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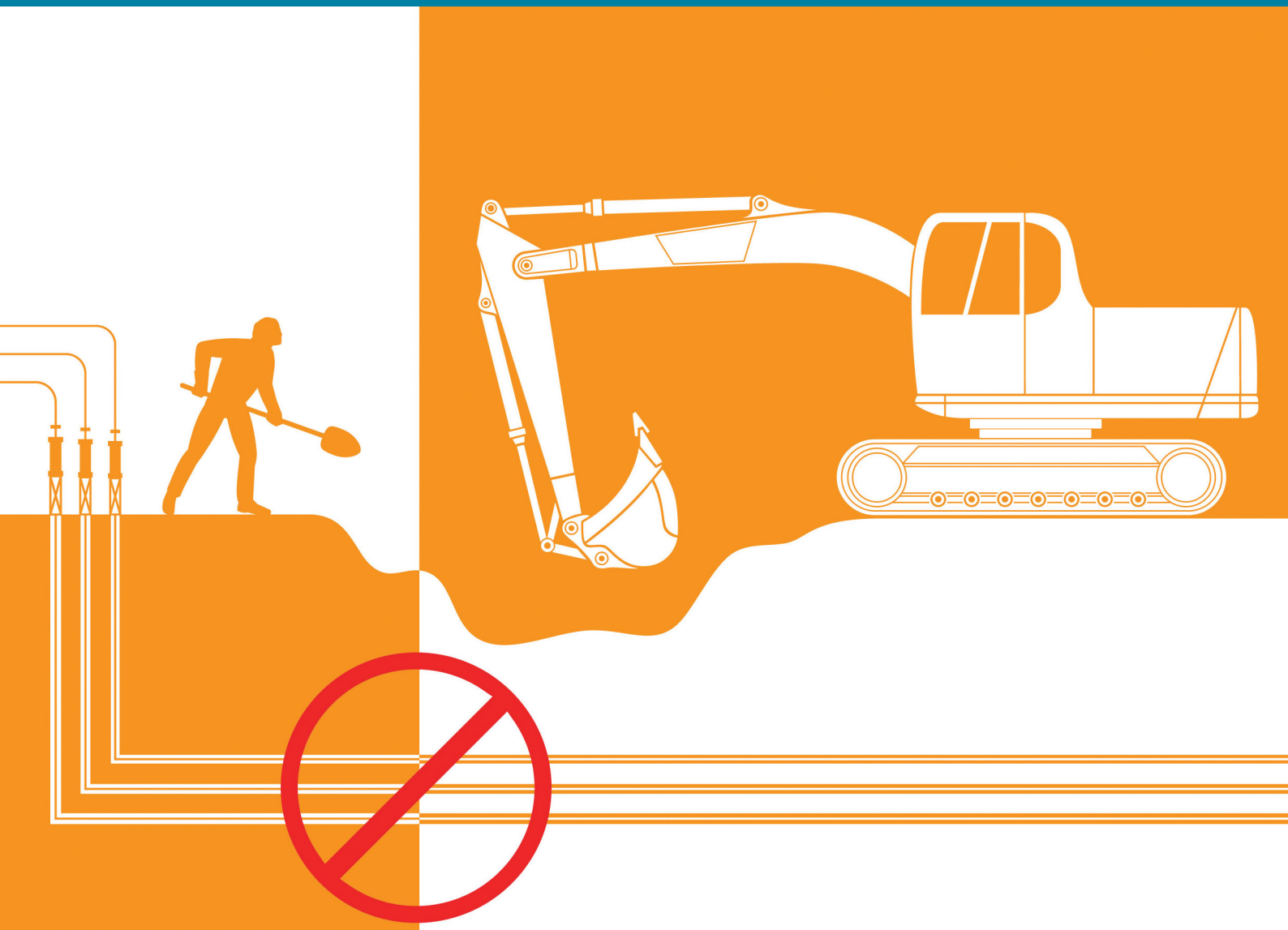
WorkSafe VICTORIA

Guidebook

Undertaking work near underground services

Edition 1

December 2022



VICTORIA State Government

Contents

Part 1: Introduction

Purpose and scope

Underground services such as electricity and telecommunications distribution cables, gas and water pipelines may supply entire communities. It is important to ensure hazards and risks associated with working near underground services are effectively managed and that underground services are not damaged in any way.

This guidebook has been produced by WorkSafe Victoria and Energy Safe Victoria to provide practical guidance on the principles and requirements for safely undertaking work that involves penetrating or excavating the ground where underground services may exist.

It is intended for employers, employees and any other persons who have responsibilities managing hazards and risks associated with undertaking work near underground services. However, it can also be used by members of the public to ensure their own safety and the safety of others.

This guidebook details No Go Zones, which are areas surrounding underground services that WorkSafe Victoria and Energy Safe Victoria recommend be applied as best practice to ensure safe working distances that:

- protect employees, independent contractors and other persons from serious or fatal injuries
- reduce the risk of damage to underground services and mobile plant
- avoid service interruptions and failures
- avoid additional associated costs

While the No Go Zones recommended in this guidebook will assist responsible parties to meet their obligations under the current safety legislation when working near underground services, responsible parties still need to consider their own specific circumstances.

For example, some work environments, such as rail corridors, may have industry-specific asset protection and risk management frameworks. Responsible parties must ensure they comply with those industry-specific frameworks and meet their obligations under the current safety legislation, ensuring no lesser degree of safety protection than what is outlined in this guidebook.

This guidebook is not intended to provide detailed information in relation to the excavation work. For further information, refer to the *Excavation Compliance Code* at www.worksafe.vic.gov.au

Part 1: Introduction

Definitions

Cable(s): a wire, conductor or form of material designed for carrying electric current or communications signals.

Competent person: a suitably trained individual with sufficient experience to safely perform, with minimal supervision, work outlined in this guidance material.

ESV: Energy Safe Victoria.

Excavation: the movement or placement of soil or other surface materials by removing, boring or forcing objects into the ground or earth surface.

Hazard: a source of potential harm or a situation with a potential to cause loss.

High Voltage or HV: a nominal voltage exceeding Low Voltage (LV).

Installation: a place (public or private) where underground services (including, gas, electricity telecommunications) have been installed.

Low Voltage or LV: a nominal voltage exceeding 50 volts but not exceeding 1000 volts for AC and exceeding 120 volts but not exceeding 1500 volts for DC.

Manual excavation includes the use of hand held tools and equipment, including shovels and manual augers.

Near: a distance of 2000mm (2m) from any underground service and 4500mm (4.5m) from any underground services registered under the *Pipelines Act* or an underground electrical cable with an in-service voltage greater than 66kV.

No Go Zone: the area surrounding underground services being 300mm for individuals and 500mm for plant or equipment or 3000mm of any underground services registered under the *Pipelines Act* or an underground electricity cable with an in-service voltage of greater than 66kV.

Note: Some service owners may have a requirement for greater clearances than articulated here to ensure the integrity of their services at a specific worksite. Any information pertaining to this additional requirement will be provided with the response to a service enquiry.

Operator: the individual in control of a piece of plant or equipment at a workplace.

Out of service includes services that are abandoned, disused, retired underground services or services left in-situ.

Permission: A written or verbal approval for people to undertake work laid out by the service owners e.g. these may be, but not limited to, covering letters, permits to work and emails.

Permit to Work (PTW): A written authority from the service owners which should include specific conditions and/or requirements that must be adhered to at all times.

Plant: Plant includes:

- any machinery, equipment, appliance, implement and tool
- any component of any of those things, and
- anything fitted, connected or related to any of those.

Plant operator: see 'Operator'.

Pressurised: a constrained flow of a substance in pipeline which may be of varying diameters and thicknesses, the flow of which may or may not be directly controlled by a service owner.

Risk: the likelihood of injury or illness or disease arising from exposure to or contact with overhead or underground services.

Part 1: Introduction

Safe system of work: work practices in which the health and safety risks to employees have been controlled so far as practicable.

Safe Work Method Statement (SWMS): A document that:

- identifies work that is high risk construction work; and
- states the hazards and risks of that work; and
- sufficiently describes measures to control those risks; and
- describes how the risk control measures are to be implemented; and
- is set out and expressed in a way that is readily accessible and comprehensible to the persons who use it.

Service: There are two service asset types 'Network' and 'Installation' services these are equally important for the management of risk and are underground water/drainage/sewerage, electricity, gas or communications services. The term Service used throughout this document covers both the network and installation of underground services.

- **Network Service:** Supply assets owned, managed by Network organisations/companies
- **Installation Service:** privately owned assets managed by owners of property/ businesses.

Service Owner: the owner of a service or the provider of a utility service.

Spotter: a competent person or trained person who undertakes the task of observing and warning against unsafe approach to underground services. This spotter shall have successfully completed an endorsed training course and be registered with ESV.

Spotter Zone: means the area near an underground service.

Step potential: means the potential electrical difference between any two points, typically on the ground, which can be touched simultaneously by a person.

Underground service: means an underground asset or underground installation on public or private land.

Trenchless techniques: use equipment to install or replace underground infrastructure without causing disturbance to the ground above. These may include but not be limited to horizontal boring, pipe jacking, directional drilling or tunnelling.

WorkSafe Victoria: the regulator for occupational health safety in Victoria.

Disclaimer

This guidebook is designed to give practical guidance to assist responsible persons to meet their obligations under the current energy and safety legislation when working near underground services. It does not cover all of the requirements under the various energy and safety legislation administered by WorkSafe Victoria and Energy Safe Victoria, and is not a substitute for legal advice.

We encourage you to seek your own advice to find out how the various energy and safety legislation applies to you, as it is your responsibility to determine your obligations. Additionally, this guidebook avoids legal language wherever possible and may contain generalisations about the application of the various energy and safety legislation for illustrative purposes.

While WorkSafe Victoria and Energy Safe Victoria have made reasonable efforts to ensure the accuracy of information in this document, we do not make any representations or warranty as to the accuracy, completeness, reliability or suitability for particular circumstances. We do not accept liability for any loss or damage which may be incurred by any person as a result of relying on the information in this document, except insofar as liability under any Victorian and Commonwealth statute cannot be excluded.

Part 2: Legal duties

Who has Occupational Health and Safety duties?

Employers

1. Employers have a general duty to provide and maintain, so far as is reasonably practicable, a working environment for their employees, including independent contractors, that is safe and without risks to health. Occupational Health and Safety Act 2004 (OHS Act) s21
2. Employers must also provide employees with the necessary information, instruction, training or supervision to enable employees to perform their work in a way that is safe and without risks to health. OHS Act s21(2)(e)
3. Employers must also, so far as is reasonably practicable, ensure that persons other than their employees (such as members of the public) are not exposed to risks to their health or safety arising from the business activities undertaken by the employer. OHS Act s23
4. Employers must not allow an employee to perform high risk work unless the employee holds an appropriate high risk work licence. Occupational Health and Safety Regulations 2017 (OHS Regulations) r129
5. A safe work method statement is required for high risk construction work. OHS Regulations r327

Employer's duties to prevent falls

6. Employers have specific duties under the OHS Regulations to prevent involuntary falls from more than two metres in the workplace, such as a duty to:
   - identify, so far as is reasonably practicable, all tasks that involve a fall hazard. OHS Regulations r43
   - control any risk, so far as is reasonably practicable, associated with a fall at the workplace in accordance with the hierarchy of control. OHS Regulations r44

Other duties apply in relation to the prevention of falls. For further information, refer to the *Prevention of Falls Compliance Codes* at www.worksafe.vic.gov.au

Note: Section 21 of the OHS Act imposes duties on employers to, so far as is reasonably practicable, provide and maintain a working environment that is safe and without risks to health. **This includes managing risks associated with falls of two metres or less**.

Part 2: Legal duties

Employer's duties regarding plant

7. An employer's primary duty is to eliminate any risk associated with plant, so far as reasonably practicable. OHS Regulations r98(1)

8. Where a risk cannot be eliminated, an employer must work through the hierarchy of control in order to reduce the risks so far as reasonably practicable. OHS Regulations r98(2)

9. Other duties apply in relation to the use of plant in the workplace. For further information, refer to the *Plant Compliance Code* at www.worksafe.vic.gov.au

Self-employed persons

10. A self-employed person must ensure, so far as is reasonably practicable, that persons are not exposed to risks to their health or safety arising from the business activities of the self-employed person. OHS Act s24

Employees

11. Employees, while at work, must take reasonable care for their own health and safety, and that of others who may be affected by their acts or omissions in the workplace. Employees must also co-operate with their employer's actions to make the workplace safe (e.g. by following any information, instruction or training provided). OHS Act s25(1)

Persons in management and control of a workplace

12. A person who has, to any extent, the management or control of a workplace must ensure, so far as is reasonably practicable, that the workplace and the means of entering and leaving it are safe and without risks to health. OHS Act s26

Who has Energy Safety duties?

Underground electricity and gas services are regulated in Victoria by Energy Safe Victoria (ESV), under the *Electricity Safety Act 1998* (Vic) (ES Act), Electricity Safety (General) Regulations 2019 (ES Regs), *Gas Safety Act 1997 (Vic)* (GS Act), parts of the *Pipelines Act 2005 (Vic)* and the regulations, collectively known as Energy Safety legislation.

Excavations works are subject to a number of specific requirements in the Energy Safety legislation, including:

- ES Act s76 – s78
- ES Regs r608
- GS Act s79B and s79C
- Pipelines Act s118

All persons undertaking work including employers, employees, contractors, utility service owners have specific duties under the Energy Safety legislation, when excavating or boring/penetrating the ground, uncovering or exposing energy assets.

Individuals undertaking work have a responsibility to positively locate underground services by electronic detection and manual excavation or other approved methods such as non-destructive excavation.

The No Go Zone rules outlined in this guidebook apply to all persons undertaking excavation or penetrating activities.

Electricity Safety legislation requires that records must be maintained on underground electricity cables including by electricity distribution companies and electrical installation owners who control those lines. These records can be maintained in the form of plans drawn to a suitable scale or on computer-aided geographical mapping systems.

There are specific requirements for permanent installation of underground electricity cables on public and private lands; these are defined in Electricity Safety legislation.

Part 2: Legal duties

Underground No Go Zone clearances

No Go Zone rules can be divided into two distinct types, depending on the service:

- services greater than 66kV and all pipelines licensed under the *Pipelines Act*
- services LESS than or equal to 66kV or services NOT licensed under the *Pipelines Act*

The recommended No Go Zone rules are designed to ensure compliance with Energy Safety legislation. For the most current Energy Safety legislation, visit the ESV website at www.esv.vic.gov.au

Note for electrical services:

- No Go Zone: Works within this area requires a No Go Zone site assessment and a Permit to Work/permission and compliance with the permit conditions.
- Spotter Zone: Works within this area requires a No Go Zone site assessment and possible Permit to Work.

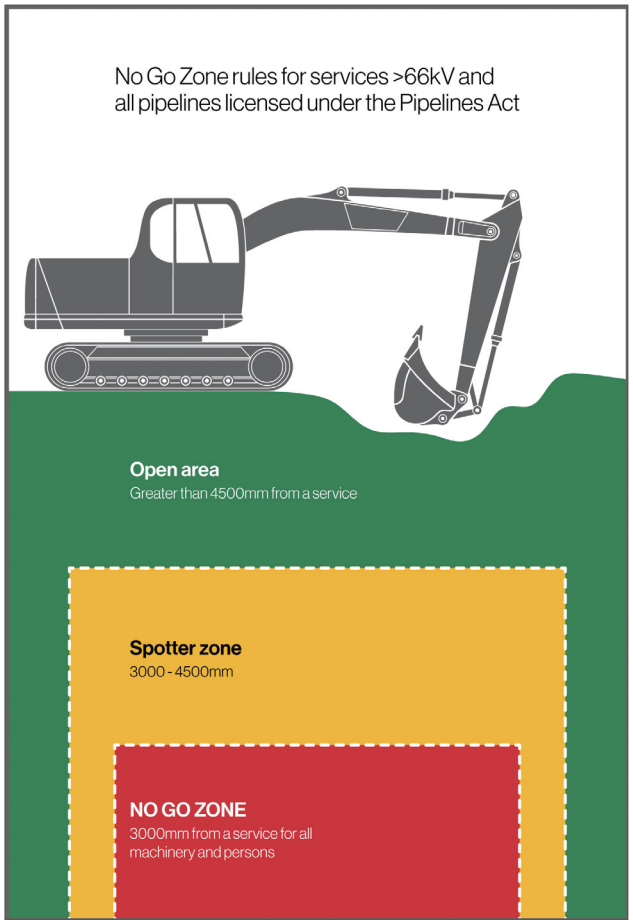


Figure 1: No Go Zone rules for services greater than 66kV and all pipelines licensed under the Pipelines Act 2005.

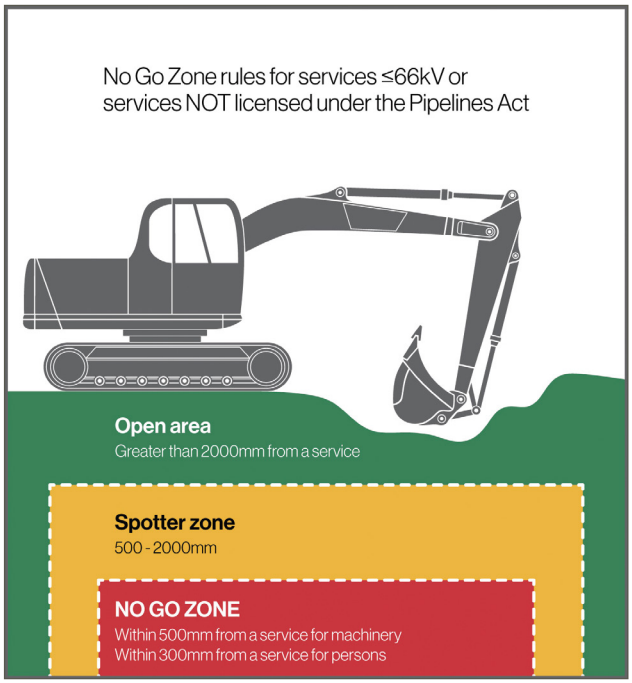


Figure 2: No Go Zone rules for services LESS than or equal to 66kV or services NOT licensed under the Pipelines Act 2005.

Part 2: Legal duties

Information, instruction, training and supervision

Under OHS legislation, employers must provide employees with the necessary information, instruction, training or supervision to enable employees to perform their work in a way that is safe and without risks to health. This duty also extends to independent contractors (including any employees of the independent contractor) engaged by the employer in relation to matters over which the employer has control.

The information, instruction, training and supervision required will depend on the type of hazards in the workplace, and employees' understanding about the hazards, risks and control measures.

Employers should ensure that employees understand the hazards and risks associated with excavation work and controls, for example:

- the nature of the hazards associated with the excavation work
- the need for and proper use of risk control measures
- working near underground services

Employers should keep records of induction and training given to employees.

Note: See Appendix A for further information on training, construction induction training, site induction, high risk work (HRW) licensing and asbestos removal and licensing.

Part 3: Planning and pre-start site assessment

This section will assist persons to determine if there are services in the ground prior to commencing any works and to develop safe systems of work when working near underground services.

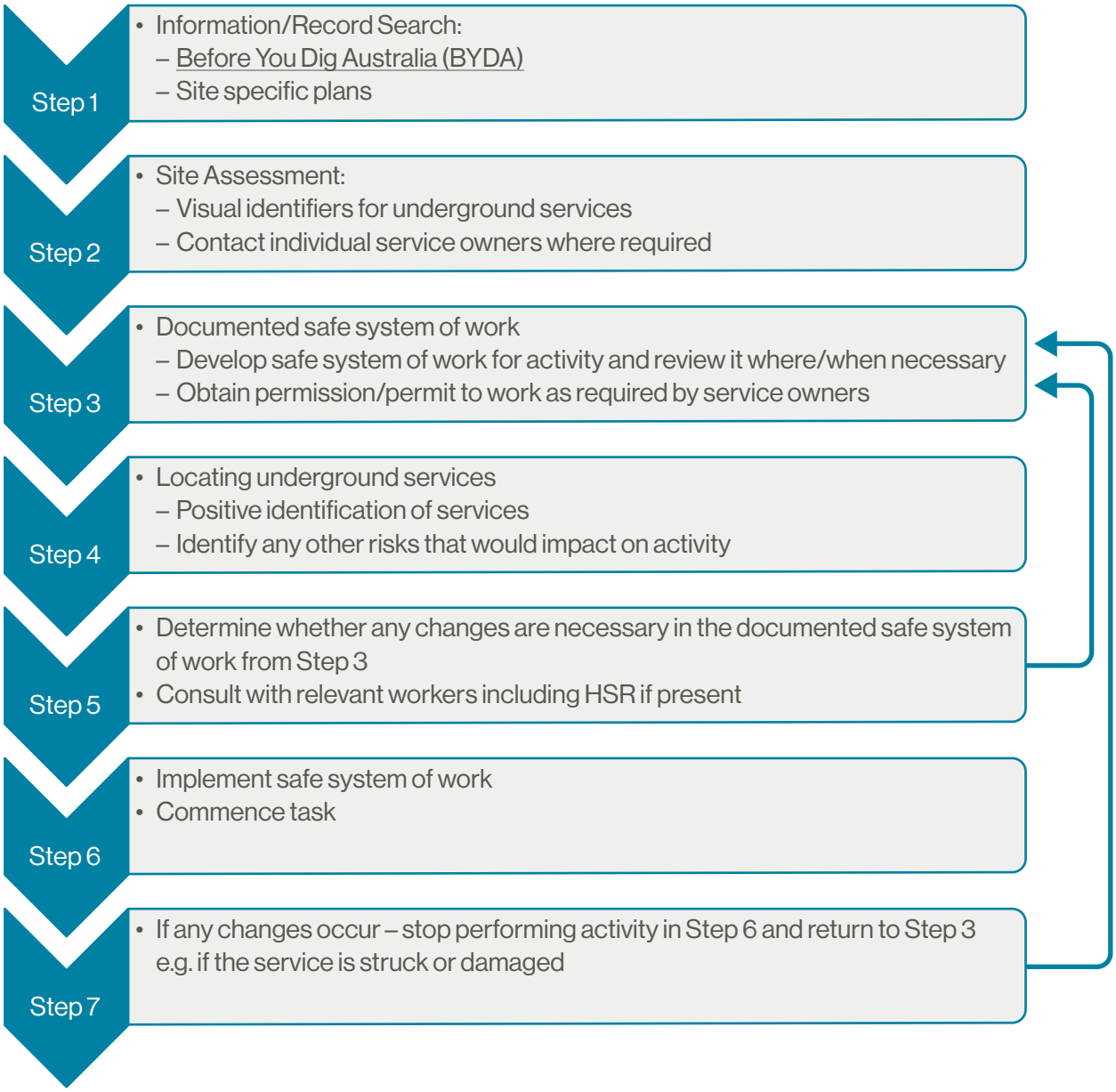


Figure 3: Process to identify underground services and develop a safe system of work.

Part 3: Planning and pre-start site assessment

Step 1: Information/record search

This section will assist persons to develop safe systems of work when working near underground services, prior to commencing any works.

When planning a job requiring excavation, Electricity Safety legislation requires that a person undertake a complete record search to obtain information on all known underground services. It is recommended that a complete record search is undertaken when undertaking any excavation work (whether involving electricity, gas or pipeline assets) to ensure a safe system of work.

Some service utilities maintain records of their underground services under legislation, but this is not necessarily the case for all installations.

All efforts should be made to identify any possible services in the work area prior to any works commencing. This could include:

- Contacting the service owner
- Lodging an enquiry with free services such as 'Before You Dig Australia' (BYDA)

- Reviewing site-specific plans identifying services
- Communication/site visit/inspections with service owners

Step 2: Site assessment

A site assessment should be conducted before work starts, to determine if the scope of work (including the type of work, materials to be used and sequence of work) will be affected by the location of underground services and if so, what safety measures are necessary to protect services, persons and property.

Note: When carrying out emergency work, if the work must commence prior to the records being obtained, it should be carried out on the basis that underground services are present.

The assessment should include the following:

- Identification of potential site safety risks
- A visual inspection of the work area: visual indications that underground services may be in the area, for example, pits, cables, conduits or pipes are entering the ground, signs etc.
- A documented Safe System of Work such as a completed job safety analysis (JSA), and/or a risk assessment or any other document describing a systematic process of evaluating and managing the potential risks that may be involved in an activity.
- For high risk construction work (HRCW), a completed safe work method statement (SWMS) must be completed and readily accessible
- If there are overhead electrical assets in the proximity of the works, including powerlines that cross or run alongside the workplace, or powerlines that cross or run alongside access routes, maintain the minimum safe working distances according to the overhead No Go Zone rules
- Information, documents, plans, drawings obtained as part of job planning (remain readily accessible)

- As part of SWMS, where positive identification is required of services located in the ground, trenchless techniques such as non-destructive digging (NDD) or potholing should be used
- Investigation using locating devices to determine and mark service (network and installation) location using the techniques as per Australian Standard (AS) 5488.1:2019 *Classification of subsurface utility information*

Table 1: Examples of standard paint colours used to mark service assets

Utility	Colour
Communications	White (or black when on white background)
Drainage	Green
Electricity	Orange
Fire Service	Red
Gas	Yellow
Water	Blue
Recycled Water	Purple

Contact service owners

Under Energy Safety legislation, permission must be sought from service owners prior to excavation above electrical and gas services.

Visual identifiers for underground services

The following are examples of some visual identifiers for the different underground services.

Note: The visual identifiers are not limited to those shown below and there may or may not be a visual identifier above underground services.

Figure 4: Example of paints used to mark underground services on roads and footpaths.

Examples of visual identifiers for electrical services

Figure 5: An electrical connection box providing warning that there are shallow underground electrical cables. Two arrow indicators showing the direction of the cables.

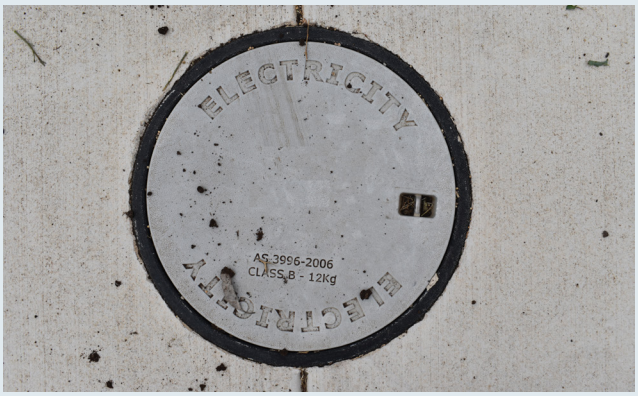


Figure 6: A pit indicating electrical cables below ground.

Figure 7: The markings "ET" (stands for Electrical Telecommunications) on concrete guttering indicates electricity and telecommunication assets beneath.

Figure 8: An underground pillar indicating low voltage electrical underground cables owned by the power company installed on public land.

Figure 9: A customer switchboard and supply point for an electrical installation on private property.

Figure 10: An underground connection pillar for an electrical installation on private property.

Examples of visual identifiers for gas/oil services

Figure 11: A warning sign advising of the presence of gas supply main in the area.

Figure 12: A warning sign advising of the presence of high pressure gas pipeline in vicinity.

Figure 13: The markings "GW" (stands for Gas Water) on concrete guttering indicates gas and water assets beneath.

Figure 14: A warning sign and an access pit for underground high pressure oil pipeline.

Examples of visual identifiers for water services

Figure 15: Hydrant connection points and water stop valves indicating water services underneath in close proximity.

Figure 16: Hydrant connection points and water stop valves indicating water services underneath in close proximity.

Examples of visual identifiers for telecommunication services

Figure 17: A telecommunication riser and pit indicating the presence of telecommunication cables in vicinity.

Figure 18: A pit indicating that there are telecommunication cables below ground.

Part 3: Planning and pre-start site assessment

Step 3: Documented safe systems of work

Persons in management and control of the activity must ensure a safe system of work is developed and where necessary, documented by a competent person.

The safe system of work should contain:

- notification to the relevant authorities if excavation exceeds 1.5 metres, where applicable (see Appendix B for more information)
- written approval from the owner of the service, where applicable
- the types of services in the ground
- adverse ground conditions (e.g. unstable ground) – that may be a risk of damage to plant, serious or fatal injuries to employees or services
- the location of the service and the No Go Zone distances
- the safety control measures to prevent encroaching into the exclusion area or No Go Zone
- how safety control measures will be implemented
- use and location of a registered ESV spotter where required
- communication methods used between spotter and operator
- the conditions of any *permission or permit to work* when issued from the service owner
  Note: keep this with the safe system of work document
- any signs, markings and visual warnings used to alert persons to the proximity of underground services
- mobile plant and equipment to be used
- location of where a mobile plant is working and traversing
- earthing mechanisms to be fitted to mobile plant where required
- any relevant training and competency required for a person to undertake the activity
- supervision and monitoring procedures including induction of all employees onto the site; and
- emergency procedures relevant to the risks, detailing actions to be taken in the event of an emergency.

Where HRCW is to be undertaken, the employer must ensure a SWMS is prepared before the work begins and ensure the work is performed in accordance with the SWMS. For further information on HRCW and SWMS, refer to the Safe work method statements (SWMS) at www.worksafe.vic.gov.au

Where it is not possible to avoid working near energised services, site specific safety measures must be specified in the SWMS. The following site specific measures should be included:

- work instructions explaining the risks, No Go Zone rules and the safe working distance required
- induction for contractors supplying materials
- BYDA or other service information, service owner or installation diagrams and instructions on No Go Zone distances
- location of the no go exclusion zones displayed in the cabins of mobile plant/vehicles
- using a spotter to assist the operator.

Part 3: Planning and pre-start site assessment

Step 4: Locating underground services

Before commencing the activity, the exact location of services must be found.

BYDA and other "as-installed" plans only give an indication of where services should be located; this should not be the only exploration prior to work commencing.

Individuals undertaking work must positively locate the underground services. Locating the service is to be undertaken before manual excavation or other permitted methods, for example non-destructive excavation.

Common 'as installed' risks

Plans supplied by the utilities, which contain basic installation depth requirements, may not provide the actual depth at which the underground service is buried. When reviewing utility plans for undertaking works on underground services, duty holders should be aware that the depths of existing services may be different due to changes or alterations to ground contours from the addition or removal of earth during road or other construction works.

A service may be laid with protection such as concrete surrounding it, to provide extra protection against excavation. In other cases, warning tape or polymeric, timber or concrete slabs may be laid over the service. The service could also be installed in conduit or pipe work. Asbestos reinforced pipelines and duct work have been widely utilised in the utility industry with much of this type of asset still in service. See Appendix A for further information on asbestos removal and licensing.

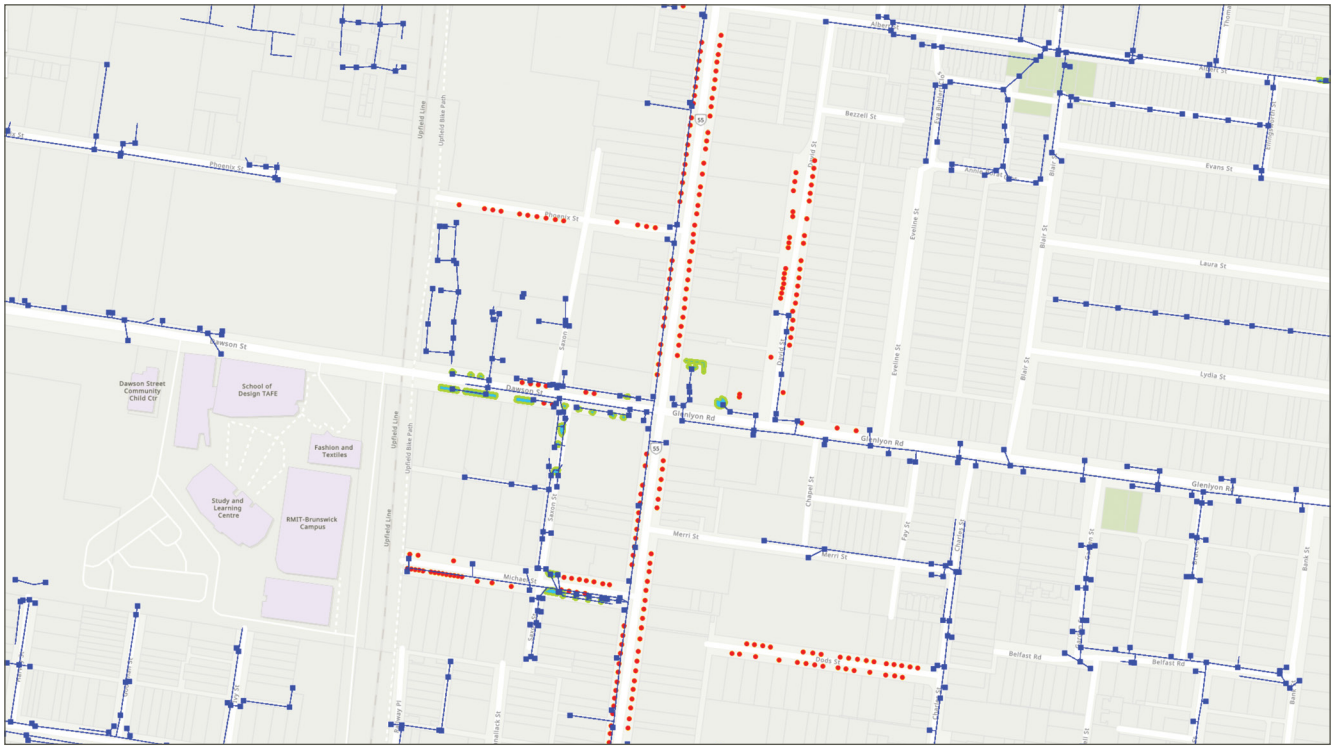


Figure 19: An example of a underground services map.

Potholing

Potholing (or equivalent service location techniques) must be used to locate existing underground services to ensure adequate clearances are maintained between services and to locate other service crossings. Potholing at each service crossing and at regular spacing along services is recommended.

Note: Where hydro or air excavation is utilized, maximum pressure should be identified and adhered to. Maximum pressure will be identified by the service owner on each occasion.

Figure 20: Two images showing the potholing technique.

Part 3: Planning and pre-start site assessment

Where clearances required by other services cannot be achieved at the proposed depth of service installation, alternative solutions should be sought in consultation with the relevant parties, which may include the regulatory authority. Alternative solutions may include:

- seeking alternative routes,
- relocation of existing services,
- installing the new service with reduced clearances,
- installing the new service well below the existing services.

Where trenchless boring techniques have been utilised to install new services, it is crucial to provide the 'as constructed' details on this type of installation for future reference, for the following reasons:

- The ground above the bore is typically undisturbed, not offering any indication of previous works.
- Inability to provide warning tape or mechanical protection above the service.
- The bore may not follow a direct route.

For more information on trenching and excavation safety, refer to *Compliance Code: Excavation* at www.worksafe.vic.gov.au

Note: See Appendix B for more information on trenching/excavation safety – engulfment protection systems

Part 4: Safe working procedures

Working inside the No Go Zone

Where work is to be undertaken inside the No Go Zone, duty holders should:

- Consider that there **may or may not** be any warning indicators (e.g. tapes, concrete slabs, tracer wire) of the presence of underground services
- Contact the service owner and arrange an onsite meeting
- Discuss the works to be completed and equipment to be used
- Discuss controls to be implemented
- Receive written permission to work and follow any requirements detailed by the service owner

Note:

- State Electricity Commission (SEC) markings identify the presence of an electrical service.
- Different colour warning tapes may be used to provide warning for the presence of different underground services

Examples of warning indicators above underground services

Figure 21: Orange marker tape to provide warning of underground electrical services.

Figure 22: Cover slabs (rigid barrier) to provide warning of underground electrical services.

Figure 23: Yellow marker tape to provide warning of underground gas services.

Figure 24: Yellow marker tape in a trench to provide warning of underground gas services.

Part 4: Safe working procedures

Using an ESV-registered spotter

If a spotter is required (see No Go Zone rules Figure 1 and Figure 2)[1], the spotter must have completed training endorsed by ESV and be registered with ESV. Spotters undertake training at the expiry of each three-year registration period and will be advised of any changes in the No Go Zone rules.

The ESV registered spotter should meet the following requirements:

- be dedicated to the spotting task at all times when an operator is at the controls of the mobile plant or where the engine/power source is operating;
- provide immediate and direct notice/warning to an operator (i.e. hand signals, whistle, hand held two-way communications as necessary) should the mobile plant or equipment's load breach the No Go Zone specified distance, example warning tape, sand or cover slabs;
- spot for one item of mobile plant at a time; and
- spot for the mobile plant that they are registered for (endorsement on spotters' card).

For more information about spotters go to www.esv.vic.gov.au.

Table 2: ESV Spotter competency classifications as of 2021

Competency class	Class Code
Backhoe	LB
Concrete placing boom	PB
Crane Chaser	CC
Crane – Bridge and Gantry	CB
Crane – Derrick	CD
Crane – Mobile Slewing (open/over 100 tonnes)	C0
Crane – Mobile Slewing (up to 100 tonnes)	C1
Crane – Mobile Slewing (up to 20 tonnes)	C2
Crane – Non-slewing	CN
Crane – Portal boom	CP
Crane – Tower	CT
Dogging	DG
Drilling Rig	DR
Elevating work platform (less than 11m)	WP<11m
Elevating work platform (longer than 11m)	WP>11m
Excavator	LE
Forestry equipment	FE
Forklift truck	LF
Front end loader	LL
Rigger – Basic	RB
Rigger – Intermediate	RI
Rigger – Advanced	RA
Road profiler	RP
Skid steer loaders	LS
Telescopic material handlers (less than 3 tonne)	TMH
Vacuum excavator	VE
Vehicle loading crane (less than 10 metre tonnes)	CV<10m/t
Vehicle loading crane (greater than 10 metre tonnes)	CV>10m/t

1 If spotter is required it should be reflected in the SWMS/JSA.

The ESV registered spotter should be clearly identifiable on site to the operator and to others on site, for example through use of a spotter arm band and/or a coloured safety helmet.

If the ESV registered spotter is concerned about the work, the work must stop, and the site supervisor or duty holder must reassess the risks and controls for the work and apply appropriate control measures. The service owner may need to be contacted for assistance/advice.

Figure 25: ESV spotter card.

Figure 26: Example of spotter arm band.

Part 4: Safe working procedures

Selection of powered plant and equipment

The type of plant and equipment to be used for the task will often depend on type and location of the underground service that the work is occurring on or near.

When selecting plant and equipment the following should be identified:

- ground condition(s) that the mobile plant is operating on for example on an incline, the soil type (soft, dry, clay, sand, etc.)
- potential loadings on the ground from the plant in its working operation
- whether overhead electrical assets are near the work area and access routes
- potential weather conditions, for example wind, rain, temperature, etc.
- the scope of the planned work, and its duration
- how the work is to be carried out
- the location of designated loading and/or unloading areas.

Operators of powered plant and equipment

Employers should ensure that employees (including independent contractors and their employees) are trained and competent and understand the following when operating powered plant and equipment near underground services:

- the No Go Zone
- operator manuals (should be with the plant)
- how to use or manage any limiting devices
- how to manage environmental or site conditions required for safe working of mobile plant, for example:
  - unstable or uneven surfaces
  - access routes
  - excavations
  - emergency procedures in the event of contact with underground services.

Signage and marking

Visual warnings including signage and markings should be used as warnings of hazards and reminders of safety requirements where work is undertaken near underground services. Visual warnings should not be relied on as the only control mechanism to reduce the risk of contact to the service.

Signs should be displayed at all hazardous locations to warn workers of the risk and how to avoid it. (Refer to Visual identifiers for underground services on pages 10–13)

Part 4: Safe working procedures

Communication

Communication systems should be appropriate for the worksite and the type of work being undertaken.

Spotters communicating with mobile plant operators should communicate verbally. Alternatively, if verbal communication is not appropriate, a combination of visual, audible, radio or buzzer system could be used.

The communication system should provide for emergency response. This may be from the site to the necessary response organisations or to a control point able to make the appropriate notification.

Supervision

Ongoing site supervision should be provided as site conditions and work activities change. As work progresses this may increase risk and ongoing supervision and monitoring may be required to ensure existing safety measures remain effective.

When making decisions about control measures, employers must, so far as is reasonably practicable, consult with employees of the employer (including HSRs, independent contractors and their employees) on matters that directly affect, or are likely to directly affect, their health and safety.

The employer should verify and document that each employee and contractor has received the required training. This includes, but is not limited to, training on the following:

- emergency procedures and provision of first aid
- underground service electrical hazard identification and risk control
- safe systems of work
- implementation of site specific SWMS
- the role and responsibility of the spotter
- effective communication systems
- equipment or machinery to be used.

Part 5: Hazards

Electricity

Hazards and risks of working near underground electrical services

Some of the hazards and risks of working near electrical underground services include:

- contact with underground cables,
- damage to live underground cables:
  - penetration of the cable by an object
  - cable is crushed or contact is made between the individual phases of a cable
  - power supply is not isolated in the event of damage,
- out of service underground cables:
  - treated as in-service unless otherwise positively proven out of service
  - If work is required near out of service underground cables, a permit or information relevant to the cable/service should be obtained
  - **Note:** Beware out of service cables may have voltage remaining in them from nearby live cables

Serious and fatal injuries, including electric shock and flash burns, can occur if these hazards and risks are not controlled. Interruptions to critical emergency service supplies, for example hospital power supply, can also occur.

Older electrical cables can discharge voltage or explode if disturbed or damaged. The discharge may not always occur at the site of disturbance or damage and may result in explosions at remote locations away from the job site.

Contact with earthing systems

Earthing systems are installed for the safe operation of the electrical network. Damage to, or contact with, this system may present electrical hazards to persons at the worksite.

If earthing systems are damaged or broken, no attempt should be made to repair them. The service owner should always be contacted and advised of the damage.

Single wire earth return (SWER) electricity systems

SWER systems are used in outer rural areas of Victoria and are identified by a single HV overhead wire.

Electricity Safety legislation states that no excavation work should be undertaken within a 10 metre radius of a pole with a SWER transformer mounted on it (see diagram below). Warning signage will usually be installed on these poles.

Figure 27: Example of warning signage installed on a pole.

If a SWER earthing system is broken, a high voltage may exist across the break in the earthing system.

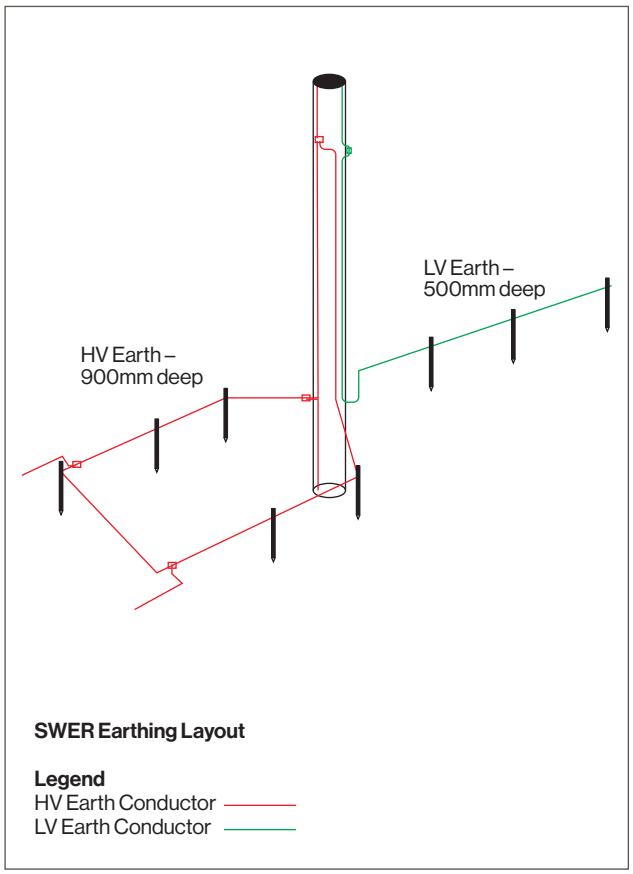


Figure 28: A diagram depicting the underground earthing systems at a SWER transformer pole.

For further information regarding work near SWER systems, contact your local electricity company.

Excavation near electrical services

Safety considerations recommended for excavation near underground electrical services include:

- No mechanical excavation shall be carried out within 500mm in any direction of a service, protective cover slab or conduit unless written permission has been obtained from service owners.
- Ensuring the underground cable, including any mechanical cover, for example concrete or polymeric cover slab is not disturbed.
- No manual excavation shall be carried out within 300mm in any direction of a service unless written permission has been obtained from service owners.

Excavation near overhead line structures

When using mobile plant/machinery near pole and tower structures, No Go Zone clearances need to be managed from the overhead conductors. For further information, refer to *Guidebook: Using powered mobile plant near overhead assets* at www.worksafe.vic.gov.au.

Where excavation is required near power line structures such as towers poles, stay or guy wires, the following exclusion zones apply **as per the Electricity Safety legislation**. This is to ensure that the structures do not have their stability compromised.

The following images depict the distances for the exclusion zones relevant to the depth of the excavation, for tower lines, poles and stay wires.

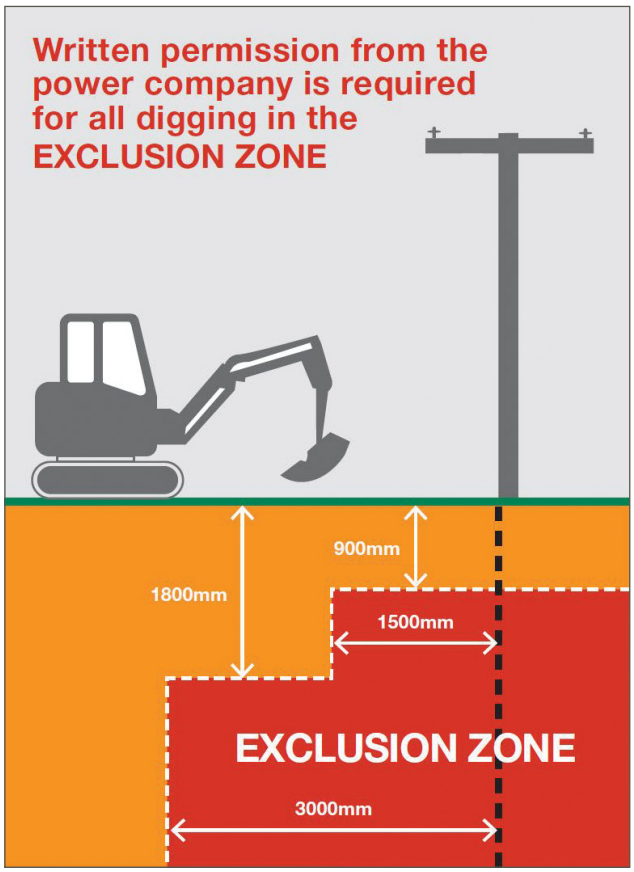


Figure 29: Excavation near poles.

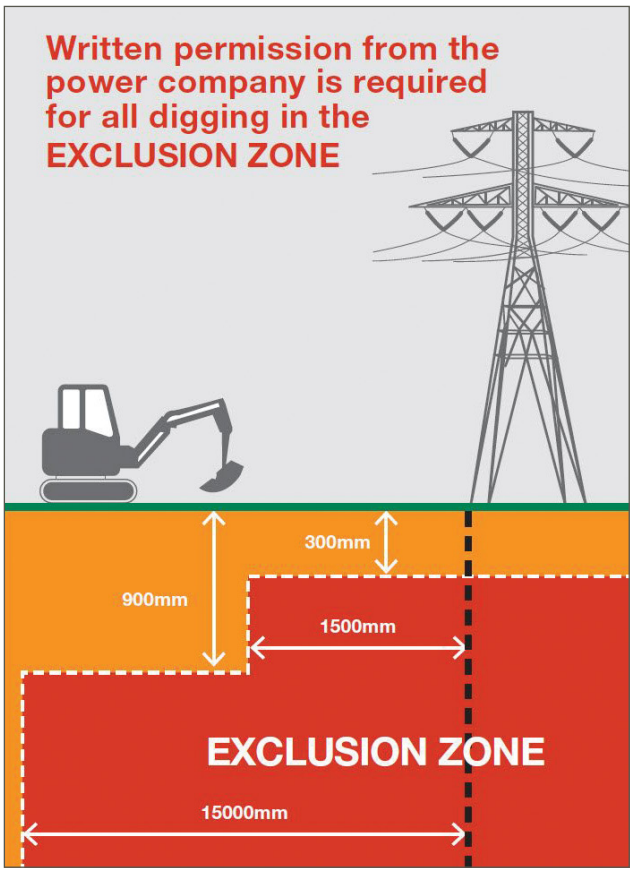


Figure 30: Excavation near towers.

Excavation near poles and stay wires structures

No excavation is permitted deeper than 900mm and within 1500mm (1.5m) of the pole or where stay wires/rods enter the ground.

No excavation deeper than 1800mm (1.8m) and within 3000mm (3m) of the support structure.

For any excavation within the exclusion zone permission from the power company is required.

Note: Due to the variety of equipment installed on poles any excavation greater that 300mm in depth within 3000mm of the pole may affect its stability. Contact with the service owner to discuss the work required as support of the pole may be required.

Excavation near tower line/transmission structures

No excavation is permitted deeper than 300mm and within 1500mm (1.5m) of the support structure.

No excavation deeper than 900mm and within 15000mm (15m) of the support structure.

For any excavation within the exclusion zone permission from the power company is required.

Note: Any excavation works within a transmission easement requires written approval from the service owner.

What to do if contact or arcing with an underground electrical cable

In the event contact is made with an underground cable or arcing occurs between the cable and an item of plant and or employee, the following actions may be taken to avoid injury from step and touch potential:

- All work must cease immediately.
- Operator should remain inside cabin. If it is essential to leave the cab (or operators station) due to fire or other life-threatening reasons, jump clear of the equipment.
- Do not touch the equipment and ground at the same time.
- When moving away from the equipment, the operator should hop slowly, shuffle or jump away from the plant (with feet together) until at least 10m from the nearest part of the plant item.
- Warn all other persons (including members of the public) to keep at least 10m from equipment.
  - Do not touch any part of the equipment or load;
  - Do not attempt to approach or re-enter the vehicle until the relevant authorities have determined the site is safe.
- Facilitate First Aid treatment and seek medical aid as required.
- Advise the organisations emergency contact and request they immediately notify the relevant authorities, including the appropriate utility service owner.
- Do not disturb site unless necessary to do so for safety reasons
- Initiate the emergency management plan and incident investigation process.

These two images show the two potential radiating circles from the bucket of a plant and the plant itself to illustrate the step potential risk if an underground electrical cable is hit by the bucket.

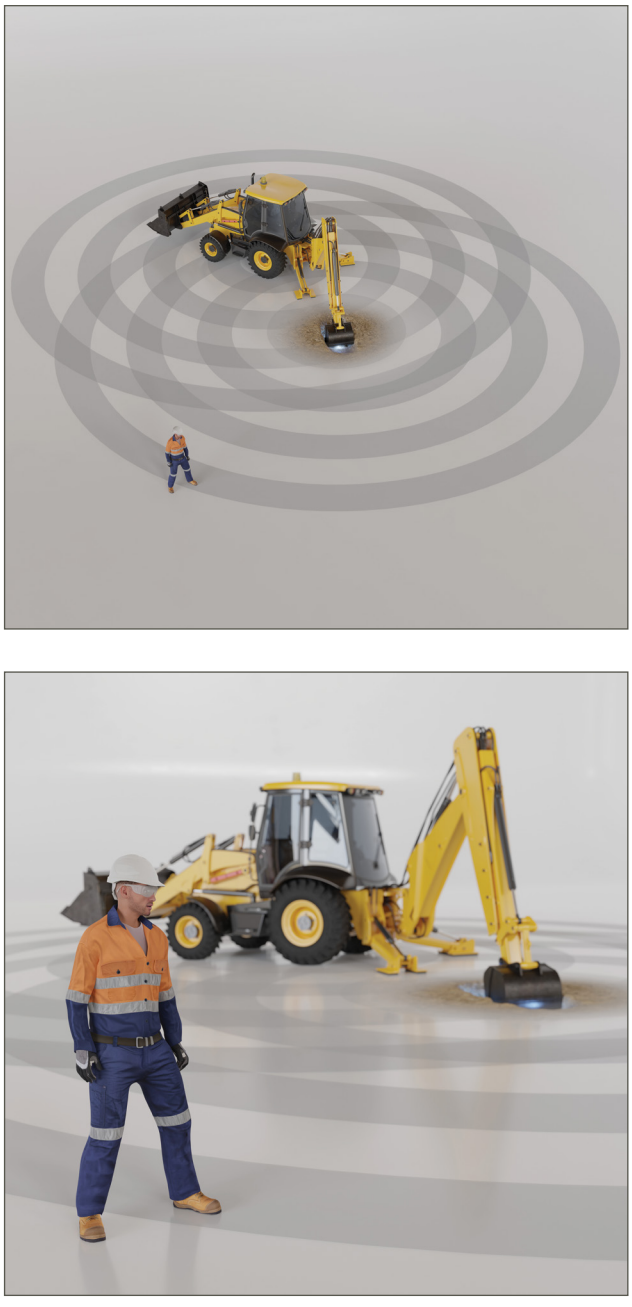


Figure 31: Step potential risk if an underground electrical cable is hit by the bucket.

When there is a voltage difference and your body becomes part of a circuit, there will be current flow through the body. Touch potential is the voltage difference between where you are standing and what you touch. Step potential is the voltage difference between the ground at each foot where the ground may be energised.

Note: See Appendix C for more information on electricity cables, including types of electrical underground services, use of cables, cable records and cable installation.

Gas

Dangers of working near underground gas services

Some of the dangers which may arise when working near other underground services are damages to gas services, which can cause gas to escape. The escape of highly flammable gas (or liquid) poses a risk to persons at the worksite and the community through:

- Jet fires
- Explosion
- Burns
- Asphyxiation

There are two types of damage to the service that can occur:

- Damage which causes an immediate escape. In this case, there is a risk to those working at the site.
- Damage which causes an escape sometime after the incident. This may be through damage which weakens the service casing or the result of poor reinstatement practice. In this instance, the public is at risk.

Energy Safety legislation requires persons to:

- not to carry out any excavation, boring or open the ground to uncover or expose gas pipelines unless they have the authority or permission to do so, and
- not carry out any excavation or boring or open any ground within 3 metres of a transmission pipeline unless they have the authority or permission to do so.

Part 5: Hazards

Safety considerations for working near pressurised gas mains

The safety considerations which should be utilised when working near pressurised gas mains include:

- Dangers of poorly ventilated workplaces, see *Compliance Code: Excavation, and Compliance Code: Confined Spaces* at www.worksafe.vic.gov.au
- Having an appropriate fire extinguishing system
- Only one individual at a time should be excavating if manual excavation is being undertaken in a confined space. Another should act as an observer and be able to operate any breathing, escape or fire equipment required
- Eliminating an ignition source in the event of an escape
- A copy of the emergency plan in a prominent position on-site. This plan should include any contact details required.
- No mechanical excavation should be carried out within 500mm in any direction of a service, protective cover slab or conduit unless written permission has been obtained
- Ensure the underground cable, including any mechanical cover, for example concrete or polymeric cover slab, is not disturbed.
- No manual excavation should be carried out within 300mm in any direction of a service unless written permission has been obtained.

When working near gas transmission pipelines, no excavation should be carried out within 3000mm in any direction of a transmission pipeline service unless written permission has been obtained from service owners. All transmission pipelines involving gas, oil and petrochemicals have separate requirements and the service owners should be contacted.

What to do if contact or damage to gas services occurs

If a gas pipeline strike occurs, the following actions should be taken:

- Cease all work immediately
- Evacuate the area, shut down the plant/equipment, leave the cab or operator station, trench or enclosure
- 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 near the gas escape. This may include mobile phones, two way radios, etc.
- Warn all other persons (including members of the 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 the organisations emergency contact and request they immediately notify the relevant authorities, including the relevant gas distribution company.
- Do not disturb site unless necessary to do so for safety reasons
- Initiate the emergency management plan and incident investigation process.

Note: See Appendix D for more information on gas pipes including gas reticulation systems, types of gas pipelines, properties of gas and pipeline depths.

Other Pipes and Pipelines

Water pipes and sewers

There are other types of pipes to consider when undertaking excavation activities e.g. water, sewer, storm water, grey water. While the risk to the worker or the community is not as high as contact with electricity or gas, the risk is not insubstantial.

The risks to be considered include:

- Engulfment/flooding – water in trench, potential for drowning, pit/trench collapse.
- Environmental – damage to properties from water under pressure, water contacting power lines depending on pipe and pressure
- Hygiene – contact with contaminated substances (raw sewerage); contacting/breaking asbestos pipes, asbestos removal

More recently, water services have been co-located with other services in shared trenches. This raises the potential problem of simultaneous damage to several services.

Pipelines may not always be visible on plans. It is important that before commencing works, contact is made with Before You Dig Australia or the water authority in local area to confirm.

Trenchless techniques may be used to locate pipes, such as pothole digging. No Go Zone requirements need to be maintained.

Note: See Appendix E for more information on water pipes and sewers including pipeline types and location.

Other pipelines

There are many pipelines operated by individual companies on special licences (*Pipelines Act 2005*). Products in these lines could be liquid or gaseous and under high pressure. They may include the following:

- petroleum pipelines (oil, petrol, etc.)
- refinery gases
- liquid flammable gases
- privately owned water pipelines

It is important that thorough searches are made in areas where proposed construction is likely to take place and No Go Zones are maintained.

Having determined these pipelines may run in the general area of the worksite; the service owner should be approached for the necessary permission or records outlining the pipeline's exact location and characteristics.

Telecommunication

Telecommunication cables are designed for installation in pipe or direct burial in a suitable stone-free backfill. They are not designed to resist the impact of manual or machine tools or to be left unsupported over any great distance.

There are hazards associated with damage to telecommunication cabling, these include:

- Optic fibre laser light – invisible light into eye
- Optic fibre is finely drawn glass fibre which produces splinters that can easily penetrate the skin or eyes
- Contacting/breaking asbestos enclosures or pipes
- Damaging cables causing loss of communications for emergency services or essential home services requiring phone connection
- Financial risk – loss of telecommunications for shopping, banks etc.

What to do if contact or damage to telecommunication services

If telecommunication services strike occurs, the following actions should be taken:

- Immediately notify the service owner
- Cease work in the immediate vicinity to ensure no further damage occurs
- Initiate the incident investigation process

Note: See Appendix F for more information on telecommunication cables including cable installation, alignments, cable records and cable locations.

Appendix A: Further information on training, construction induction training, site induction, high risk work (HRW) licensing and asbestos removal and licensing

Training

Training should be task specific, site specific and practical. Training provided to employees should be reviewed, and if necessary revised, by employers if:

- there is change to work processes, plant or equipment
- there is an incident
- new control measures are implemented
- there is a request by an HSR
- changes are made to relevant legislation
- any other issues impact on the way the work is performed.

Employers need to provide such training as is necessary to enable employees to perform their work in a way that is safe and without risks to health. This may include training as appropriate for a particular workplace. OHS Act s21(1)&(2)(e)

The frequency of training should be determined having regard to the frequency with which employees and independent contractors are required to carry out tasks associated with excavation near underground services this may include but not be limited to:

- Spotters
- Traffic management
- Confined space entry

Construction induction training

An employer must ensure that any person employed to perform construction work has completed construction induction training before they start the construction work. An employer must not allow a person to perform construction work unless the person holds a current construction induction card. The construction induction training must be provided by a construction registered training organisation. OHS Regulations r338 and r342

Appendix A: Further information on training, construction induction training, site induction, high risk work (HRW) licensing and asbestos removal and licensing

Site induction

An employer must ensure that any person employed to perform construction work is provided with OHS training that relates to the particular workplace where the construction work will be performed. Site induction needs to be undertaken before the person starts work at the workplace (that is, before starting work on the construction site). OHS Regulations r330

The aim of site induction is to make sure that employees and contractors are familiar with site specific hazards, risk controls, and OHS rules and site procedures (e.g. the emergency procedures, arrangements for supervision of the work, and who the HSRs are).

The detail required in the site induction may vary between construction sites and between phases of a project. The length of time it takes may depend on things such as the size of the site, the number and variety of trades working on the site, and how much the site is expected to change as work progresses.

Where an employer has information about the particular site that would form part of a site induction (e.g. OHS information, site specific hazards or risk controls), they need to provide that information to persons (such as contractors) performing construction work.

High risk work (HRW) licensing

A person must not do any HRW unless they hold an appropriate HRW licence OHS Act s40(4), OHS Regulations r128 and r130. The range of HRW licences are listed in Schedule 3 of the OHS Regulations and include licences for the use of cranes, elevated work platforms, and for dogging and rigging. This is in addition to the duty to provide employees with any necessary information, instruction, training and supervision to enable them to perform their work in a way that is safe and without risks to health.

An employer must ensure that any employee who will be performing HRW holds an appropriate HRW licence in relation to that work OHS Regulations r129.

For information about licensing, including how to apply for a HRW licence and exceptions that apply, go to www.worksafe.vic.gov.au

Asbestos removal and licensing

Persons who manage or control workplaces and employers have specific duties in relation to asbestos, including licensing requirements. See Part 4.4 of the OHS Regulations.

For further information about asbestos removal and licensing, refer to the *Removal of asbestos in workplaces compliance code* at www.worksafe.vic.gov.au

Appendix B: Trenching/excavation safety – engulfment protection systems

Before commencing trenching works, planning must be undertaken taking into account risk associated with a trench or excavation. Some of the risks associated with trenches include:

- engulfment (from soil, sand, liquid) spill piles collapsing into the trench
- falls into trenches
- atmospheric contaminants (for example, gas leak in confined space)
- mobile plant toppling into trenches

All trenching work should be pre-planned so that work can be done safely, including;

- identifying causes of engulfment (soil, sand, liquid)
- identify the correct trenching techniques to be used and determining appropriate engulfment protection (battering, benching, shoring, shields)
- provide safe exit and entry access, for example;
  - trench shields with guard rails attached
  - tied-off access ladder
  - site security requirements

Employers and self-employed persons must develop a safe work method statement (SWMS) and implement it for all trenches where the depth exceeds 1.5 metres, or when powered mobile plant is involved.

An emergency procedure must also be in place, regardless of trench depth, where there is a risk of a person becoming engulfed.

Employers and self-employed persons should ensure:

- a competent person who has knowledge, skills and experience in trenching/excavation, supervises the work
- workers never work outside the engulfment control measures, including where protection is being progressively installed
- workers are trained in the emergency procedure and SWMS
- materials, spoil and plant are kept away from the trench edge
- the trench and work area is secure and will prevent unauthorised access
- the risks of a fall into the trench is controlled, for example by:
  - using trench box extensions or trench sheets with a height greater than the trench depth
  - installing guard rails or covers on trench shields
  - inserting guard rails and toe boards into the ground immediately next to the supported excavation side
  - installing landing platforms or access structures, such as scaffold towers, inside deep excavations
  - installing effective barriers or barricades
- clearly defined pedestrian detours are provided
- fencing is in place around excavations or trench shields
- the trench is regularly inspected while open, and immediately after an event that could affect the trench's stability, for example a weather event or ground slip

For further information on trenching and excavation safety including *notice of construction excavation work requirements*, please refer to *Compliance Code: Excavation* at www.worksafe.vic.gov.au

Appendix C: Electricity cables

Types of electrical underground services

The various types of electrical underground services include:

- Underground electrical equipment
- High Voltage and Low Voltage cables
- Supervisory and signalling cables
- Cathodic protection cables
- Earthing rods and conductors
- Cable pits and chambers
- Cable joints and joint enclosures (wooden boxes) and epoxy filled plastic enclosures
- Conduits and ducts
- Cabinets, pillars and transformers that underground cables enter into

Electrical cables are often identified by:

- operating voltage
- conductor size and material
- number of conductors in the core
- insulation type and design grouping

Electric cables consist of a conductor or conductors to carry the current, and insulation to isolate the conductors from each other and from their surroundings. For example:

- **Low voltage street lighting cables:** the two components may form the finished cable, but generally as the voltage increases, the construction becomes more complex.
- **Other cables:** components may include screening to obtain a radial electrostatic field, a metal sheath to keep out moisture or to retain a pressuring medium, armouring for mechanical protection and corrosion protection for any metallic components.

Cable systems may also have a variety of external additions such as earthing conductors or pipes to supply oil or gas to the cables.

Cables are designed for installation in ducts or to be buried directly in a suitable stone-free backfill. They are not designed to resist the impact of plant or machine tools and are not designed to be left unsupported over any great distance.

Some armour protected cables may have been ploughed directly into the ground with only warning tape and cable markers to identify the cable position.

Appendix C: Electricity cables

Use of cables

Underground (and overhead) service cables have four broad classifications:

Table 3: Underground and overhead service classifications

Classification	Description
Distribution systems	Local area distribution generally involves installation of low voltage cables (230/400V), and high voltage 6.6kV, 11 kV, 12.7kV, 22 kV or 66kV cables. These installations are common throughout city business districts, shopping centres, industrial centres, and rural and residential estates. It is common practice to provide underground electricity supply to street lighting on major roads and to traffic signalling equipment. Electricity cables may also be installed in parks, easements, rights of way, unformed road reserves, swamps, cemeteries, bridges and waterways. Most electricity cables are owned by the local electricity distribution companies. In some areas, buildings and street lights are supplied by underground cables as there are no overhead lines. However, even when a local area is supplied by overhead lines, an electrical underground cable network may still be present. These cables may interconnect the various supply points and load centres by the shortest available route.
Transmission systems	Transmission system cables are high voltage systems operating at 132kV, 220kV, 275kV, 330kV or 500kV AC and 400kV DC and which interconnect the generation centres with supply points or Terminal Stations. These are generally overhead systems. There are some 220kV AC and 400kV DC transmission underground cable systems in Victoria.
Traction industry (tram/train)	Traction industry (tram/train) have other electricity cables that may be present. These are owned by electricity generation, rail or tram companies, councils or road and traffic authorities. These systems run a 600V DC for the trams and 1500V DC for the train systems. The train system can also include 2.2kV and 22kV AC systems.
Customer installation	Customer installation cables are usually owned by the site owner or occupier. These can be low voltage or high voltage installations.

Appendix C: Electricity cables

Cable records

Under the *Electricity Safety Act 1998*, records are required to be maintained on electric lines and cables. These records can be in the form of plans drawn to a suitable scale or on computer-aided geographical mapping systems.

The detail of the records will vary with the type of installation. For cable installed in a standard location, the records may provide only general cross sectional arrangements of cable and conduits together with road crossing and street lighting information.

Maps may be supplied with a legend that needs to be understood to ascertain depths and offsets provided.

For transmission cable installations, it is common practice to negotiate a special alignment. These records are more detailed with reduced level and offset information provided. The details of local area distribution and of transmission cables are often shown on separate plans.

Cable installation

The specific requirements for permanent installation of underground electricity cables on public and private lands are detailed in Electricity Safety legislation.

The minimum depth of underground electricity cables may vary from 450mm to 1000mm. If in doubt, follow the advice indicated on your BYDA response form the service owner.

The cable installation methods and materials have changed over the years. Measures that have been used to identify the services in vicinity where digging may occur in future have included using one or more of the following:

- Conduits or ducts – Orange PVC, concrete, fibro asbestos concrete, earthenware, steel
- Bricks or tiles – terracotta, concrete
- Marker tape – plastic (orange in colour)
- Cover boards or slabs – polymeric, concrete, timber, washed sand

Note: State Electricity Commission (SEC) markings identify the presence of an electrical service.

Appendix D: Gas Pipes

Gas reticulation systems

There have been many and varied methods of gas reticulation systems used, from low pressure services through to transmission systems. These have been constructed from a wide range of materials including:

- coated welded steel
- cast iron
- uncoated steel
- a variety of plastics

In most areas, these are buried directly in a suitable stone-free backfill. They are not designed to resist the impact of tools or mechanical plant or to be left unsupported over any great distance.

These pipeline systems could convey different types of gases, such as natural gas or liquefied natural gas. The operating pressure of the distribution system could range from as low as 1.1kPa up to as high as 15mPa for a transmission system.

All high pressure steel pipelines have protection systems. These form part of the pipeline and incorporate test points and anodes at various points along its length. If these are broken or damaged, it should be reported to the gas utility immediately. Damage is easily rectified but can be extremely difficult to locate if the damage is not reported.

Types of gas pipelines

- Transmission pipelines – convey gas between gas supplier and distribution network. Transmission pipelines are shown on BYDA plans. These pipelines are required to be licensed under the *Pipelines Act 2005*
- Distribution network – includes mains and services conveying gas from the transmission pipelines to consumer pipework. These pipes are usually shown on BYDA plans.
- Installation and consumer piping – conveys gas between the meter and the appliance. These pipelines are located within the boundaries of a consumer's premises, including for example, substation, street mains to house, commercial properties gas supply, high volume customer.
- LPG network (including kiosks, valves and syphons) – stored in cylinders or tanks on private land. Involves pressures which range between 1750kpa – 2.75kpa. LPG pipelines maybe underground on private land, these pipelines may not be shown in BYDA plans.

Appendix D: Gas Pipes

Properties of gas

Gases have different properties. If a leak occurs, it is important to understand these properties.

Table 4: Different properties of gas

Types	Descriptions
Natural Gas	Natural gas is lighter than air, allowing most leakage to disperse rapidly into the atmosphere. This may include hydrogen blended natural gas.
Liquid Natural Gas	Liquid Natural Gas (LNG) is natural gas in its liquefied form. When cold LNG makes contact with warmer air, it becomes a visible vapour cloud. As it gets warmer, the vapour cloud becomes lighter than air and rises becoming potentially dangerous.
Liquid Petroleum Gas	Liquid Petroleum Gas (LPG) is generally stored in cylinders or tanks. LPG is heavier than air and tends to collect at ground level, particularly in any depressions such as trenches, pits, or underground storm water drains, etc. Leaking LPG may cause a potentially dangerous situation if the gas ignites. This may be at a considerable distance away from the actual leak.

Records of services

All gas distribution utilities are required to maintain records of the pipe network in a road reserve. The detail of the records will vary with the type of installation. Transmission pipelines may be in areas other than verges in road reserves. They may be under road pavements and either dedicated or shared easements on private lands.

Pipeline depths

Most pipelines laid in recent years may have a marking tape or polymeric slab laid above the pipeline for identification when excavating. However, these tapes or slabs may have been damaged by other excavations in the area since the initial construction and not replaced. For location purposes, plastic pipelines may have been laid with a metal detector wire or tracing tape.

It is important these tracer wires are not interfered with or broken, as it makes future location of these pipes very difficult. Other structures, such as siphon pots, valve pits, regulator pits and other varied components may be installed in the pipeline.

Care needs to be taken to locate these before excavation. While the plans may show the expected location of underground services, it is doubtful whether services entering properties will be identified. These services are generally at right angles to the pipeline and are easily damaged by excavation alongside the main pipeline. Properties should be checked to ascertain whether gas meters are present.

If so, the services normally run at right angles to the main pipeline to the service connection at the meter. The installed depth of pipelines varies from 600–800mm for gas mains to 900–1200mm for transmission pipelines.

Appendix E: Water pipes and sewers

Pipeline types

Water pipeline networks have been operating for more than 100 years. A wide variety of materials have been used for sewer and water pipes over this time. The table below provides information on common types of pipe that have been used and the durability of the pipes.

Underground water pipelines and services range in size from 15mm to 1800mm.

Table 5: Water and sewer pipe types

Types	Descriptions
Cast iron pipes Asbestos cement pipes	Cast iron and asbestos cement pipes are easily disturbed and very brittle, having been laid over 50 years ago and often joined with lead.
Mild steel pipes Ductile cast iron pipes	Mild steel and ductile cast iron pipes have external protective coatings which, when damaged, significantly reduce the pipe's lifespan.
Cement lined steel pipes	Cement lined steel pipes
Copper pipes	Copper pipes are very soft and easily compressed or bent. Though copper pipes are less prone to breaking, the water flow can be significantly reduced.
PVC pipes Earthenware pipes	PVC or earthenware pipes are commonly used for sewerage and drainage services to houses.
Sewer lines	Larger sewer lines may be PVC, asbestos cement or concrete.

Appendix E: Water pipes and sewers

Location

Records of pipeline locations are maintained by water authorities. The depth of the pipelines can vary depending on their age and the amount of surface reconstruction over the years.

It is important to know the depth of pipelines before commencing works to avoid incidents occurring, such as:

- in rush of water or sewerage into a shaft, trench or excavation etc.
  - engulfment of persons in a trench or shaft
  - collapse of a trench
- contact with contaminated substance
- serious or fatal injuries to persons
- disruption of services
- water coming into contact with a power supply

Water pipelines are required to be installed at a minimum depth of 450mm under footpaths and a minimum of 600mm under roads. These depths may be much less depending on the requirements at the time the pipes were installed.

Major sewer lines are commonly installed at depths greater than 600mm; however this should not be assumed. Rising mains may have only 600mm of coverage. Major sewer lines will have manholes approximately every 90 to 130m or when there is a change in pipeline direction.

Appendix F: Telecommunications cables

Telecommunications cables developed for underground installations have changed in line with technology requirements.

Cable installation

Cables are designed for installation in pipe or direct burial in a suitable stone-free backfill. They are not designed to resist the impact of manual or machine tools or to be left unsupported over any great distance. Where agreement is reached between service owners, cables may share trenches with other utility assets. Power cables are often found in 'shared trenches'.

There have been many changes to installation methods and materials used for telecommunications cables over the years.

Understanding the depths cables may be buried at will assist in avoiding impacting or damaging them.

Cables may be buried directly or installed in one or more of the following:

- White PVC pipe – 10mm to 100mm internal diameter
- Fibro asbestos cement (FAC) pipes and ducting
- Galvanised iron (GI) pipe – various diameters
- Large numbers of conduits (100mm) may be encased in concrete to provide added support and security.
- Depth of cover

The depth cables are laid at has varied, often depending on the location and if there were obstructions.

Common depths that cables may be installed at include:

- Shared trenches and in private property at a depth of 300mm or more
- Public footpaths at a depth of approx. 450mm
- Beneath roadways at approx. 600mm

These measurements can vary according to surface level changes over time or where physical obstructions prevent achieving these depths.

Note: Telecommunication cables may be conductive (e.g. copper) or non-conductive (e.g optic fibre). Non-conductive cables may or may not have a metal tracer wire included and can be difficult to locate.

Alignments

The majority of telecommunication services at joint locations are housed in pits or manholes. However, the route between these may not be straight if obstructions were encountered during installation.

Direct buried cable in rural areas may be identified by pits or manholes and marker posts. However, it cannot be assumed that a cable follows a direct path between these items.

Cable records

Cable records indicating the type of service installed are maintained by telecommunication carriers. The accuracy of information however can only be confirmed by either electrical location methods (metal content cables) or by manual excavation (non-metallic optical fibre cables).

Cable depths are not recorded.

Cable locations

Persons wanting to identify the location of telecommunications services should contact Before You Dig Australia.

More information

Australian standards

Australian standards can be purchased from Standard Australia's Customer Service Centre on 1300 654 646 or at www.standards.org.au

- AS 5488.1:2019 *Classification of subsurface utility information*
- AS 2648.1 1995 *Underground Marking Tape*
- AS 1345-1995 I*dentification of the contents of pipes, conduits and ducts*
- AS 2566.2 2002 *Buried flexible pipelines*
- AS 4271 – *Interim – Geographic information Data dictionary*
- AS 1742.3 *Traffic control devices for works on roads*

Legislation

- *Electricity Safety Act 1998*
- *Electricity Safety (General) Regulations 2019*
- *Gas Safety Act 1997*
- *Occupational Health and Safety Act 2004*
- *Occupational Health & Safety Regulations 2017*
- *Pipelines Act 2005*
- *Telecommunications Act 1997* (Commonwealth)
- *Telecommunications Codes of Practice 1997* ACIF C524:2001
- *Water Act 1994*

WorkSafe Victoria Compliance Codes & Industry Standard

- *Compliance Code: Excavation*
- *Compliance Code: Confined spaces*
- *Compliance Code: First Aid in the Workplace*
- *Compliance Code: Plant*
- *Compliance Code: Prevention of falls in general construction*
- *Compliance Code: Removal of asbestos at workplaces*
- *Industry Standard: Civil Construction*

Notes

Notes

WorkSafe Victoria

WorkSafe Agents
Agent contact details are all available at
worksafe.vic.gov.au/agents

Advisory Service
Toll-free 1800 136 089
Email info@worksafe.vic.gov.au

Head Office
1 Malop Street, Geelong 3220
Phone (03) 4243 7000
Toll-free 1800 136 089
Website worksafe.vic.gov.au

Information in your language
For information about WorkSafe in your own language, call our Translating and Interpreting Service (TIS National) on **131 450**.

WorkSafe Victoria is a trading name of the Victorian WorkCover Authority
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