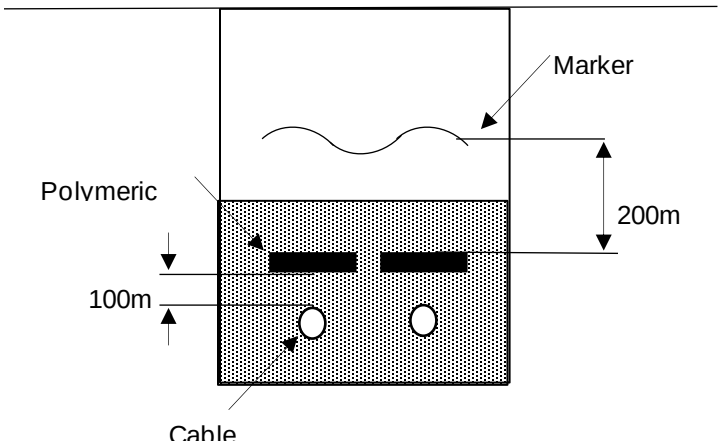
Polymeric cover joins are to overlap by 300mm

Polymeric covers are to be replaced/located over any reactive works

Stretch tapes are to be placed a minimum of 200mm above polymeric covers and deeper than 300mm below the site level

Stretch tapes are to be located over joints

Stretch tape joins are to overlap by a minimum of 300mm



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APPENDIX D – CLEAN UP & REINSTATEMENT

Rehabilitation

Remove all waste

Contaminated waste/spoil is be disposed of correctly

Remove all unused material and return to stores if able to do so

Level out any vehicle tyre marks

Any removed trees to be replaced are done so with agreed species

Restoration

Minimum topsoil backfill of 150mm

Topsoil to be raked in place to a depth of 25mm of undisturbed areas

Areas of grassland are to be reseeded with a mixture containing less than 1% weed seed

Areas must be level or in the same condition as the original unexcavated land

Vegetation/ flora must be restored if disturbed

Permanent reinstatement of surfaces is to be carried out as soon as possible after backfilling,

The surface level and finish will match as near as possible to that prior to excavation and to the satisfaction of the local authority, owner or us as applicable.

Reinstatement of fixtures, crossings or surfaces must be in accordance with ACT municipal infrastructure standards. Refer to Civil Works Manual

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Conduit protects the cable against heavy vibrational loads

APPENDIX E – CONDUITS

General

Conduits are not to be placed in water filled excavations

Conduits in open excavations are to be located in bedding sand

Conduit fittings will have no burrs

All cut ends to be fitted with approved bell mouths

All joints and bell mouths must to glued using approved jointing glue

All conduit ends and bell mouths are to be stopped with an approved plug or cap

Plugs or caps are to be fitted such that accidental dislodgement is prevented

Where conduit is to be installed on curves, these should be assembled in several lengths before attempting to form large radius bends

Bending angles not to exceed 90o in a single run- Exception for street lighting columns

Sealing of Conduits Entering Buildings

To be sealed where conduits are hard against the surface where they penetrate the building

Denso 16A or a sealing plug from Tyco to be used

Concrete penetration points must cure for 28 days prior to installation

Brick/block walls to have penetrations must cure for 14 days prior to installation

Cable Haul Handover

Conduits correctly installed including placement of bedding sand

Minimum back fill 200mm

Prevent hauling tension lifting conduits

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APPENDIX F – DAMAGE/CONTACT WITH ASSETS

Our Assets

Stop work

Clear all personnel to a distance of 8m

Guard site and immediately report to Person in Control

Other Utility Assets

Stop work

Initiate emergency management plan

Shut off any equipment – unless it has the potential to create a hazard

Extinguish naked flames

Facilitate first aide if required or seek medical advice

Keep people away from the area

Preserve the site

Contact the person in Control

Contact the asset owner

Initiate the incident investigation process

Preserving the Site

If an incident has occurred the site must be preserved. Our incident process must be followed. Incident Management Manual

This page is to be used as a guide only. Detailed information can be found in the main part of this document

Approval must be obtained

APPENDIX G – EXCAVATING CLOSER THAN SAFE APPROACH DISTANCES

Requirements

Obtain approval (Mandatory)

Electrical safety rules training (Mandatory)

Potholing (Mandatory)

Job briefings (Mandatory)

Fencing / barrier locations / distance from assets and equipment

Approach distance obtained

Use of safety observers

Close excavation Practices

Polymeric covers or stretch tape is not always in place over assets

The depth can vary over time

Cables and conduits do not always run straight

Non-destructive dig / Hydrovac down to the asset

Non-destructive dig / Hydrovac a slot trench across the assets to identify the number and locations. The slot trench must be as wide as the excavation

Perform a non-destructive dig /Hydrovac slot trench at the other end

Verify that no other assets cross the area you wish to excavate

White line down the other side to mark the box to excavate

Excavate to the highest asset + the approved approach distance.

Use powered excavation around the asset once you are beyond the approved approach distance

Complete exposing the asset using non-destructive digging

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APPENDIX H – EXCAVATION CLEARANCES

What is needed?

Electrical Safety Rules Training to provide authorisation to dig closer than an ordinary person

Dial before you dig/ contact asset owner if high voltage cables are involved

Positive asset location- potholing, cable identification methods

Use of insulated hand tools

Use of non-destructive digging tools

Approval for the use of powered excavation

Safe Approach Distance (mm) to Underground Cables for Ordinary, Instructed and Authorised Workers				
Voltage	Non Destructive Digging		Powered Excavation	
Nominal phase to phase voltage AC	Ordinary person	Instructed person or authorised worker	Ordinary person	Instructed person or authorised worker
LV up to and including 415 V	300	Insulated contact*	500	300mm or to marker tape/hard cover**
HV up to and including 22 kV	300	Insulated contact*	500	300mm or to marker tape/hard cover**
66 kV	2000	300	3000	300mm or to marker tape/hard cover**
132 kV	3000	1800	3000	1800
* Denotes – no picks, crow bars, jackhammers or sharp edged shovel use within 300mm - Hydrovac excavation and hand digging to pothole down the cable itself is permitted				
** Denotes positive asset identification and location must be conducted first				

TABLE 2. ELECTRICAL SAFETY RULES

Excavation Next to Assets

Must be authorised to mechanically excavate closer than 1200mm to medium voltage assets

This page is to be used as a guide only.
Detailed information can be found in the main part of this document

APPENDIX I – EXCAVATIONS

Key Points

Shore/shield/bench all excavations greater than 1500mm in depth

Monitor spoil locations

Always check activities against environmental management plans and notification processes

Brownfields

Always positively locate the asset

Never mechanically excavate beyond your safe approach distance without the appropriate approvals

Ensure your mechanical equipment is earthed

Consider using non-destructive dig / Hydrovac

Ensure cables and conduits are supported every 1500mm

Greenfields

Excavation depths and widths are to be as per the “released for construction” works packages

Spoil is not to be placed in a position where it may damage or affect the operation of existing equipment or assets.

Spoil is to be located on the high side and at least 1000mm from excavation

Maximum spoil height of 1000mm

Adhere to recommended operating ratios

Be aware of track position on hills and create a terrace or bench where required

If cable is direct buried and only conduit for a road crossing conduit shall extend 1000m pas the kerb

Changes in Levels and Directional Changes

To avoid an undisclosed asset it is preferred to traverse underneath the asset

Changes in depth to avoid known assets do not require a variation if: the gradient slop is no more than 100mm for every set back. Setbacks are not to exceed 4metres

Reduced Cover Excavations

Are not permitted without design approval.

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APPENDIX J – FENCING, SIGNAGE AND PROTECTING TREES

Temporary Fencing

Provide a safety barrier during excavation, demolition, construction and maintenance works

Protect the public where works may impact on a public way or road reserve

Provide a visual highlight of the presence of works underfoot

Restrict access and contain materials including debris on excavation, and construction sites

A minimum height of 1.5metres but no more than 2metres

Signage

Appropriate signage is to be located on fences

Protecting Trees

Registered and regulated trees are protected under AS4970 Protection of Trees on a Development Site

Registered trees can be found on the identified tree register.

Regulated trees are trees that meet the following conditions

- 12 metres or more in height or
- Has a trunk diameter of 1.5metres or greater measured at 1 metre above the natural ground level or
- Has two or more trunks and the total circumference of all the trunks, 1 metre above the natural ground level, is 1.5 m or more or
- Has a canopy diameter of 12 metres or greater

Contact the Environmental Team to seek guidance where required

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APPENDIX K – LOCATION BURRIED ASSETS/SERVICES

Key Points

Dial Before You Dig

Find and expose all underground services and assets before you start excavating

Adhere to clearance distances, no go zones / envelopes

Keep a record of notes and all contact with asset owners to demonstrate your duty of care

Be aware that not all assets / services may be disclosed or in the nominated location

Check for signs of undisclosed assets / services include pits, markers and drains

Depths may have altered or the asset may present at a different depth

There may be more than one asset at the location

New works may not have reached plans

Locating can get it wrong, one may be 2 or 3 or more

If you see something STOP, verify what it is before moving on

Markings and Colour Codes

Markings must always be visible

COLOUR	ASSET TYPE
	Red – Electric power lines, cables, conduits, lighting cables and traffic lights
	Yellow – Gas, oil, steam, petroleum or gaseous materials
	Orange – Communication, alarm or signal lines, cables or conduit
	Blue – Potable Water
	Green – Sewers and drains
	Pink – Temporary survey marking
	Purple – Reclaimed water, irrigation and slurry lines
	White – Proposed excavation

APPENDIX L – PITS, DUG & FABRICATED

Brownfields Dug Pits

Precautions must be taken to protect existing cables and joints against any damage

All cables and associated joints that are undergoing work are to be supported and protected using non-conductive structures

Non-destructive digging/Hyrdovac is the recommended method for excavating and existing jointing/hauling put

Dug Pit Locations

Cable hauling pits where the conduits are continuous are not to be located within 1.2 metres of a road edge or in driveways.

Cable hauling pits where the conduit is not continuous are not to be located within 6 meters of a road junction.

Pits should not be located at the bottom of hills.

Pits for cable joints are not to be located within 6 metres of a road junction.

Not to be located with 10 metres of a bus stop

Pits are to be located so that cable hauling equipment can be safely located.

Pits should not be located within the drip zone of trees.

Backfilling of Prefabricated Pits

Backfilling cannot commence until cable conduits are installed or direct buried cables are in place

Bedding sand is to be placed around cables / conduits to a minimum of 100mm

Voids are to be back filled with clean site backfill to within 150mm of the surface and compacted for every 250mm. Mechanical compaction cannot occur over cables or conduits until the backfill is more than 100mm above these items.

If clean site back fill is not available a suitable backfill must be sought see also backfill material

Backfill containing more than 15% clay must not be used. Prevention of sloughing / subsidence.

APPENDIX M – REOPENING & WIDENING EXCAVATIONS

Reopening, Pits and Jointing Bays

Machine dig to your approved safe approach distance

Non-destructive dig/ Hydrovac the remaining material around the asset in question

Support exposed assets

Expanding Puts and Jointing Bays Containing Rock

White line to the width, including your approved safe approach distance e.g. new trench width + approved safe approach distance

Consider using “Crack rock” or a rock expanding products to break the rock

Blasting is not allowed, however products such as PCF and Cardox will be considered

Break the rock on the far side first (The side furthest away from the assets)

Re-opening Trenches

Positive asset identification and location at both ends of the dig and a minimum of every 10 metres in between.

White line to the width you are going to dig

Machine dig to your approved safe approach distance

Non-destructive dig / Hydrovac the remaining earth around the asset that requires exposure

Expanding Trenches

Positive asset identification and location every 10 metres

White line to the width, including your approved safe approach distance eg trench width trench + approved safe approach distance.

Excavate the far side first (The side furthest away from the assets) to the required depth. Recommend that a small bucket width (300mm, 12”) is used.

If the trench is predominantly rock then consider either a new trench in a new location or a bore (HDD) installation. As there is the possibility of loose rock impacting existing assets. A rock saw could may be used for short runs of up to 100m

Perform the close sweep machine excavation to within the approved safe approach distance

If the asset needs to be exposed then non-destructive dig the remainder

APPENDIX N – SPECIAL EXCAVATIONS

Excavating to a Pole

Where possible locate cables to the opposite side of oncoming traffic

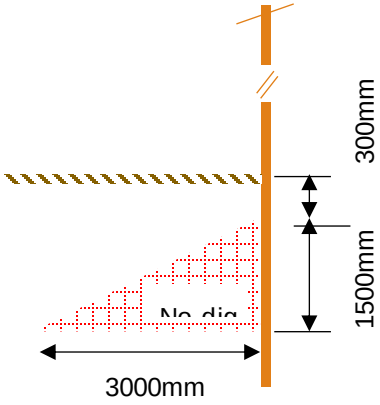
Where possible on termination poles the cable should come up on the conductor side and opposite any stays

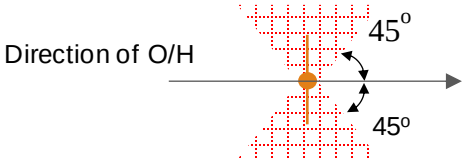
Excessive excavation at the pole base may disturb the pole foundation. Provide stabilisation if required

Check for earth cables on the pole or existing cables

Seek engineering consultation if you need to enter the no dig zone

Ensure cable bend radius is not compromised





Avoid excavation in the hatched area

Excavating near Padmounts and Switching Stations

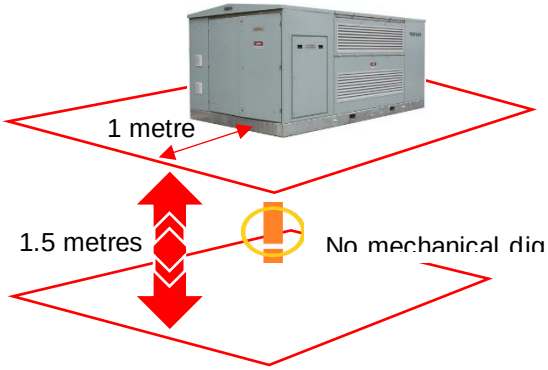
Mechanical excavation is to cease 1metre before the padmount

Potholing/positive asset location is to be used to identify earthing grading ring

Mechanical digging is not permitted within a depth of 1.5metres of padmounts/switching stations

Permission is required to excavated deeper than 300mm within 1metre of padmount

Never expose more than 300mm of grading ring without approval



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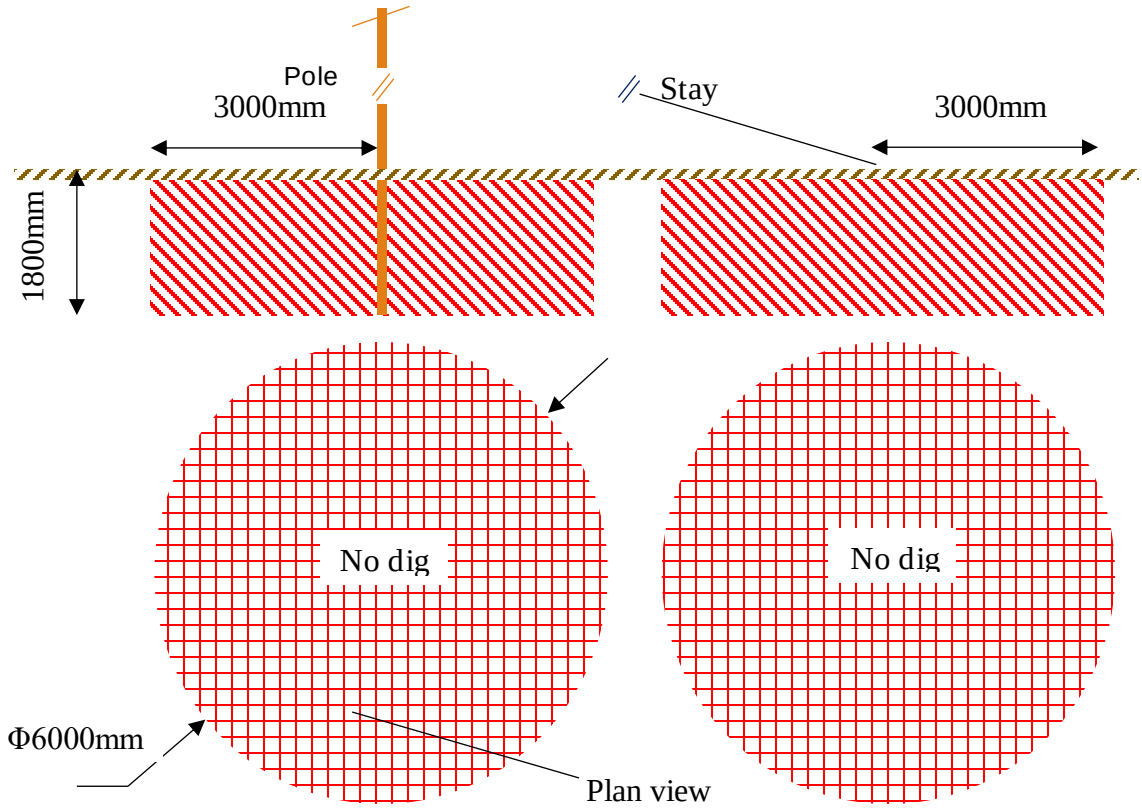
Excavation that Pass near Poles or Stays

Check for earths and other cables that run from the pole

Refer to Figures 3 and 4 for no dig zones

Check Dial Before you Dig for Single Wire Earth Return (SWER) poles as they may have a larger no dig radius



Excavating to damaged cables/suspected fault

Known/suspected locations of fault that have a hard top surfaces (eg concrete) maybe removed prior to de-energisation

Unknown fault locations can proceed as per normal excavations prior to de-energisation

If fault signs such as smell, heat, noise or signs of cable damage, STOP work immediately

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APPENDIX P – **MAXIMUM NUMBER OF CABLES IN CONDUITS**

As per AS3000, SAA wiring rules, Appendix C6 for the number of cables in a conduit has been calculated and presented below.

GUIDE TO THE MAXIMUM NUMBER OF HV CABLES INSTALLED IN CONDUIT

CABLE				CONDUIT SIZE (Internal Diameter) WITH MAXIMUM NUMBER OF CABLES IN CONDUIT				
Type & number of Cores	Conductor cross sectional area (mm²)	Cable Diameter (mm)	Minimum Bending Radius (mm)	50mm	63mm	100mm	125mm	150mm
HV One Core	35	28	510	0	1	2	3	3
	240	37	640	0	0	1	2	3
HV Three Core	240	76	1320	0	0	0	1	1
	300	78	1430	0	0	0	1	1
	400	90	1560	0	0	0	0	1

GUIDE TO THE MAXIMUM NUMBER OF LV CABLES INSTALLED IN CONDUIT

CABLE				CONDUIT SIZE (Internal Diameter) WITH MAXIMUM NUMBER OF CABLES IN CONDUIT				
Type & number of Cores	Conductor cross sectional area (mm²)	Cable Diameter (mm)	Minimum Bending Radius (mm)	50mm	63mm	100mm	125mm	150mm
LV One Core	70	16	150	1	2	3	4	4
	150	23	210	0	0	4	4	4
	240	28	260	0	0	0	4	4
	300	31	280	0	0	0	4	4
	500	39	360	0	0	0	4	4
LV Two Core	16	18	330	1	2	3	4	5
LV Four Core	16	22	400	1	1	2	4	5
	35	30	540	0	1	2	3	4
	240	55	990	0	0	1	1	1

REFERENCES

AS 2032 Installation of PVC pipe systems

AS/NZS 2033 Installation of polyethylene pipe systems

AS 2067 Substations and high voltage installations exceeding 1KV AC

AS 4799 Installation of underground utility services and pipelines within railway boundaries

AS/NZS 2566.2 Buried flexible pipelines - Installation

AS 1742.3 Manual of uniform traffic control devices - Traffic control for works on roads

AS 4687 Temporary fencing and hoardings

AS/NZS 1170.2 Structural design actions - Wind actions

AS 1319 Safety signs for the occupational environment

AS/NZS 3845.1 Road safety barrier systems and devices - Road safety barrier systems

AS 4970 Protection of trees on development sites

AS 3996 Access covers and grates

AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)

AS 5113 Fire propagation testing and classification of external walls of buildings

AS 1530 Methods for fire tests on building materials, components and structures - Combustibility test for materials

AS/NZS 61386 Conduits and fittings for electrical installations - General requirements

AS 60076.10 Power transformer, Part 10: Determination of sound levels

AS60076 Series Electrical equipment for explosive atmospheres – selection, installation & maintenance

AS/NZS 2566.2 Buried flexible pipelines - Installation

AS 4702 Polymeric cable protection covers

AS/NZS 2648.1 Underground marking tape - Non-detectable tape

AS 1289 Methods of testing soils for engineering purposes - Definitions and general requirements

TCCS Standard specification for Urban Infrastructure works, Section 2 – Earthworks and Section 3 – Underground Services

ASTM D 6103 Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)

Safework NSW - Construction Safety

Safework Australia – excavation work

Evoenergy - Electrical Safety Rules

Evoenergy Unit assembly and construction standard drawings

Dial Before You Dig

ActewAGL – Contractors Manual

ISO 45001 Occupational health and safety management systems - Requirements with guidance for use

EPA Act

Safework NSW Excavation Code of Practice

APWA Uniform Colour Codes for temporary marking of utilities

VERSION CONTROL

VERSION	DETAILS	APPROVED
3.0	Conversion to new format and numbering convention.	Manager Asset Standards
4.0	Addition of Conduit proven requirements	Manager Asset Standards
5.0	Addition if Submersible Pits	Manager Works Practices
6.0	Consolidation of PO07107 Conduit Technical Standard into this document	Electrical Work Practices Manager

DOCUMENT CONTROL

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