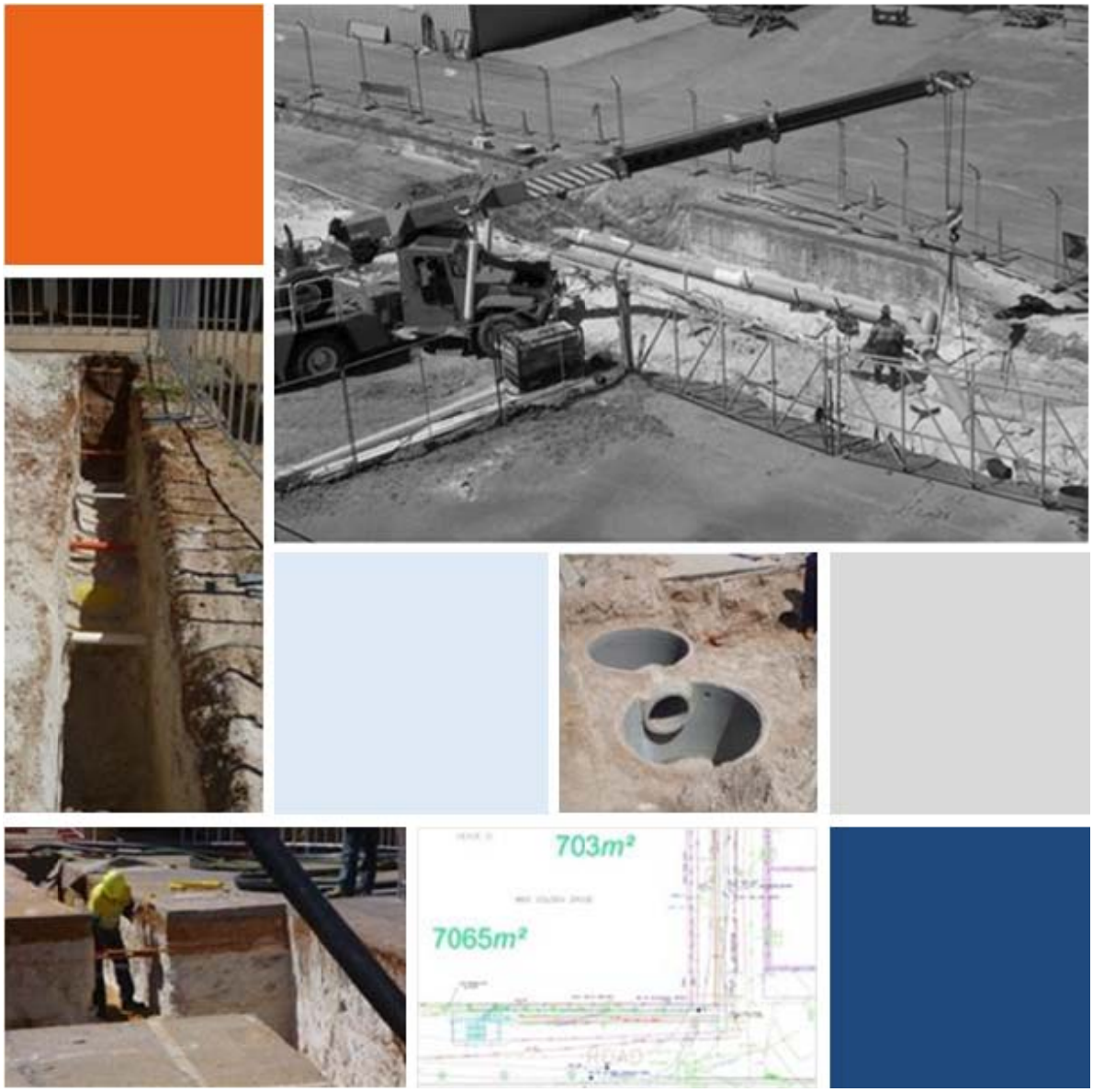
MID WEST PORTS

TECHNICAL GUIDELINE

MWPA502 – GUIDELINES FOR BURIED SERVICES



Version	Revision Date	Details	Prepared By	Authorised By
Draft 3	09/08/2013	Draft	GHD	I. McLeod
Rev 0	28/08/2013	Document Approved for Use	I. McLeod	P. Blundell
Rev 1	10/11/2015	General Update of Format	I. McLeod	P. Blundell

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1. PREFACE

This document has been compiled on behalf of the Mid West Ports Authority to provide designers and contractors with the necessary guidance for buried services design and construction in the port area. It draws heavily on the Utility Provider manuals and codes of practices for construction guidance as these are considered best practice in the area at the time of writing.

The chapters of this guide include guidance on buried services generally and utility specific requirements for individual services. Multiple references have been used in the compilation of this guideline and should be referred to for more detailed information.

This document is not intended to replace bespoke project basis of design, design criteria or specifications, but is intended to provide developers, designers and contractors with a guideline for which their development must meet on a technical basis. This document will be used as a basis for identifying any shortcomings in the technical content, and thus ultimately accepting or rejecting a proposed development or current construction works.

2. SCOPE

2.1. GENERAL

This document provides design and construction guidelines for buried service including pits, pipes, cables, stormwater drainage and ancillary works, and forms part of the MWPA Development Guidelines.

While the majority of assets within the Port site will be MWPA-owned and operated, the major utility providers have well developed manuals and codes of practice. These are considered best practice for buried services unless stated otherwise.

Where documents are referred to in this part of the MWPA Technical Guidelines, the reference shall be taken to mean the most recent revision, unless noted otherwise.

Note: This guideline lists minimum requirements that should be considered. Where features of the standard design offered by the Contractor exceed the stated requirements, the contractor shall bring it to the attention of the Client's Representative for his approval.

This document shall be read in conjunction with the associated scope of work document, project specification and other supporting reference information schedules.

2.2. PRECEDENCE

As a general guide, where particular aspects are not covered in the MWPA Technical Guidelines or where conflict between documents exists, the following precedence for standards applies:

1. Statutory Regulations;
2. Project Specific Specification;
3. Standard MWPA Specifications;
4. This Guideline;
5. Design Codes and Standards; and
6. References.

Regardless of the general order of precedence, if there is a conflict between documents the clause presenting the more conservative and pragmatic guidance will govern. If in doubt, or in all cases where noncompliance is anticipated, clarification shall be sought from the MWPA.

3. GLOSSARY

For the purposes of this Guideline the following particular definitions apply:

Table 1: Glossary of Terms

Term	Definition
Design Life	Period of time the structure remains serviceable subject to fair wear and tear. Regular inspections and a reasonable level of periodic and as-needed maintenance will be required to ensure that the structure remains serviceable during its design life.
Authorities	Any statutory, public, municipal, government or administrative department, commission, authority, agency or entity with jurisdiction in connection with the WUC.
Company's Representative's Nominee	Means an individual appointed in writing by the Company's Representative under the Contract.
Contract	The agreement between the Company and the Contractor to which the Scope of Work pertains.
Company, Purchaser, Buyer	Refers to the Mid West Ports Authority (MWPA).
Contractor, Supplier	The person/s and/or organisation/s so named in the Contract.
Company's Representative, Purchaser's Representative or Buyer's Representative.	The person/s so named in the Contract.
Designer	Persons or Organisation responsible for the design of a proposed project.
Drawings	Engineering plans and drawings provided by the Designer as part of a proposed project's documentation package.
Execution Date	Means the date on which the Formal Instrument of Agreement is signed by the Company.
Equipment	Means the goods to be supplied by the Supplier.
Guideline	Means this Guideline for Buried Services.
Leaseholder	The person who pays the owner of a piece of land or a building in order to be able to use it.
Performance Defect	Means a failure of the Equipment or any part to satisfy a Performance Warranty.
Port Site	Geraldton Port.
Wet Commissioning	Commissioning when the product is moving through the plant at typical operation rates and quantities.
Work	Includes the Supply of Equipment.

For the purposes of this Guideline the following particular abbreviations apply:

Table 2: General Abbreviations

Abbreviation	Meaning
BOD	Basis of Design
DBYD	Dial Before You Dig
FAT	Factory Acceptance Testing
FEED	Front End Engineering Design
MWPA	Mid West Ports Authority
HAZOP	Hazard and Operability Review
HME	Heavy Mining Equipment
HSEC	Health, Safety, Environment and Community
HV	High Voltage
IFC	Issued for Construction
IFU	Issued for Use
Kw	Kilowatt
LV	Low Voltage
MIS	Management Information Systems
MTOs	Material Take Offs
MV	Medium Voltage
PC	Practical Completion
P&IDs	Piping and Instrumentation Diagrams
PEP	Project Execution Plan
PCS	Process Control System.
PLC	Programmable Logic Controller
PDT	Project Delivery Team
PFDs	Process Flow Diagrams
SCADA	Supervisory Control and Data Acquisition
SDRL	Supplier Data and Document Required List
SOW	Scope of Work
WUC	Means the whole of the Works to be carried out under the Contract
WPC	Western Power Corporation

4. RELEVANT DOCUMENTATION

4.1. GUIDELINE SERIES

This guideline should be read in conjunction with all other parts of the MWPA Technical Guidelines, and these should be followed if relevant:

- MWPA 000 Series – Port Development Guidelines
- MWPA 100 Series – Port Technical Guidelines General
- MWPA 200 Series – Drafting & Survey Guidelines
- MWPA 300 Series – Mechanical Guidelines
- MWPA 400 Series – Maritime Structures Guidelines
- MWPA 500 Series – Civil Engineering Guidelines
- MWPA 600 Series – Buildings and Structures Guidelines
- MWPA 700 Series – Electrical and Instrumentation Guidelines
- MWPA 800 Series – Rail Infrastructure Guidelines
- MWPA 900 Series – Additional Guidelines

4.2. STATUTORY REQUIREMENTS

In addition to the requirements of this part of the MWPA Technical Guidelines, all Projects shall be constructed to meet the requirements of all current Local, State and Federal Acts and associated Regulations:

- Western Australian Environmental Protection Act
- Western Australian Occupational Safety and Health Act (1984) and Regulations (1996)
- Western Australian Marine (Certificates of Competency and Safety Manning) Regulations (1983)
- Westerns Australian Mines Safety and Inspection Act (1994)
- Western Australian Mines Safety and Inspection Regulations (1995)
- Dangerous Goods Safety Act (2004)
- Port Authorities Act (1999)
- Maritime Transport and Offshore Facilities Security Act (MTOFSA) (2003)
- Environmental Protection Act (1986) and Regulations (1987)

4.3. STANDARD SPECIFICATIONS

The following standard specifications shall be adopted for Works covered by this Guideline:

Table 3: Relevant Australian Standards

No.	Title
Soil Compaction	
AS 1289.5.6.1	Methods of testing soils for engineering purposes – Soil Compaction and density tests – Compaction control test – Density index method for a cohesionless material
AS 1289.5	Methods of testing soils for engineering purposes – Soil compaction and density tests
AS 4969	Series of Standards: Analysis of acid sulfate soils - Dried samples - Methods of test

No.	Title
Electrical and Related Works	
AS 1102	Graphic Symbols for electrotechnical documentation
AS 1319	Safety Signs for the occupational environment
AS 1768	Lightning protection
AS 1882	Earth and bonding clamps
AS 2053	Conduits and fittings for electrical installations
AS 2373	Electric cables - Twisted pair for control and protection circuits
AS 2700	Colour standards for general purposes
AS 2885.1	Pipelines—Gas and liquid petroleum - Design and construction
AS 2967	Optical fibre communication cabling systems safety
AS 2978	Insulating mats for electrical purposes
AS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS 3008	Electrical installations – Selection of cables
AS 3017	Electrical Installations – Verification guidelines
AS 4058	Precast concrete pipes (pressure and non-pressure)
AS 4325	Compression and mechanical connectors for power cables with copper or aluminium conductors
AS 4437	Solderless crimped connections – General requirements, test methods and practical guidance
AS 5000	Electric cables – Polymeric insulated
AS 60529	Degrees of protection provided by enclosures (IP Code)
AS 61000	Electromagnetic compatibility (EMC)
Concrete and Related Works	
AS 2350	Methods of testing portland and blended cement
AS 3600	Concrete structures
AS 3610	Formwork for concrete
Piping and Related Works	
AS 1260	PVC-U pipes and fittings for drain, waste and vent application
AS 1477	PVC pipes and fittings for pressure applications
AS 3500	Plumbing and drainage
AS 2032	Installation of PVC pipe systems
AS 4058	Precast concrete pipes (pressure and non-pressure)
AS 4799	Installation of underground utility services and pipelines within railway boundaries

In addition, the following relevant guidance may be adopted for Buried Utilities:

Table 4: Relevant Design Codes and Other Industry Standards

No.	Title
Design Standard DS63	Water Corporation: Water Reticulation Standard – Design and Construction Requirements for Water Reticulation Systems up to DN250
WSA06-2008	Water Services Association of Australia Standards – Vacuum Sewerage Code of Australia
ISBN 1 74043 565 6	Water Corporation Plumbing Handbook
-	Utility Providers Code of Practice For WA
NCN MA00001	ATCO Gas Australia – Connection Process Handbook
NS 14.2	Network Standard – Underground Cable Installation Manual, Part II – Technical Requirements
HB01-2007	Western Power – Distribution Construction Standards Handbook
NS 05/2013	Western Power - Network Standard, Testing and Commissioning
	Western Power – Underground Distribution Scheme (UDS) Manual
017153a07	Telstra's Lead-In Trenching Requirements
ISBN 978-0-642-33313-1	Confined Spaces Code of Practice
Specification 201	MRWA – Quality Systems
Specification 302	MRWA – Earthworks
Specification 407	MRWA – Kerbing
Specification 501	MRWA – Pavements
Specification 503	MRWA – Bituminous Surfacing
Specification 504	MRWA – Asphalt Surfacing
Specification 803	MRWA – Dismantling and Demolition

4.4. OTHER REFERENCES

Table 5: Other Industry References

Item No.	Reference
4.4.1	*www.transport.wa.gov.au*
4.4.2	*www.midwestports.com.au*
4.4.3	*www.westernpower.com.au*
4.4.4	Water Corporation Design Standard DS 63 - Water Reticulation Pipelines Design Standard
4.4.5	Water Corporation Design Standard DS 50 - Design and construction requirements for gravity sewers – Sewers DN 150 to DN 600

5. GENERAL AND MWPA SPECIFIC REQUIREMENTS

5.1. CONTRACTOR AND WORKER REQUIREMENTS

All workers and contractors entering a MWPA controlled site are to be familiar with the MWPA Contractor and Worker requirement (Contractor Handbook). This can be found on the Mid West Ports website at:

www.midwestports.com.au/Health,Safety,Environment&Quality/Contractor&WorkerRequirements/ContractorHandbook

or can be provided upon request.

Most works on site will require completed and signed Excavation/Penetration Permit. Further information can be found on the MWPA website at:

www.midwestports/health,safety,environment&quality/permit system

5.2. LOCAL GRID FORMAT AND SURVEY SET OUT

All survey to be undertaken using survey datum Geraldton Coastal Grid 94 (GCG-94) unless otherwise noted on construction drawings. Vertical datum shall be Australian Height Datum (AHD).

The Contractor shall ensure that all survey controls installed remain uncovered and undisturbed. If so directed by the Company's Representative, the Contractor is responsible for ensuring that all marks remain visible, or pay the Licensed or Engineering Surveyor to reinstall any marks that have been disturbed.

The contractor is responsible for establishing and maintaining coordinate reference points and level control on site and is to notify the MWPA representative in the event of any disturbance of survey controls.

5.2.1. ONSITE SERVICE LOCATION

Before undertaking design or construction works the Designer or Contractor respectively shall undertake to locate existing buried utilities using MWPA utility drawings and the MWPA Permit to Work System for information to minimise impact of design and reduce the possibility of incidents during the works. 'Dial Before You Dig' (DBYD) information should also be collected to ensure a comprehensive overview of port utilities.

5.2.2. LOCATION OF EXISTING PORT UTILITY INFORMATION

MWPA maintains their own records of existing port buried services. Refer to Port infrastructure plans 010-G-0094 to 010-G-0127 for location of existing utilities within Port land.

5.2.3. LOCATION METHOD

Utility locations should be performed by Approved Plant Location (APL) organisations. Equipment used will include Ground Penetrating Radar (GPR) and electronic cable locators. Vacuum and hand excavation equipment will be used for potholing to expose and measure the depth of a service. The vacuum equipment will be mounted on a light truck.

5.2.4. STANDARD OF LOCATION

The level of confidence in the information related to buried utilities will be classed as follows:

LEVEL A: Confirmed 3D survey following potholing.

LEVEL B: Confirmed 2D surface location via non-intrusive methods such as Ground Penetrating Radar and Metal Detection. (Indicative depth will also be marked when available).

LEVEL C: Information available from service authorities via the "DBYD" service or MWPA. Note: Refer to DBYD information for utility tie-in outside of MWPA boundaries. For utility information within MWPA controlled boundaries refer to MWPA utility drawings.

LEVEL D: Utilities which have not been documented, but are thought to exist based on site observation or anecdotal evidence.

Services should generally be located two dimensionally on the surface (Level B) at five metre intervals and three dimensionally (Level A by potholing) every 20 metres, or closer spacing at changes in direction or intersection with other services. Where services cannot be located, plant locators will advise the MWPA and seek on-site assistance to locate or confirm the abandonment of the un-located service.

5.2.5. MARKING OF SERVICES

Once located, utilities should be marked either permanently or temporarily for survey pick up.

PERMANENT MARKING

Permanent marking is to be undertaken once a utility has been laid in its final alignment, backfilled and compacted. The alignment of high risk assets (high voltage and high pressure) shall be marked with permanent marking paint on paved, concrete and asphalt surfaces or a 300 x 450 x 250mm concrete slab flush with the surrounding ground over the utility route on unsealed surfaces. Direction paint/markers are required at 100 metre intervals and/or at a change of direction.

The concrete slabs shall have cast in them the words "DANGER UTILITY BELOW" and define the utility. Directional arrows indicating the route of the utility will also be cast into the slab.

BURIED WARNING TAPE

The contractor shall allow for the inclusion of buried warning tape when installing, replacing or relocating a utility. Minimum depth shall be 300mm from finished surface level. Maximum depth will be determined by Table B1 'Clearance Zones Guide – Clearance limits to underground services when undertaking works in road reserves' from the Utility Providers code of Practice for WA. Any depth between the minimum and maximum is acceptable.

Tape colour to conform with MRWA standard colours for utilities as set out under 'Temporary Marking' below.

TEMPORARY MARKING

Temporary marking is to be undertaken during investigative or temporary works on site, i.e. the temporary relocation of a utility.

Horizontal utilities will be marked on the surface of the ground with spray paint colour coded to MRWA standard for marking system:

- Communications Alert Orange
- Power Safety Red
- Gas Yellow
- Water Corporation Water Precaution Blue
- Water Corporation Sewer Safety Green
- Port Authority Assets White
- Fuel White

Alternatively survey pegs may be used with either spray paint or flagging in the colours discussed above as means of utility identification. Where pegs are used, there will be a peg at every change of direction or every 15m on straights. All available relevant information regarding the utility will be written on the peg, i.e. Utility Provider, type, size/diameter and depth. Arrows on the peg may be used to indicate utility direction.

Utilities located in three dimensions by potholing will have a PVC pipe inserted into the pothole. The bottom and top of the PVC pipe will be capped and the information about the service written inside the top cap, Utility Provider, type, size, diameter and depth. The PVC pipe will be cut such that the cap is level with the surrounding ground.

5.2.6. PROVISION OF AS CONSTRUCTED DATA

The Contractor shall complete all "As Constructed" and quality verification record documentation and submit all records, including Manufacturer's certificates, to the Company's Representative at regular intervals during the contract Period as agreed with the Company's Representative.

Quality verification record documentation shall be in a format acceptable to the Company's Representative. Manufacturer's and supplier's certificates shall enable a clear trace of items from source to the location within the Works.

The Contractor shall survey, using a suitably qualified person, the completed utility network prior to backfill and supply to the MWPA a copy of the data. This includes existing, temporary, redundant, removed and installed utilities. The data shall include the X Y and Z coordinates and be provided on the Geraldton Coastal Grid 94 in either .dwg or .dxf format.

Each utility will be on a separate layer, each layer will contain the Utility Provider, Conduit/cable size, Current State (existing, abandoned or installed) and Material type. This information may be shortened to a code to be confirmed with by the MWPA. Utility digital data colours will conform with the colours stated under **Section 5.2.5 Marking of Services.**

Alternatively the contractor may seek approval from the MWPA to supply As Constructed drawings clearly identifying the works which have taken place and accurately marking any deviation from design greater than 50mm.

5.3. LOCAL SITE SPECIFIC CONDITIONS

The general conditions for the Site are:

5.3.1. TEMPERATURE

Table 6: Temperature Statistics

Description	Condition
Mean Max Temperature	25°C
Mean Min Temperature	14.5°C
Highest Max Temperature	46.4°C
Lowest Temperature	0.8°C
Mean Number of Days above 30°C	50
Mean Number of Days above 40°C	4

For the purpose of this Guideline the maximum outdoor ambient air temperatures shall be taken as 45°C.

Unless otherwise stated, all components shall be rated to operate continuously under full load conditions in an ambient temperature of 45°C, with due allowance for the temperatures reached inside the enclosures, if any. All components shall be rated to operate at the temperatures which they will reach under these conditions and installed in such a manner and location.

5.3.2. RAINFALL

Table 7: Rainfall Statistics

Description	Condition
Yearly Average	455mm
Highest Monthly Fall	328mm May
Highest Number of Rain Days	14 days July

All equipment subject to outdoor conditions shall be protected to a minimum degree of protection of IP66 to AS60529.

5.3.3. WORKING IN A HEAVILY SALT LADEN ENVIRONMENT

When making design and construction decisions regarding materials for use within the port environment, consideration will need to be made to ensure they can adequately cope with the saline environment. Local water can have a chloride content of up to 1200ppm.

REINFORCED CONCRETE – any instances where reinforced concrete is used within the port, extra cover to reinforcement will need to be provided. See Table 4.8.2 under AS 3600 for cover to reinforcement in saline soils.

CORROSION –Consideration will need to be made when designing and installing assets within the port which may be prone to corrosion. Protection methods include, but are not limited to, Galvanic protection, anodic protection and selection of alternate materials. Other equipment including fixings or cables shall be marine grade.

5.3.4. DEWATERING

The Contractor shall allow in his Tender the cost of all dewatering and any additional construction cost due to wet ground conditions.

In the event of water being encountered, the Contractor shall make adequate provisions to ensure that the excavation is kept free from water during the process of concrete pouring and for a period of at least 24 hours after the pouring of concrete. No bedding or pipe shall be laid in water and trenches shall be kept free from water until backfill has been completed to above groundwater level. As stormwater pits and pipes are generally in or near mean sea level, it is expected that dewatering is likely to be required during construction.

Extracted ground water should be discharged in a way that satisfies relevant environmental legislation and is approved by the Company's Representative. Acid Sulphate soils may be encountered during excavation. The Contractor is to allow for appropriate management methodologies, including but not limited to the standard measures specified in the AS 4969 and the use of limestone dosing units, should the particular circumstance dictate this is required.

5.4. WORKING IN AN ACTIVE PORT ENVIRONMENT

Note: Port operations will always take precedence over other activities.

Refer to MWPA – Contractor and Worker Requirements (Contractor Handbook) for requirements whilst work is undertaken within a MWPA controlled site.

5.4.1. GENERAL PORT OPERATING ACTIVITIES

Works shall not affect shipping and other operations or facilities within the Port without prior written approval from the MWPA.

Shutdowns that affect the Port Users Operations normally require a minimum of six weeks' notice to arrange and may be subject to change at short notice. Shipping schedules are available from the MWPA, but are subject to change and must be regularly confirmed by the contractor.

All vehicles travelling in the minerals handling areas of the Port are required to use a dedicated orange flashing light. The use of hazard lights is not accepted as vehicles are unable to indicate when they are about to turn when hazard lights are in use.

5.4.2. PPE REQUIREMENTS

MWPA PPE requirements for visitors and operational personnel are described in **MWPA HSEQ Procedure 2.5**, available from the MWPA web page:

www.midwestports.com.au/HSEQ Policies and Procedures

MWPA expects that any additional PPE required to carry out works on buried services will be identified and used in accordance with safe working practices detailed on the project Safety Management Plan/JSEA.

5.4.3. PORT REPORTING REQUIREMENTS

The following information is required by the port as soon as it is available and shall be forwarded to the Company's Representative:

- Written records of daily toolbox and all safety meetings shall be provided to the MWPA's Representative as soon as they are available.

- Copies of all test results shall be provided to the MWPA's Representative as soon as they are available.
- All HSE incidents shall be reported to MWPA's Representative immediately with a written report describing the incident and response submitted within 48 hours of the incident occurring.

5.4.4. PROCESS FOR ROAD CLOSURES

Plans for traffic management of the site need to be approved by the MWPA to ensure that necessary access permits are obtained and the plans will not disrupt Port operations.

Refer to **MWPA Permit F2.20a** for information about applying for a road closure within the port.

5.4.5. MSIC REQUIREMENTS

If a buried service is designed to enter into or pass through a Secure area of the Geraldton Port a Marine Security Identification Card (MSIC) may be required to complete the works. Contractors should allow a minimum of six to eight weeks from time of application to receipt of card.

The extents of the Secure area can be viewed on the MWPA webpage at:

www.midwestports.com.au/Port_Security

The MSIC card is not free and requires a background check and processing time. This should be considered when planning works that will interact with the Secure area.

Further information about the MSIC card is available at the MWPA web page:

http://www.midwestports.com.au/Port Security/MSIC

5.4.6. SEPARATION OF SERVICES

Separation of services should comply with the Utility Providers Code of Practice for WA (UPCPWA). Instances where compliance cannot be achieved, discussions between the respective utility authority and the MWPA should be undertaken to reach a mutually beneficial outcome. Instances where there is insufficient corridor width to maintain utility offset as per the UPCPWA all care should be taken to maintain utility order from the boundary; such as Power, Communications, Gas, Water, Power, Communication Mains and Trunk, Storm and sewer utilities, whilst taking into account minimum clearance requirements for individual utilities. The removal of redundant utilities as encountered is necessary to enable utility corridor functionality.

5.4.7. UTILITY PROVIDER ACCESS REQUIREMENTS

While the majority of utilities within MWPA are privately owned, utility providers may require port access in order to maintain their assets.

Any party that wishes to carry out work within a MWPA controlled area will need to refer to the MWPA's permit system, on the MWPA website under:

http://www.midwestports.com.au/permit_system.aspx

5.4.8. WORKING IN CONFINED SPACES

A Confined Space Entry Permit shall be obtained when carrying out work in pits or other confined spaces as defined by 'Confined Spaces code of practice'. Refer also AS 2865 – Safe Working in a Confined Space. **Section 11.5** of the **MWPA Contractor's Handbook** provides more information and permit applications are available on the MWPA website.

5.5. SAFETY IN DESIGN

MWPA promotes the use of Safety in Design to consider options to reduce potential hazards and increase the safety of all stakeholders of the Port. A Safety in Design risk review shall be provided for all buried services projects unless otherwise agreed by the Project Manager.

- A Safety in Design approach needs to begin early during the design phase and requires consideration of all stages of the life of the asset, not just construction risks. A Safety in Design review should consider how the assets will be interacted with during:
  - Construction;
  - Normal operations;
  - Emergencies;
  - Ease of maintenance;
  - Future works on or around the asset;
  - Decommissioning.

By considering the full life of the asset a designer can anticipate scenarios and modify designs to reduce the hazards, or if mitigation isn't possible can provide advance warning that additional policies and procedures will be required.

The types of situations which may occur, but not limited to, and lead to hazards include:

- Manual handling of materials;
- Specification of hazardous substances;
- Inhalation of dust from sawing/drilling/coring activities;
- Confined spaces working (within pits);
- Uneven finished surfaces due to differing pit and conduit levels;
- Deep excavations;
- Maintenance in pits close to ongoing operational machinery or vehicles;
- Striking existing services while excavating for new containment works;
- Working around and moving existing live electrical assets;
- Sharp edges to conduit ends, transition boxes;
- Accidental release of contaminants during demolition.

A basic Safety in Design risk table is provided in Appendix B.

5.6. DESIGN CRITERIA

The work includes, but is not limited to, the following:

- Installation of new buried services;
- Installation of temporary buried services;
- Realignment and relocation of services;
- Protection of existing services.

Design information should include the proposed alignment set out from the edge of road reserve, stating typical cover with any changes to cover noted. Notation should include the number of conduit per trench, conduit size and material type, as well as method of installation. For example, bore shot or trenching.

All connections to existing utility networks should be highlighted and detailed.

Where design of new services cannot meet the depth of cover requirements shown in Figure 1, appropriate protections to mitigate the lack of cover shall be considered an essential part of the design.

5.7. PROTECTION FROM WEATHER

The Contractor shall provide all plant, materials and labour necessary to protect the Works from damage by inclement weather or any other causes. Low points or excavations where water may collect shall be kept thoroughly drained by mechanical or gravitational means. Drains or watercourses utilised for this purpose shall be cleaned out and maintained free of silt or other material to the satisfaction of the Company's Representative.

The Contractor shall prevent, in so far as is reasonably practicable, any material entering any gully, manhole or pipe, and shall remove from the drainage system any material from any source which may be deposited in the drainage system by any agency.

5.8. PROTECTION OF EXISTING SERVICES

It is a MWPA requirement that no changes or alterations are made to any Navigation Aids, Lights or Beacons without the express permission in writing from the MWPA Harbour Master. The Contractor must also ensure that the Navigation Beacons' lines of sight are not disturbed by any machinery or activities on site.

Particular care must be taken by the Contractor to avoid damage to all existing services and all brackets, posts and fittings for them. The Contractor shall arrange and pay for all reasonable measures to prevent damage to any services, shall be responsible for all costs involved in making good any damage to services, and shall provide all assistance necessary to permit expeditious repairs.

Where possible, protection of existing buried services is preferable to relocation and should be considered where:

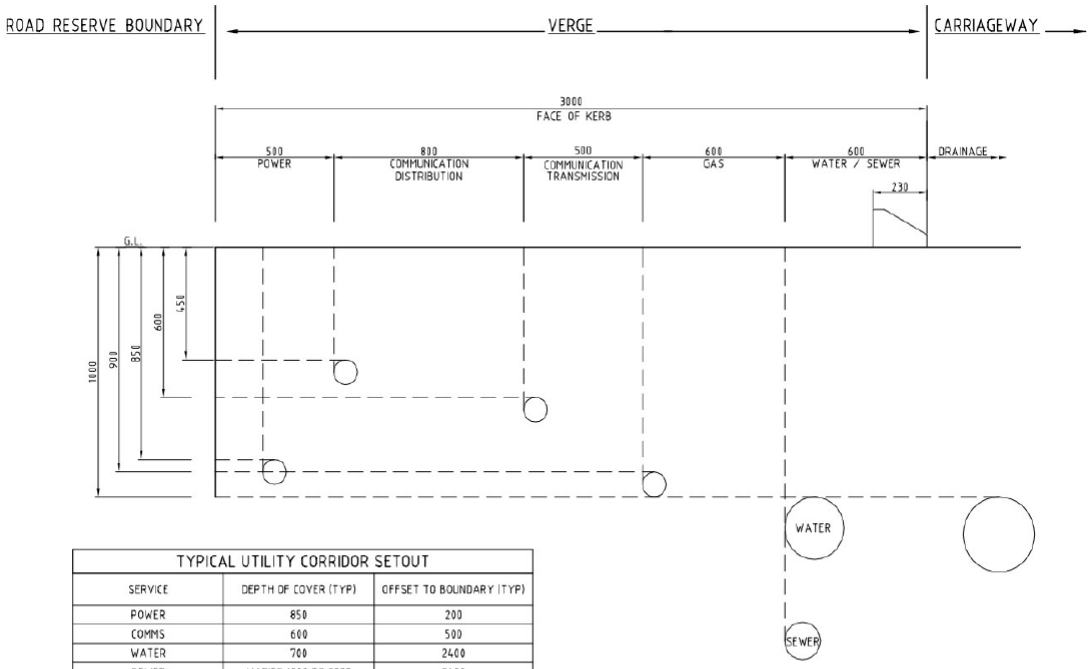
- The works will not affect the final alignment of the existing assets;
- The works are adjacent to or will not interact with the existing assets;
- The costs of relocation should also be considered as part of the design solution. This includes the effect of a shutdown, in addition to the cost and lead times for replacing the existing assets.

To avoid clashes a service corridor allocation is used to separate services. Section 5.8.1 shows the standard service corridor allocation from the Utility Provider's Code of Practice for Western Australia. Where there is insufficient road reserve additional protection measures shall be considered.

Note: Where abandoned services are encountered as part of the Works, they are to be removed as part of the project wherever practicable. This information is to be recorded along with other As Constructed information.

5.8.1. UTILITY DEPTH GUIDELINE AND GENERAL MWPA REQUIREMENTS

The following figure from the Utility Provider's Code of Practice shows the standard service corridor allocation MWPA wishes to achieve. Due to the numerous existing live and redundant buried services in the port, it is noted that these allocations may not be achieved in all cases.



TYPICAL UTILITY CORRIDOR SETOUT		
SERVICE	DEPTH OF COVER (TYP)	OFFSET TO BOUNDARY (TYP)
POWER	850	200
COMMS	600	500
WATER	700	2400
SEWER	VARIES 1000 TO 2000	2400
GAS	850	1800
DRAINAGE	1000 (MIN)	N/A

MIN. AND MAX. DESIGN DEPTHS		
UTILITY	MIN. DEPTH (mm)	MAX. DEPTH (mm)
TELSTRA	600	1000
WA GAS	750	1500
WESTERN POWER	600	1200
WATER CORPORATION	600	1000

Figure 1: Service Corridor Allocation

NOTES:

1. Nominated designer to submit detailed design for proposed utility alignment in three dimensions. Design must take into account the 3D location of existing utilities. Design to be submitted to the MWPA for approval.
2. All measurements relate to distance from the edge of road reserve on either side unless otherwise specified.
3. All conduit installed must be left with draw wires.
4. Approval may be sought from the MWPA to omit conduit and install steel wire armoured (SWA) cables or direct buried cables as an alternative. This methodology is entirely dependent upon the levels of risk associated with this type of installation.
5. Although the diagram shows a single utility service within each corridor, these may be multiple services of similar utilities.
6. Utility services may be located beneath the carriageway where verge space is insufficient. Consultation must be made and agreements obtained with all relevant Utility Providers and the MWPA.
7. Electricity to pass under Gas and Water at Reticulation crossings.
8. Gas to pass above Water at Reticulation crossings.
9. A minimum clearance of 300mm is required between gas and other utility services. If 300mm clearance cannot be achieved, approval of the gas provider shall be obtained.
10. A minimum clearance of 150mm is required between Sewer main and other utility services and between Water main and other utility services (note clearance of Reticulation services may vary from this value).

11. All Reticulation to be laid within +/-100mm wherever practicable of the indicated centre line and secured against movement with backfill. Some utility practices may vary from this requirement, particularly for multiple utility services
12. Low voltage cables used by non-network provider for street lighting may be installed in the 2.4 – 3.0 metre corridor. All Electricity network provider cabling must be installed at a minimum depth of 850mm. Cable joints shall have a minimum cover of 750mm. All other low voltage cabling shall be installed at a minimum depth of 600mm. Refer to Section 5.1.2 of the Utility Provider's Code of Practice for WA for more detail.
13. HV power cables can be located in the same corridor as LV, however HV assets should increase depth of cover by 300mm to maintain clearance between high and low voltage assets. Where this occurs, place additional electrical asset warning tape between the two assets to alert future contractors to the presence of the deeper services.
14. Where there are problems with the 0 to 0.5 metre alignment, power may be installed on the 2.7 metre alignment subject to approval by the Power authority.
15. Where the situation permits, and with MWPA approval, additional empty conduit should be installed to allow for ease of utility expansion in the future.
16. It is a MWPA's preference to install additional empty conduit at road and rail crossings. Seek MWPA guidance for number of.
17. The removal of redundant utilities as encountered is necessary to enable utility corridor functionality.
18. Utility pits shall be provided on either side of any road or rail crossing for cable based utilities.
19. Fuel pipelines do not have a standard alignment under the WA Code of Practice. Route classification can be determined from Section 4 of AS 2885.1. Depth of cover based on route classification and additional protection requirements are included in Section 5 of AS 2885.1.

BEDDING REQUIREMENTS

Sand used for bedding shall be clean sand free of rocks, lumps of clay, vegetation, building waste, metal, glass or other material that is likely to damage cables or conduits. Nominal bedding depth shall be a minimum of 80mm thick and compacted to match the surrounding soil.

Individual utility provider may have additional requirements (e.g. water reticulation in accordance with Water Corporation's Drawing BD62-1-1).

5.8.2. TYPICAL UTILITY SIZE AND MATERIAL RANGE

The following are considered typical sizes and materials for existing buried service pipes and conduits that may be encountered on a brownfields site.

TYPICAL MATERIALS

The following are typical abbreviations for common utility service conduits and pipes. These abbreviations are commonly used in DBYD information and service provider documentation.

PE	Polyethylene	**CI**	Cast Iron
MDPE	Medium Density Polyethylene	**CU**	Copper
UPVC	Unplasticised Polyvinyl Chloride	**GI**	Galvanised Iron
RCP	Reinforced Concrete Pipe	**AC**	Asbestos Cement
S	Steel	**GS**	Galvanised Steel
MSCL	Mild Steel Concrete Lined		

TYPICAL PIPE AND CONDUIT SPECIFICATIONS

Pipe materials and dimensions should suit their purpose and the local environment, typical materials and classes to be used within MWPA controlled areas are provided below. Variations required due to local conditions or special requirements should be detailed in project specific documentation.

Table 8: Pipe Class Criteria

Service	Criteria
Sewer	Unpressurised sewers shall be UPVC, DN100 pipes shall be SN6, DN150 to DN375 pipes shall be SN8. Where the depth of cover to the top of the pipe exceeds 7.0 m but is less than 9.5 m, SN16 pipes shall be used. Pressurised sewers shall be UPVC and shall have a PN rating to suit the diameter and flow.
Water	Blue Brute UPVC. As per Table 3.2 of Water Corporation Design Standard DS63, with a Pressure Rating of PN12 or 16 as per Table 3.1 of Water Corporation Design Standard DS63.
Stormwater	Reinforced Concrete Pipes shall be minimum Class 3 as described in AS4058. Subsoil drainage can be concrete or UPVC. Where UPVC is used it shall be minimum class SN8 as described in AS1260.
Electrical and Communications	Electrical cables are to be armoured and suitable for direct burial. Communications conduits shall be Heavy Duty UPVC or PE.

5.8.3. ROAD CROSSINGS

Where cover dictated by the relevant utility authority cannot be achieved, consultation must be made and agreements obtained with the relevant Utility Providers and the MWPA in regard to utility protection methods.

In cases where a utility must be relocated due to Works, consultation must be made and agreements obtained with the relevant Utility Providers and the MWPA as to the new route of the utility or potential decommissioning.

When a utility can remain in place however above minimum cover requirements, protection methods may be enlisted including but not limited to: cement stabilised sand, concrete encasement and placement of reinforced concrete slab.

All electrical utilities to be steel sleeved under road and rail, conduit to be heavy duty.

5.8.4. DESIGN, INSTALLATION, TESTING, COMMISSIONING AND SERVICING

Different utility types have different Installation, testing and commissioning requirements. As the following utility providers hold a majority of the utility assets in the overall network their standards have been chosen as a basis to be followed within the port. The advantages of this adoption include availability of parts, materials and specialist contractors will already have an understanding of the requirements stated within the standard.

5.8.5. TRENCHING AND BORING

TRENCHING

Where trenches are required for utility installation the Contractor shall take all due care to comply with safe working practices, such as the West Australian Code of Practice: Excavation.

Where a trench is more than 1.2m deep and a person must enter the trench to work protection shall be considered. Potential protection methods may include:

- Shoring.
- Trench wall compaction.
- Safe slopes.

In addition to trench construction, general safe working practices, such as never working in isolation, consideration of spoil placement and daily pre work inspections, can decrease the risk of an incident.

Trenches shall be backfilled to match the surrounding ground surface height. Compaction should match the surrounding soil and should be compacted in 150mm layers.

TRENCHING THROUGH ROADS AND PAVED SURFACES

Where boring or horizontal drilling is not suitable and an existing road or paved surface will be modified, effort should be to carry out the works in a neat manner.

Saw cuts shall be used to isolate the surface treatment area to be removed.

Backfill is to match the composition and compaction rating for the surface requirements. If the original design requirements are not available then **MWPA503 – Guidelines for Roads & Pavements** shall be used.

Reinstated pavement and surface treatments shall create a seal between the original and reinstated surface to prevent ingress of water.

Final surface shall match the existing and any road or surface markings are to be reinstated.

BORING

Instances where longitudinal drilling is employed to install a utility, the contractor must carry out adequate investigation of the proposed utility alignment to ensure the location of all existing utilities have been accurately recorded. This investigation includes but may not be limited to:

- Relevant MWPA permit/permits to be completed under the MWPA permit to work system.
- Under Health, Safety, Environment & Quality on the MWPA website.
- Dial Before You Dig application.
- Investigation of the Mid West Ports Authority Infrastructures maps 010-G-0094 to 010-G-0127.
- On site investigation using ground penetrating radar recorded with ground survey.
- On site investigation using potholing methods (i.e. vacuum truck for non-destructive investigation) recorded with ground survey.

BORING UNDER RAILWAYS AND ROADS

MWPA requires all under rail and under road crossings to be steel sleeved.

Boring under railways requires extra consideration. Section 3.6 under Australian Standard 4799 discusses the requirements for boring and jacking of pipes under tracks.

All electrical utilities to be steel sleeved under road and rail, conduit contained within sleeve to be high density.

It is a MWPA preference to install additional empty conduit at road and rail crossings. Seek MWPA guidance for number of.

SUPPORT OF EXISTING SERVICES

In excavations where a utility may run unsupported for any length, support methods will need to be enlisted to ensure no permanent damage occurs to the utility whilst works are undertaken.

Support structures should be spaced at a maximum of 1.5m apart.

5.9. PIT CONSTRUCTION

All pits within the port environment are to be insitu concrete or prefabricated, fibre reinforced concrete and suitable for the environment, as per **Section 5.3.3** of this document.

5.9.1. PIT LIDS

All lids are to be minimum Class E trafficable Gatic lids or similar approved as per Table 3.1 – Load Classification of Covers and Grates under AS 3996.

Unless directed otherwise by the Company's Representative, pits are to be installed so that the lids are flush with the surrounding surface.

Pit lids should identify and label the utility within, e.g. communications, electrical, drainage, etc.

5.9.2. PIT DRAINAGE

Drainage holes shall be provided in the pit base except where the base of the pit is below the water table level.

Where pits extend below the permanent water table level, provide an exterior water proofing membrane to the section of the pit which is below the water table. Do not provide a drainage hole in the base of these pits but on the side a minimum of 75mm above the water table level. The Contractor/Designer will need to take into account the effects of buoyancy when designing/constructing pits which extend below the water table.

5.9.3. PIT SIZING

Pits should be sized suitably for their purpose. Larger pits, suitable for two people to work in, will be required in situation where:

- Spare cable will be looped and stored in the pit;
- Cables will be joined or spliced within the pit;
- The pit forms the intersection of more than two cable alignments;
- On either side of road/rail crossings;
- Conduit depth is lower than standard requirements.

Pits designed to be entered shall be a minimum of 1200mm internal diameter.

Pits designed to be entered shall be fitted with suitably spaced step irons. Maximum step-down distance shall be 600mm and maximum step-up shall be 300mm. Where step irons are installed they shall be aligned with the access cover if the entire lid is not removable.

5.9.4. CONDUIT ENTRY

Conduit entry shall be a minimum of 100mm above the pit base.

Holes for conduit entry should be cut, not broken and the entry sealed after conduits are installed.

Pit bushes are to be provided to conduit ends to protect cables from sharp edges during pulling.

6. WATER, SEWER AND DRAINAGE

6.1. SCOPE OF SECTION

The Port site has a number of water services onsite including water, fire services, stormwater and sewerage systems.

6.2. WATER SERVICES, GRAVITY SEWERS, VACUUM PRESSURE MAINS AND PITS AND ACCESS CHAMBERS

See Section 5.8.1 for utility allocation requirements or refer to the relevant provider's plumbing guide i.e. Water Corporations 'Plumbing Handbook – a guide to working with Water Corporation' for installation details and construction guidelines.

6.2.1. WATER RETICULATION

When designing water reticulation between 100mm and 250mm in diameter, special consideration must be made to the horizontal forces placed on the pipe network. Unbalanced hydrostatic forces at axially unrestrained pipeline joints (e.g. socketed bends, tees, tapers, blank ends) can move installed pipes in the ground and cause leakage. These forces should be managed through the use of thrust blocks. Refer to Water Corporation standard drawings BD62-002-004-01 and BD62-002-005-01 for details of standard thrust block designs.

Larger pipes will require a specific design solution.

6.2.2. STORMWATER DRAINAGE

Precast concrete drain pipes shall be in accordance with AS 4058:2007, and as amended from time to time. Concrete pipes shall be of a spigot and socket rubber ring joint type. Strength class shall be Class 3 as specified on the Drawings, and shall have additional cover to allow for the aggressive marine environment.

INTERCEPTOR PITS

Hydrocarbon interceptor pits to capture hydrocarbons are required on all drainage lines prior to discharging into external drainage, infiltration basins or the ocean.

Interceptor pits shall be identified as such from the surface and be located in an area accessible to vehicles to facilitate maintenance and draining.

Specific interceptor pits are designed for use within zones influenced by tidal movements. All interceptor pits which discharge into the ocean must be of this type.

6.2.3. LAYING AND JOINTING OF PIPES

The barrel of each pipe shall be firmly bedded on specified material for its whole length except above the base slab at manholes where the pipe shall be wholly supported by concrete. All pipes shall be laid to the correct level and in the correct horizontal position within the tolerances permitted. Pipes shall be laid and jointed within four hours of completion of the preparation of the bedding to receive them.

Concrete pipes shall be laid and jointed in accordance with the manufacturer's instructions so that the rubber rings are correctly seated and that flexibility at the joints is maintained.

7. POWER AND ELECTRICAL

7.1. SCOPE OF SECTION

The Port has a dedicated substation and high and low voltage power cables are present throughout the site.

7.2. POWER IDENTIFICATION

High and low voltage power has different requirements during both the design and construction phases.

The two voltage types should be clearly differentiated in all design documentation as there are significant safety implications when managing high voltage works.

High voltage assets should be clearly marked on site as per **Section 5.2.5 Marking of Services** with the addition of 'HV' clearly marked on the tile.

7.3. PITS AND PIPE NETWORK

In addition to the requirement in **Section 5.9 Pit Construction** the following requirements must be considered during design.

Cable pits shall be provided as per the requirements outlined within the Western Power Installation Manual Part II. In all instances pulling tensions must be taken into account to determine distance between access pits. See Appendix B - Cable Installation Data under the Western Power Installation Manual Part II.

Multiple changes in direction on a conduit run without a pit is generally unacceptable unless approved for a specific purpose.

Conduit shall be laid level to prevent water pooling within depressions. Where a depression is necessary to the design, crossing under a gas pipe, the conduit end shall be stoppered around the installed cables to prevent the ingress of water.

Where HV and LV power are laid in the same trench HV shall be below the LV with 200mm of bedding sand between them.

7.3.1. CONSTRUCTION GUIDELINES

The Western Power Distribution construction standards handbook and Network Standard provide further guidance on construction of power infrastructure.

Contractors are to familiarise themselves with the Underground Distribution Schemes (UDS) manual produced by Western Power under

http://www.westernpower.com.au/Land_development/Guidelines_and_Manuals/Underground_distribution_schemes

8. TELECOMMUNICATIONS

8.1. SCOPE OF SECTION

Telecommunications cables, including external communication links and internal voice and data links are present at the Port.

8.2. FIBRE OPTIC

Fibre optic communications on site shall be installed as per the design and in accordance with manufacturer's standards.

Exceeding the Manufacturer's maximum stated bending radius is unacceptable and shall be considered grounds for replacement at the Contractor's cost.

Fibre optic cables shall be installed in a continuous length; joints in new cable will not be accepted unless they are an approved part of the design.

Procedures for working safely with fibre optic cable are described in AS 2967 Section 5: General Health and Safety and shall be adhered to.

8.3. OTHER COMMUNICATIONS CABLES

Traditional coaxial, twisted pair and multicore cables may be in use throughout the Port for telecommunications, CCTV and SCADA.

The bending radius, electromagnetic separation and shielding and other construction requirements for these cables will be defined by the manufacturer's documentation and any the project specific specification.

Where works take place in proximity to existing communication installations additional care should be taken to avoid impacting the existing cables. Where existing communications cables must be relocated or replaced an effort should be made to ensure materials and system documentation are available for remediation prior to starting Works.

MWPA CONTROLLED SPACE

Work carried out within MWPA controlled space by communication authorities, including but not limited to Telstra and NBN Co and their contractors will work to MWPA rules and must indemnify MWPA.

EXISTING ASBESTOS ASSETS

Should any known instance of existing asbestos infrastructure be within the WUC areas, the contractor is to allow a provisional sum for the inclusion of an accredited asbestos removal contractor to remove and make good the site.

Should any unknown instance of existing asbestos infrastructure be encountered during works the Contractor shall immediately halt works and contact the Company's Representative for further instruction.

9. OTHER SERVICES

9.1. SCOPE OF SECTION

This section describes other types of utilities that are present at the Port site.

9.2. FUEL PIPELINES

Existing steel Berth 6 Fuel Pipelines (1 x 300mm dia. and 1 x 150mm dia. nominal) and refuelling assets are owned by MWPA and operated/maintained by Shell Australia Pty Ltd and BP. Refuelling assets within the Fishing Boat Harbour are also owned by MWPA and operated/maintained by Baileys Marine Fuels.

Liaison with the MWPA, Shell, BP and Baileys will be required before any work affecting these services is undertaken or planned. Work Permits are required if carrying out work on equipment in the tank farm, fuel discharge infrastructure or fuelling equipment. These permits would need to be accessed from BP or Shell as the case may be. In these situations the MWPA must be informed of the requirements of the permits. A MWPA permit will be required to overarch fuel company permits.

The existing steel Berth 6 Fuel Pipelines are critical infrastructure to the MWPA, Shell and BP and therefore a very high emphasis will need to be placed on safety measures, timing and planning, testing and Quality Assurance measures, supervision and Contractor selection.

These works will need to be sub-contracted out to a MWPA, Shell and BP approved subcontractor.

9.3. SALT WATER PIPES

Salt water pipes are in use on the Port site in Port leased areas. These pipes are used and operated by the fishing company Leaseholders. Both the Leaseholder and MWPA must be consulted during the design stage should they appear to be impacted by the Works.

9.4. GAS NETWORKS

There are currently no live gas assets at the Port site. The redundant gas network is connected to a live meter. Gas supplied from a gas utility-owned main in Marine Terrace terminates at a meter adjacent to the Northeast top of the bulk handling facility access ramp to Gillam Road.

The process for requesting a commercial or industrial gas connection is detailed in Section 7 of ATCO Gas Australia's Connection Process Handbook.

The Port site already contains many services and the service corridor allocation for gas may not be currently available. Designers should take this into account and check the existing service plans and on site for capacity.

Where the service corridor does not maintain minimum separation of services, seek advice from the gas provider as to the preferred method of protection.

10. QUALITY ASSURANCE AND TESTING

10.1. GENERAL

The Contractor shall at all times be responsible for achieving the specified standards and demonstrating such achievement through testing and measurement and the provision of documentation which shall cover all work under the Contract, both onsite and offsite and shall include the activities of all Subcontractors and Suppliers.

10.2. TRACEABILITY

Traceability is required for all materials. The trace shall start at the specified or nominated source point and finish at the location where the material is incorporated into the Works and/or removed from site. (Refer also **MWPA Procedure 2.37: Contaminated Sites Management**)

10.3. INSPECTION

The MWPA's Representative shall at all times be provided access to any facility where work associated with the Contract is being performed, including the facilities of subcontractors or suppliers either on-site or elsewhere.

10.4. TESTING

10.4.1. GENERAL REQUIREMENTS

The Contractor shall carry out all necessary inspections and tests in order to demonstrate that all materials, equipment and workmanship are in accordance with the relevant standards and specifications, and that it is in accordance with MWPA requirements and Contractual requirements.

All inspections and tests shall be conducted within normal MWPA office hours, unless otherwise authorised by MWPA. MWPA always retains the right to witness any and all inspections and tests, at the sole discretion of MWPA. Surveying processes to verify conformance shall be conducted by personnel with a minimum qualification for acceptance to the SSSI (Surveying and Spatial Sciences Institute).

NOTIFICATION

The Contractor shall notify MWPA at least seven (7) days in advance of the date, time and place where the inspections and/or tests will be carried out and provide a detailed test plan.

MWPA may, at its discretion, nominate a representative who will witness all or part of the inspections or testing. If a MWPA representative attends an inspection or test, the Contractor shall ensure that all inspection and test sheets that were witnessed are appropriately annotated and signed by the MWPA representative.

If a MWPA representative is not nominated or does not attend, the Contractor shall proceed with all inspections and tests on the date and time proposed and submit all inspection and test sheets to the MWPA representative.

10.4.2. TEST FREQUENCY

Sampling methods shall be unbiased and either random or systematic in concept or as specified. For testing of backfilled trenches particular regard shall be required for compaction around and over structures such as manholes and gullies, and under and around pipes.

The frequency of tests shall at all times be adequate to demonstrate the work's conformance with the Specification. The minimum frequency of tests are listed below.

MINIMUM TESTING FREQUENCY

The minimum frequency of testing to determine the conformance of works processes with specified requirements shall be as follows:

Table 9: Minimum Testing Frequency

Process	Quality Verification Requirement	Minimum Testing Frequency
Pit and Pipe (Comm's and Power)	Materials "As Constructed" survey	1 supplier's certificate per delivery 1 per conduit alignment between pits
Pit and Pipe (Comm's and Power)	Mandrel Testing	1 test per 30m (linear) of pipe Changes of direction outside of pits
Electrical and Communications Cables	Materials Signal Testing Electromagnetic Interference	1 supplier's certificate per delivery 1 test per signal path 1 test per installation
Sewers and Stormwater	Materials "As Constructed" survey	1 supplier's certificate per delivery 1 per sewer/drainage line
Sewers and Stormwater (Gravity)	Water Test	1 test per 30m (linear) of pipe
Sewers, Water Mains	Pressure Testing	1 test per pressurised section of the network
Trench Backfill (General)	Compaction Standard	1 test full depth per 30m (linear) of trench
Trench Backfill (Over Concrete Encasement)	Compaction Standard	1 test full depth per 10m (linear) of trench with encased utility

10.5. MEASUREMENT AND TEST EQUIPMENT

Measurement and test equipment shall include all equipment necessary for the proper setting out and for production and conformance testing of the Works.

10.5.1. MATERIALS QUALITY VERIFICATION

Pits and pipe materials supplied to MWPA or to MWPA's nominated personnel shall be fit for purpose and comply with Australian Standard 2053.1 requirements for:

- Mechanical Strength;
- Resistance to Heat;
- Resistance to Burning;
- Electrical Characteristics.

Electrical and Communication cables will be fit for purpose and devoid of physical defects when installed. Insulated electrical cables and serial communications cables shall not produce electromagnetic fields larger/stronger than described in the manufacturers documentation.

Concrete pipes shall comply with Section 2 and 3 of Australian Standard 4058 for materials and manufacturing requirements.

It is expected that these tests will be carried out by the manufacturer and a certificate of compliance shall be provided to MWPA for materials used on site.

10.5.2. AS CONSTRUCTED SURVEY

As Constructed survey shall function as a test of utility alignment. Utilities should remain with the allocated road reserve corridor or follow the route approved as part of the Project Documentation.

Undocumented and unapproved deviations from the approved route shall be considered as a failure condition of this test and MWPA may require remediation to correct.

10.5.3. MANDREL TESTING

When testing conduit the Contractor shall carry out a pull-through test with a standard mandrel to prove the straightness, concentricity and internal diameters of the installed ducts.

MWPA reserves the right to require the Contractor to pull through a reasonable length of the actual cable that will be run through the conduit, in addition to the standard mandrel test, or replacing the standard mandrel test, to ensure that internal bend radii are sufficiently large to allow the cable to pass through.

The mandrel length shall be four times the conduit internal diameter and with a diameter of 95% of the internal diameter of the conduit being tested.

10.5.4. SIGNALS TESTING

Electrical and communication cables shall be tested as to ensure signals or electricity is being transmitted from along the length of the cables without interference or drop out.

The Contractor shall notify MWPA whether these tests shall be carried out after installation with independent testing equipment and unterminated cables or during commissioning with the final equipment.

10.5.5. WATER TESTING

Leak testing of installed gravity systems shall be carried out as per Australian Standard 3500.3. A successful test will require no make-up water after five minutes.

10.5.6. PRESSURE TESTING

Pressure testing of services shall be carried out as per Water Corporation Design Standard 63. A reading, from the lowest point of the section, of 1.25 times the design pressure or 1200 Kpa, maintained for at least one hour, shall be considered a success.

Pressure testing shall be carried out prior to backfilling trenches.

10.5.7. COMPACTION STANDARDS

Compaction testing of the surrounding area shall provide a baseline for compaction of backfilled trenches and excavations in regular soil.

Compaction of excavation under roads or other surfaces shall meet the original design guidelines for that surface.

10.6. RECORDS AND REPORTING

The Contractor shall provide all "As Constructed" and quality verification certificates, including Manufacturer's certificates to the MWPA's Representative at regular intervals during the Contract Period as agreed with the MWPA's Representative.

Quality verification pro-forma shall be in a format acceptable to the Company's Representative. Manufacturer's and supplier's certificates shall enable a clear trace of items from source to the location within the Works. Example pro-forma are provided in Appendix A.

APPENDIX A

SAMPLE QUALITY VERIFICATION PROFORMA

ITEM A1 - QUALITY ASSURANCE CERTIFICATE: CONDUIT INSTALLATION

Project Title:			
MWPA Project No.:		**Date:**	
Principal:			
Contractor/Developer:			
Description of Works / Separable Portion of Works / Equipment:			

1. Conduit Installation

Test Method

☐ Mandrel Testing ☐ Other Specify .....

Test Locations (Diagram to be attached or drawn)

Test Results

Test No.	1	2	3	4	5	6	7	8	9	10
Result										

Date Tested: .....

Testing Authority: .....

Signed: .....

Signed laboratory result sheets appended to this certificate: ☐ Yes ☐ N/A

2. Geometrics

Marked up plan of surveyed levels submitted to Superintendent

....

Surveyor (Print Name) Signature Date Surveyed

3. Verification

Section conforms: ☐ Yes ☐ No

Date Results Submitted to Superintendent: .....

Signed (contractor): .....

APPENDIX B

SAMPLE SAFETY IN DESIGN RISK TABLE

ITEM B1 - SAFETY IN DESIGN RISK ASSESSMENT

Design Life Cycle:	Investigation and Design	Setup, Construction and Commissioning	Operation	Maintenance	Disposal

Job Name:			Job No:		Design (Type of service):								Date:			
Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating			Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating			Comments
					C	L	RR					C	L	RR	
N/A	Manual handling of materials.	Setup, Construction and Commissioning.	Muscular-Skeletal injuries to operatives.	Minimise weight of individual components. Where possible, design out arrangements, obstacles etc. which potentially make manual handling more difficult.	B	3	Medium	Provide mechanical handling equipment where practical. Train operatives in good manual handling techniques.	Civils Manager, Site Engineer.	Before site works commence.	To be included in the contractors safety plan.	B	2	Low	
N/A	Striking existing services while excavating for new containment works.	Setup, Construction and Commissioning.	Electrocution of operative, damage to infrastructure.	Full services search & survey undertaken in advance.	E	2	High	Contractor's safety plan in place. "Dial before you dig", Port services plans.	Civils Manager, Site Engineer.	Before site works commence.	To be included in the contractors safety plan.	E	1	Medium	

RISK ASSESSMENT MATRIX

			CONSEQUENCE				
			MINOR A	MAJOR B	SEVERE C	CRITICAL D	CATASTROPHIC E
LIKELIHOOD	VERY UNLIKELY	1	Low	Low	Medium	Medium	Medium
	UNLIKELY	2	Low	Low	Medium	Medium	High
	POSSIBLE	3	Low	Medium	High	High	High
	LIKELY	4	Medium	Medium	High	High	Extreme
	ALMOST CERTAIN	5	Medium	High	High	Extreme	Extreme

CONSEQUENCE & LIKELIHOOD DESCRIPTORS

CONSEQUENCE DESCRIPTORS

(Select the MOST LIKELY/PROBABLE consequence descriptor for the information available).

Risk Consequence	Design Consequence Descriptors
E- Catastrophic	Could result in fatality or irreversible severe environmental damage required to be notified under jurisdiction requirements.
D – Critical	Could result in permanent total disability or reversible environmental damage required to be notified under jurisdiction requirements.
C- Severe	Could result in permanent partial disability, injuries or illness that may result in hospitalisation of persons or reversible environmental damage required to be notified under jurisdiction requirements.
B - Major	Could result in injury or illness resulting in one or more lost work day(s) or reversible environmental damage not required to be notified under jurisdiction requirements where restoration activities can be accomplished.
A – Minor	Could result in injury or illness not resulting in a lost work day or minimal environmental damage not required to be notified under jurisdiction requirements.

LIKELIHOOD DESCRIPTORS

(Select the best likelihood descriptor for the information available).

Likelihood Descriptor	Design Likelihood Descriptors
5 – Almost Certain	Industry experience suggests design failure is almost certain to occur during the life of the product.
4 – Likely	Industry experience suggests design failure is likely to occur during the life of the product.
3 – Possible	Industry experience suggests design failure is possible some time during the life of the design.
2 – Unlikely	Industry experience suggests design failure is unlikely to occur in the life of design.
1 – Very Unlikely	Industry experience suggests design failure is very unlikely. It can be assumed failure occurrence may not be experienced.