



Australian Government

CPCPCM5014A Design sewer infrastructure systems

Release 1

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Modification History

Changes to unit title, descriptor, performance criteria, required skills and knowledge, range statement and critical aspects
Not equivalent to CPCPCM5004A

Unit Descriptor

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

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

In some jurisdictions, this unit of competency may form part of accreditation, licensing, legislative, regulatory or certification requirements.

Pre-Requisites

Nil

Employability Skills Information

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

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|---|--|-----|--|
| 1 | Prepare and implement sewer contracts. | 1.1 | Sewer contracting procedures are implemented. |
| | | 1.2 | Required qualifications, roles and responsibilities of local authority personnel and contracted parties are documented. |
| 2 | Evaluate design parameters. | 2.1 | <i>Scope of work</i> is established for sewer infrastructure systems. |
| | | 2.2 | <i>Design requirements</i> are determined from relevant Australian standards, codes, plans, specifications and client brief. |
| | | 2.3 | <i>Cost-benefit analysis</i> is conducted comparing a range of pipe materials and system designs. |
| | | 2.4 | <i>Statutory and regulatory requirements and relevant Australian standards and codes</i> for the design of sewer infrastructure systems are analysed and applied. |
| | | 2.5 | <i>Manufacturer requirements</i> and trade and technical manuals are interpreted. |
| | | 2.6 | Additional research, including a <i>desktop study</i> , is conducted to outline design parameters. |
| | | 2.7 | Factors that contribute to quality, safety and time efficiency are determined. |
| | | 2.8 | Point of connection to the authority's system is determined. |
| | | 2.9 | <i>Safety procedures and regulations for trench safety</i> and for pumping stations are specified. |

- 2.10 **Performance requirements** are established.
- 2.11 Pipe sizes are assessed using equivalent population (EP) density.
- 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, valves and controls** are planned.
 - 3.4 **Pipelaying**, dewatering and testing procedures for installation of pipework of varying sizes are specified.
 - 3.5 Self-cleaning velocities, **pipe size and grade, and ventilation requirements are calculated** for a range of systems.
 - 3.6 Sewer connections, **access chambers**, bedding material and support systems are detailed.
 - 3.7 **Requirements for pump station, pumps, controls and equipment** are sized and detailed.
 - 3.8 Approved **materials, jointing methods** and **installation requirements** for sewer infrastructure systems are specified.
 - 3.9 Maintenance procedures of the system are identified.
- 4 Design and size systems.
 - 4.1 Easements and location for sewer infrastructure systems are identified, including pumping **rising mains**.
 - 4.2 Sewer infrastructure systems are designed for a range of applications.
 - 4.3 Sewer long sections are designed and detailed.
 - 4.4 Pump rising main systems are designed.
 - 4.5 Pumping stations are designed.
 - 4.6 Sewer infrastructure systems are designed and sized using calculations and **computer software packages**.

- 4.7 Ventilation requirements are determined and designed.
 - 4.8 ***Sustainability principles and concepts*** are applied throughout the design process.
- 5 Prepare documentation.
- 5.1 Client brief of the desired design is prepared.
 - 5.2 ***Plans*** and ***specification*** are prepared for a range of sewer infrastructure systems.
 - 5.3 ***Testing*** and ***commissioning schedule*** is prepared.
 - 5.4 ***Operation and maintenance manual*** is produced, including information on how to properly and safely maintain the system.

Required Skills and Knowledge

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

Required skills

- 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
 - use language and concepts appropriate to cultural differences
 - use and interpret non-verbal communication, such as hand signals
- initiative and enterprise skills to:
 - develop creative and responsive approaches
 - identify and accurately report to appropriate personnel any faults in tools, equipment or materials
- literacy skills to:
 - read and interpret:
 - plans, specifications, drawings and design briefs
 - standards and manufacturer requirements and manuals
 - statutory and regulatory requirements
 - produce written documentation, including:
 - plans, specifications and schedules
 - an operation and maintenance manual
- planning and organising skills to:
 - research, collect, organise and understand information relating to the design of sewer infrastructure systems
 - take initiative and make decisions
- problem-solving skills to analyse requirements, consider options and design an appropriate system
- technology skills to:
 - access and understand site-specific instructions in a variety of media
 - use mobile communication technology

Required knowledge

- application of:
 - relevant Australian standards, including Sewerage Code of Australia

- manufacturer specifications, including hazards identified in relation to devices and systems used
- fire safety requirements
- other codes or standard operating procedures
- pipe sizing procedures
- pump selection and rising main requirements
- ventilation requirements
- regulatory authorities' requirements
- common terminology and definitions used in the design of sewer infrastructure systems
- nature of materials used and effects of performance under various conditions
- principles of technology in the design of sewer infrastructure systems
- workplace safety requirements, including relevant statutory regulations, codes and standards

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 the ability to:

- design, size and document the installation and layout details for a sewer infrastructure system of a residential development of 50 properties, incorporating a gravity system and pumping station, to include:
 - sewer reticulation mains
 - pump station
 - pump rising main
 - ventilation
 - odour control
- evaluate and document design parameters to relevant Australian standards and codes, and regulatory, client and manufacturer requirements
- specify soil identification and trench safety procedures
- prepare plans and specifications
- prepare testing and commissioning schedules
- prepare operation and maintenance manuals
- apply sustainability principles and concepts throughout the process
- communicate with others to ensure safe and effective workplace operations.

Context of and specific resources

This competency is to be assessed using standard and

for assessment

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 work 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.

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

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.

Scope of work:

- must include:
 - interpretation of plans and specifications
 - sizing and documenting layout of sewer infrastructure systems
- may be for either new projects or existing sewer mains being extended.

Design requirements may include:

- architectural plans
- builder specifications
- Sewerage Code of Australia
- fire safety requirements
- owner requirements
- pipework identification
- flow requirements and sizing of pipework

- ventilation requirements.

Cost-benefit analysis:

- compares the range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project
- may include:
 - design styles
 - energy costs
 - expected design life
 - labour costs
 - material costs
 - safety factors
 - speed of installation
 - suitable materials.

Statutory and regulatory requirements and relevant Australian standards and codes may include:

- Acts, regulations and commonwealth, state or territory, and local government policies
- AS/NZS3500 National plumbing and drainage
- AS2200 Design charts for water supply and sewerage
- Environmental Protection Authority (EPA)
- National Construction Code
- Sewerage Code of Australia
- other relevant Australian standards and codes.

Manufacturer requirements may include:

- material specifications
- collection and storage systems
- design and installation
- equipment installation
- pump installation
- technical manuals.

Desktop study may include collection and interpretation of data for design purposes, such as:

- architectural and building plans
- developer's plans
- equivalent population (EP) density
- manufacturer's data
- other documents, including:
 - forms

- brochures
- applications
- policies
- regulations
- other reports as available.

Safety procedures and regulations for trench safety:

- may 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
 - Work Health and Safety Act
 - other Acts, codes or regulations relating to trenching
 - working in confined spaces.

Performance requirements are established using relevant Australian standards, codes and local authorities' requirements may include:

- discharge requirements
- durability
- emergency storage backup
- longevity
- self-cleaning ability
- sufficient capacity.

Trenching safety procedures may 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.

Layout of pipework systems may include:

- gravity
- pumped and rising mains
- vacuum
- identification of easements and location for sewer infrastructure systems, including pumping rising mains
- layout, which must:
 - not unduly affect building integrity and aesthetic appeal
 - have principles of economy, serviceability, durability and fit for use applied.

Fittings, valves and controls may include:

- fittings, including:
 - bends
 - flanges
 - junctions
 - inspection openings
 - unions
- valves, including:
 - non-return
 - isolation
- controls, including:
 - level
 - alarms
 - management communication systems.

Pipelaying may include:

- cutting, handling and storage procedures
- fittings used for sewerage work
- jointing methods and procedures
- laying procedures for pipework
- methods of dewatering trenches methods of grading and maintaining pipe direction and reduced levels
- methods of placing bedding materials, encasing

- pipes, backfilling and compacting
- methods of testing sewer drains
- methods of pressure testing pump rising mains.

Pipe size, pipe grade and ventilation requirement calculations may include:

- determination of flow and loadings
- gradient calculations
- equivalent population (EP) density
- interpretation of design charts and tables
- pipe sizing calculations
- projected flows
- pumping flow rates
- reduced level calculations
- self-cleaning pipe velocities
- stormwater infiltration
- system ventilation.

Access chamber details must include:

- access
- benching
- connections
- covers
- flow and gradient
- open and closed channel
- sizing.

Pump station, pumps, controls and equipment requirements may include:

- access covers
- access ladders
- automatic controls
- capacity
- corrosion-resistant materials
- emergency storage and power supply
- impeller sizing and selection
- inlet and outlet design
- installation and mounting
- odour control
- macerator requirements
- management communication system
- provision for servicing
- pump selection
- pumpwell sizing
- space requirements

- valves
- ventilation
- warning system.

Materials may include:

- cast iron (CI)
- concrete
- vitrified clay pipes (VCP)
- polyethylene (PE)
- polypropylene (PP)
- unplasticised polyvinyl chloride (PVC-U)
- other approved material.

Jointing methods may include:

- electrofusion welding
- mechanical joints
- rubber ring
- solvent cement welding
- other approved jointing methods.

Installation requirements may include:

- bedding
- pipe protection, which may include:
 - cover
 - corrosion
 - impact
- level of workmanship
- manufacturer-recommended specific fixings
- pipe support
- provision for pipe movement
- serviceability and access.

Rising main systems may include:

- approved pressure pipe and fittings
- calculated rise and pump delivery requirements
- environmental protection
- pump sizing to meet calculated flow conditions
- self-cleaning pipe velocities
- odour control.

Computer software packages include:

- manufacturer software
- proprietary design software.

Sustainability principles and concepts:

- cover the current and future social, economic and environmental use of resources
- may include:
 - selecting appropriate material to ensure minimal environmental impact
 - efficient use of material
 - efficient energy usage/capital outlay comparison
 - consideration of the Green Building Council of Australia rating scheme.

Plans:

- **may include:**
 - axonometrics
 - cross-sections
 - details
 - elevations
 - isometrics
 - schematics
 - site
 - sections
- may be produced using:
 - computer generation
 - drawing equipment.

***Specification* may include:**

- bedding
- commissioning
- excavation requirements
- support
- concrete support and detailing specialised components
- jointing
- access chambers (manholes)
- manufacturer requirements
- materials
- piping
- pumps
- pumping stations
- safety (WHS)
- testing
- workmanship.

Testing may include:

- air pressure
- drainage inspection
- hydrostatic
- performance
- compliance with authorities discharge requirements
- quality assurance (QA) audit.

Commissioning schedule must include:

- system certification
- check for foreign material
- containment
- leak check
- operational
- pumping
- system defects
- system functions as per design
- ventilation
- odour control
- WHS compliance.

Operation and maintenance manual may include:

- as installed drawings
- certification documentation
- emergency procedures
- results of commissioning test
- maintenance schedules
- manufacturer brochures and technical information
- odour control
- WHS requirements
- ventilation.

Unit Sector(s)

Functional area

Unit sector Plumbing and services

Custom Content Section

Not applicable.