



Australian Government

Department of Education, Employment and Workplace Relations

CPCPCM5004A Design sewer systems

Release: 1

CPCPCM5004A Design sewer systems

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit of competency specifies the outcomes required to design and document sewer systems, including specifying responsibilities, procedures and safety standards for sewerage equipment, construction, soil classification, pipelaying techniques and trench protection; analysing factors relating to pumping and tunnelling; and supervising the installation of a sewer system.
------------------------	--

Application of the Unit

Application of the unit	This unit of competency supports development of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.
--------------------------------	---

Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units	Nil
---------------------------	-----

Employability Skills Information

Employability skills This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare and implement sewer contracts.	1.1. Sewer contracting procedures are implemented. 1.2. Required qualifications, and roles and responsibilities of local authority personnel and contracted parties, are negotiated and documented.
2. Evaluate design parameters.	2.1. Scope of work is established for sewer systems. 2.2. Design requirements are determined from plans, specifications and client briefs. 2.3. Cost-benefit analysis is conducted comparing a range of pipe materials and system designs. 2.4. Statutory and regulatory requirements and Australian and New Zealand standards for the design of sewer systems are analysed and applied. 2.5. Manufacturer requirements and trade and technical manuals are interpreted. 2.6. Additional research, including a desktop study is conducted to outline design parameters. 2.7. Safety procedures and regulations for trench safety are specified. 2.8. Performance requirements are established.
3. Plan and detail system components.	3.1. Soils are tested and classified and characteristics of soil types are analysed. 3.2. Trenching safety procedures are detailed and backfilling and compaction methods are specified. 3.3. Layout of pipework systems and type and location of fittings and valves are planned. 3.4. Pipelaying, dewatering and testing procedures for pipework of varying sizes are specified. 3.5. Pipe size, pipe grade and ventilation requirement calculations are performed for a range of applications. 3.6. Sewer connections, manholes, bedding material and concrete support are detailed. 3.7. Pump station, pump and pump control requirements are sized and detailed. 3.8. Approved materials, jointing methods and installation requirements for sewer systems are specified.
4. Design and size systems.	4.1. Sewer systems are designed for a range of applications.

ELEMENT	PERFORMANCE CRITERIA
	4.2. Sewer long sections are designed and detailed.
	4.3. Rising main systems are designed.
	4.4. Pump stations are designed.
	4.5. Sewer systems are designed and sized using computer software packages .
5. Prepare documentation.	5.1. Plans are prepared for a range of sewer systems.
	5.2. Specification for a sewer system is prepared.
	5.3. Testing and commissioning schedule is prepared.
	5.4. Operation and maintenance manual is produced.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

Required skills for this unit are:

- communication skills to:
 - communicate with others to ensure safe and effective work practices
 - confirm job specifications and client requirements
 - enable clear and direct communication, using questioning to identify and confirm requirements, share information, listen and understand
 - prepare written documentation, including plans, specifications and schedules
 - produce an operation and maintenance manual
 - read and interpret:
 - plans, specifications, drawings and design briefs
 - standards and manufacturer requirements and manuals
 - statutory and regulatory requirements
 - use language and concepts appropriate to cultural differences
 - use and interpret non-verbal communication, such as hand signals
- identifying and accurately reporting to appropriate personnel any faults in tools, equipment or materials
- innovation skills to develop creative and responsive approaches
- planning and organisational skills to:
 - research, collect, organise and understand information relating to the design of sewer systems

REQUIRED SKILLS AND KNOWLEDGE

- take initiative and make decisions
- problem solving skills to analyse requirements, consider options and design an appropriate system
- technological skills to:
 - access and understand site-specific instructions in a variety of media
 - use mobile communication technology.

Required knowledge

Required knowledge for this unit is:

- common terminology and definitions used in the design of sewer systems for all classes of building
- drafting principles
- nature of materials used and effects of performance under various conditions
- principles of technology in the design of sewer systems
- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- workplace safety requirements, including relevant statutory regulations, codes and standards.

Evidence Guide

EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment

This unit of competency could be assessed in the workplace or a close simulation of the workplace environment providing that simulated or project-based assessment techniques fully replicate plumbing and services workplace conditions, materials, activities, responsibilities and procedures.

It may be assessed on its own or as part of an integrated assessment activity involving preparation of designs for two sewer systems for different applications, including plans, specifications and all associated documentation.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of:

- evaluating and documenting design parameters, including client, regulatory, manufacturer and Australian and New Zealand standard requirements for a range of sewer systems
- specifying soil identification and trench safety procedures
- planning and detailing sewer system components, including:
 - manholes
 - piping systems
 - pump stations
- designing and sizing a range of sewer systems
- designing and sizing a rising main
- designing a sewer long section
- preparing plans for a range of sewer systems to industry standards
- preparing specifications for sewer systems
- preparing testing and commissioning schedules
- preparing operation and maintenance manuals.

Context of and specific resources This competency is to be assessed using standard

EVIDENCE GUIDE

for assessment

and authorised work practices, safety requirements and environmental constraints.

Assessment of essential underpinning knowledge will usually be conducted in an off-site context.

Assessment is to comply with relevant regulatory or Australian standards' requirements.

Resource implications for assessment include:

- an induction procedure and requirement
- realistic tasks or simulated tasks covering the minimum task requirements
- relevant specifications and work instructions
- tools and equipment appropriate to applying safe work practices
- support materials appropriate to activity
- workplace instructions relating to safe working practices and addressing hazards and emergencies
- material safety data sheets
- research resources, including industry related systems information.

Reasonable adjustments for people with disabilities must be made to assessment processes where required. This could include access to modified equipment and other physical resources, and the provision of appropriate assessment support.

Method of assessment

Assessment methods must:

- satisfy the endorsed Assessment Guidelines of the Construction, Plumbing and Services Training Package
- include direct observation of tasks in real or simulated work conditions, with questioning to confirm the ability to consistently identify and correctly interpret the essential underpinning knowledge required for practical application
- reinforce the integration of employability skills with workplace tasks and job roles
- confirm that competency is verified and able to be transferred to other circumstances and environments.

EVIDENCE GUIDE

Validity and sufficiency of evidence requires that:

- competency will need to be demonstrated over a period of time reflecting the scope of the role and the practical requirements of the workplace
- where the assessment is part of a structured learning experience the evidence collected must relate to a number of performances assessed at different points in time and separated by further learning and practice, with a decision on competency only taken at the point when the assessor has complete confidence in the person's demonstrated ability and applied knowledge
- all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence.

Assessment processes and techniques should as far as is practical take into account the language, literacy and numeracy capacity of the candidate in relation to the competency being assessed.

Supplementary evidence of competency may be obtained from relevant authenticated documentation from third parties, such as existing supervisors, team leaders or specialist training staff.

Range Statement

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Sewer contracting procedures include:

- acceptance of work
- contract administration

RANGE STATEMENT

Scope of work:

- documentation
- initial survey
- invitation to tender
- preparation of plans.
- includes:
 - interpretation of plans and specifications
 - sizing and documenting layout of sewer systems for residential, commercial and industrial applications
- may be for either new projects or existing sewer mains being renovated, extended, restored or maintained.

Design requirements include:

- architectural specifications
- builder specifications
- owner requirements
- specialist applications.

Cost-benefit analysis includes:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project.

Statutory and regulatory requirements and Australian and New Zealand standards include:

- Acts, regulations and local and state government policies, including group and strata titling
- AS/NZS3500 National plumbing and drainage set: Parts 2.1 and 2.2
- AS2200 Design charts for water supply and sewerage
- Building Code of Australia.

Manufacturer requirements include:

- material specifications
- pump tables
- sizing tables
- technical and trade manuals.

Desktop study includes collecting and interpreting existing data for design purposes from:

- architectural and building plans
- council plans
- developer plans
- other documents, including:
 - forms
 - applications
 - sewer detail maps
 - other reports as available.

RANGE STATEMENT

Safety procedures and regulations for trench safety:

- include:
 - analysing factors that determine tunnelling
 - assessing and identifying types of soil requiring tunnel excavation and shoring procedures
 - defining methods of trench installation
 - defining procedures for trench rescue
- specify safety procedures with reference to:
 - advisory standards
 - compliance standards
 - industry standards
 - Occupational Health and Safety Act
 - OHS regulations
 - other Acts, codes or regulations relating to trench protection.

Performance requirements are established using Australian and New Zealand standards and local authority plans and may include:

- discharge requirements
- durability
- longevity
- self-cleaning ability
- sufficient capacity.

Trenching safety procedures include:

- conditions affecting trench stability
- condition of soils disturbed by previous excavations
- effect of water on excavations
- effects of moisture content on excavated trenches
- traffic and vibrations
- confined space safety requirements, e.g. for exhaust emissions
- prevention of trench collapse
- trench collapse procedures
- trench inspection procedures
- trench excavation methods used for different:
 - backfilling methods
 - bedding methods
 - depth
 - slope
 - support systems
 - types.

RANGE STATEMENT

Layout of pipework systems
include:

- gravity systems
- pumped and rising mains
- layout, which should:
 - not unduly affect building integrity and aesthetic appeal
 - have principles of economy, serviceability, durability and fit for use applied.

Fittings and valves include:

- access openings
- bends
- junctions.

Pipelaying may include:

- cutting, handling and storage procedures for each pipe material
- fittings used for sewerage work
- jointing methods and procedures for each material
- laying procedures for pipework of varying sizes
- methods of dewatering trenches before and during pipelaying
- methods of grading and maintaining pipe direction and reduced levels
- methods of placing bedding materials, encasing pipes, backfilling and compacting
- methods of testing sewer and branch sewer drains.

Pipe size, pipe grade and ventilation requirement calculations include:

- determination of flow and loadings
- gradient calculations
- interpretation of design charts and tables
- pipe sizing calculations
- projected flows
- stormwater infiltration reduced level calculations.

Manhole details include:

- benching requirements
- connections to and from
- flow and gradient requirements
- inspection chambers
- lids
- open and closed channel
- sizing.

Pump station, pump and pump

- automatic controls
- capacity

RANGE STATEMENT

- control requirements*** include:
- chains
 - corrosion-resistant materials
 - detailing
 - high and low-level water controls and alarms
 - impeller sizing
 - inlet and outlet design requirements
 - installation and mounting requirements
 - ladder access
 - macerator requirements
 - pump selection
 - pump sizing
 - pump station sizing
 - space requirements
 - step irons
 - valve requirements
 - warning system.
- Materials*** include:
- cast iron
 - concrete
 - earthenware
 - high density polyethylene (HDPE)
 - unplasticised polyvinyl chloride (PVC-U).
- Jointing methods*** include:
- gluing
 - mechanical joints
 - rubber ring
 - solvent cement welding
 - threading.
- Installation requirements*** include:
- bedding
 - clipping
 - concrete support
 - installation details
 - jointing requirements
 - level of workmanship.
- Rising main systems*** include:
- approved pressure pipe and fittings
 - calculated rise and pump delivery requirements
 - pump sizing to meet calculated flow conditions.
- Computer software packages*** include:
- manufacturers' software
 - proprietary design software.

RANGE STATEMENT

Plans:

- may include:
 - axonometrics
 - cross-sections
 - details
 - elevations
 - isometrics
 - schematics
 - sections
- may be produced to industry standards and in accordance with regulatory and manufacturer requirements using:
 - computer generation
 - Indian ink
 - pencil
 - pigment liner.

Specification may include:

- bedding
- clipping
- concrete support
- descriptions
- details of specialised components
- jointing
- manholes
- manufacturer requirements
- materials
- workmanship.

Testing may include:

- air pressure test
- hydrostatic test
- quality assurance (QA) audit
- visual and site inspection.

Commissioning schedule
includes:

- checking leaks
- flushing.

Operation and maintenance manual may include:

- check for blockages
- leak detection
- pump maintenance
- water auditing
- yearly inspection
- yearly maintenance requirements.

Unit Sector(s)

Unit sector Plumbing and services

Co-requisite units

Co-requisite units Nil

Functional area

Functional area