Australian Government

CPCPCM5012A Design complex stormwater and roof drainage systems

Release 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

CPCPCM5012A Design complex stormwater and roof drainage systems

Modification History

Changes to performance criteria, required skills and knowledge, range statement and critical aspects
Not equivalent to CPCPCM5002B

Unit Descriptor

This unit of competency specifies the outcomes required to design complex stormwater and roof drainage systems for commercial, industrial and residential properties.

Application of the Unit

This unit of competency supports the needs of experienced plumbers specialising in 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

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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

1	Evaluate design parameters.	1.1	***Client requirements*** are determined from relevant Australian standards, codes, plans, specifications and client brief.
		1.2	***Local government, Environment Protection Authority (EPA), and relevant Australian standards and codes*** for the design of complex stormwater and roof drainage systems are interpreted.
		1.3	Regulatory requirements for design of complex stormwater and roof drainage systems are analysed and applied.
		1.4	***Other documentation relevant to the design*** is researched, evaluated and applied.
		1.5	Safety of system users or building occupants is considered.
2	Plan system components.	2.1	Layout of ***system components*** is planned according to design parameters and site limitations, and is coordinated with other services.
		2.2	Stormwater detention and retention systems and first-flush stormwater systems are planned and evaluated.
		2.3	Most suitable methods of preventing backflow of sub-soil and stormwater into buildings are determined

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			and specified.
		2.4	***Treatment and disposal options for stormwater discharge*** are evaluated and planned.
		2.5	Overland flood path affecting the property and buildings is analysed.
3	Design and size systems.	3.1	***Rainfall intensities are determined*** and volumes of water are estimated using measurements of different ***catchment areas***.
		3.2	Methods of collection and disposal of surface run-off water are specified.
		3.3	Strategies for harvesting and re-using rainwater are identified and evaluated.
		3.4	Sub-soil water types are determined and ***stormwater drainage systems*** are designed, sized and detailed using appropriate calculations and software applications.
		3.5	System components are selected, designed, sized and detailed using appropriate calculations, software applications and ***approved materials***.
		3.6	***Stormwater systems requiring pumping*** are identified and designed using appropriate calculations and software applications, with storage, pump and discharge pipe sizes calculated and specified.
		3.7	Correct installation, laying and jointing procedures for materials and components are specified.
		3.8	***Sustainability principles and concepts*** are applied throughout the design process.
4	Prepare documentation.	4.1	Client brief of the desired design is prepared.
		4.2	***Plans*** and ***specifications*** are prepared for a range of complex stormwater and roof drainage systems.
		4.3	Testing and commissioning schedule is prepared.
		4.4	Operation and maintenance manual is produced, including information on how to properly and safely maintain the system.

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Required Skills and Knowledge

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

Required skills

- communication skills to:
  - 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:
  - charts and hand drawings
  - job drawings
  - manufacturer specifications and instructions
  - material safety data sheets
  - memos
  - organisational work specifications
  - regulatory requirements
  - requirements and instructions issued by authorised organisational or external personnel
  - signage
- numeracy skills to apply measurements and calculations
- planning and organising skills to:
  - research, collect, organise and understand information relating to the design of complex stormwater and roof drainage systems
  - take initiative and make decisions
- problem-solving skills to analyse requirements, consider options and design an appropriate system
- technical skills to:
  - apply design concepts and principles
  - communicate graphical representations and plans
- technology skills to:
  - access and understand site-specific instructions in a variety of media
  - use mobile communication technology

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Required knowledge

- relevant Australian standards and codes, including:
  - Australian rainfall and run-off document
  - AS/NZS3500 National plumbing and drainage
  - manufacturer specifications
  - National Construction Code
  - other relevant codes or standard operating procedures relevant to the sector
- terminology and definitions used in hydraulic design
- installation methods used in hydraulic systems
- hazards associated with devices and systems used in the hydraulic sector
- environmental requirements, including:
  - clean-up protection
  - stormwater protection
  - waste management
  - water quality management
- quality assurance requirements, including:
  - EPA
  - internal company quality assurance policy and risk management strategies
  - International Standards Organisation
  - site safety plan
  - workplace operations and procedures
- regulatory and legislative requirements, particularly those pertaining to:
  - building codes
  - WHS and environmental requirements
  - plumbing regulations
  - safe work procedures relating to planning, sizing and documenting layout of pipework and fixtures

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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 production of designs, plans, specifications and supporting documentation for a complex stormwater and roof drainage system.

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 layout details, including a specification, of a stormwater system for a site incorporating a high rise mixed development building and a wide span project, such as a school
- evaluate and document design parameters, including client, regulatory, manufacturer and relevant Australian standards and code requirements for a stormwater system
- evaluate health risks associated with the stormwater system
- collect, analyse and evaluate research, including:
  - catchment area
  - survey plans
  - existing services
  - building plans
  - site plans
  - civil drawings
  - reduced levels
  - contour levels
- prepare a plan coordinated with other services for the layout of piping, pits, gullies and other system components according to design parameters and site limitations
- calculate stormwater detention, retention and

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harvesting systems
- calculate roof catchment areas and surface run-off volumes
- determine specifications for guttering requirements and size of downpipes
- design sub-soil drainage systems, including sizing for collection, containment and discharge
- create detail drawings, including long sections and cross-sections
- create a design, including size and detail for complex stormwater and roof drainage systems, including:
  - access chambers (manholes)
  - grade of drains
  - holding pits
  - collection sumps
  - detention, retention and harvesting systems
  - other system components
- apply appropriate software in order to design, size and detail selected stormwater systems
- prepare plans for a range of complex stormwater and roof drainage systems
- prepare a specification for a complex stormwater and roof drainage system
- prepare a testing and commissioning schedule
- prepare an operation and maintenance manual
- apply sustainability principles and concepts throughout to achieve a star rating under the Green Building Council of Australia rating scheme.

Context of and specific resources for assessment

This competency is to be assessed using standard 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

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- 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

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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.

Client requirements may include:

- architectural plans
- briefs
- site conditions
- statutory bodies
- standards and codes
- specifications.

Local government, Environment Protection Authority, and relevant Australian standards and code requirements may include:

- local government requirements, including:
  - Australian rainfall and run-off documentation
  - Integrated Planning Act (IPA)
  - other regulatory requirements
  - standard drawings and details
  - town planning requirements
  - urban design manuals
- treatment requirements, such as:
  - screens
  - silt traps
  - solid removal systems
- environmental requirements to cover water quality management, including:
  - clean-up protection
  - stormwater protection
  - waste management
- Australian standards and codes, including:

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- National Construction Code
- AS/NZS3500 National plumbing and drainage.

Other documentation relevant to the design must include plans, drawings, manuals and reports regarding:

- buildings
- catchment area analysis
- civil drawings
- contour levels
- existing services
- manufacturer requirements and specifications
- reduced levels
- site plans
- stormwater design
- surveys.

System components may include:

- access chambers (manholes)
- channels
- culverts
- downpipes
- fire rating of penetrations
- grated pits
- gullies
- guttering
- inspection chambers
- inspection openings
- kerbs
- piping
- pits.

Treatment and disposal options for stormwater discharge may include:

- treatment options:
  - grass and rock swales
  - lagoons
  - momentum diffusers
  - ponds
  - screens
  - silt traps
  - traps
  - other solid removal systems as determined
- disposal options:
  - connection to stormwater mains

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- creeks
- harbour
- kerb and street channels
- lakes
- on-site harvesting and reuse
- rainwater collection systems, including tanks and dams
- rivers
- streams.

Rainfall intensities are determined by:

- average rainfall intervals
- roof, surface and subsurface calculations
- site location
- time and concentration.

Catchment areas must include:

- land surface catchment areas, including a variety of surface conditions such as grassed and paved areas
- roof catchment areas.

Stormwater drainage systems may include:

- access chambers (manholes)
- collection sumps
- detention and retention
- grade of drains
- harvesting
- holding pits
- pump discharge.

Approved materials may include:

- piping materials:
  - concrete
  - earthenware or vitrified clay pipe (VCP)
  - fibre cement (FRC)
  - polyvinyl chloride (PVC)
  - other approved materials
- fittings:
  - bends
  - grates
  - gullies
  - junctions
  - non-return valves.

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Stormwater systems requiring pumping must include:	• holding tanks • overflow provisions • pump and controls • rising main.

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
	  • harvesting and reuse
	  • efficient use of material
	  • efficient energy usage/capital outlay comparison
	  • effect on the environment due to overflow or leakage
	  • consideration of the Green Building Council of Australia rating scheme.

Plans:	• may include:
	  • cross-sections
	  • details
	  • elevations
	  • sections
	  • site
	• may be produced using:
	  • computer generation
	  • drawing equipment.

Specification and user manuals may include:	• commissioning • bedding • support • concrete support and detailing specialised components • jointing • access chambers (manholes) • manufacturer requirements • materials • pumps

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- safety (WHS)
- testing
- workmanship.

Unit Sector(s)

Functional area

Unit sector Plumbing and services

Custom Content Section

Not applicable.

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