



Australian Government

Department of Education, Employment and Workplace Relations

RTE5603A Design irrigation, drainage and water treatment systems

Release: 1

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Modification History

Not applicable.

Unit Descriptor

This competency standard covers the process of identifying design requirements, determining specifications for suitable pumping and power systems, designing distribution, drainage, storage and treatment systems, and determining capital and operating expense budgets for the system designed. It requires the ability to collect and analyse information, identify design requirements, develop specifications, compare costings, develop budgets and document outcomes. Designing irrigation, drainage and water treatment systems requires knowledge of design processes, developments in related technology, automatic control and monitoring systems, waste management and environmental issues, budgeting, contractual development and obligations, and environmental protection agency regulations.

Application of the Unit

Not applicable.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

Not applicable.

Elements and Performance Criteria Pre-Content

Not applicable.

Elements and Performance Criteria

Elements and Performance Criteria

Element	Performance Criteria
1 Determine design requirements	1.1 Water is predicted to be available in sufficient quantity and quality for the particular crop or situation at the time it is needed by the enterprise. 1.2 Water transfer, recharge, reuse and harvesting systems are designed to conserve natural resources. 1.3 The process of collecting or storing water does not degrade the water quality for the enterprise or the environment. 1.4 Construction specifications define the work required to make suitable water available to the enterprise in accordance with environmental and OHS requirements. 1.5 Environmentally sensitive areas are identified and protected according to local, State and National legislation. 1.6 Design calculations and decisions are documented to enterprise requirements.
2 Define pumping and power systems	2.1 Pumps are selected to deliver water efficiently when needed, from the water storage at the flow and pressure required to operate the distribution system to the design specifications. 2.2 The pump motor combinations are efficient and the pumps are reliable, functional, serviceable and flexible for the intended application. 2.3 Energy requirements are determined, and layout of electricity lines are determined and checked with local authority. 2.4 The relationship between capital and operational costs are optimised including a comparison of energy sources. 2.5 Structures, valves and accessories are selected and integrated into a functional system that can be monitored and maintained according to enterprise

guidelines.

- 2.6 Performance indicators, design calculations and decisions are documented according to enterprise guidelines.
- 2.7 Construction specifications define work required to make suitable pumping and power system available to enterprise.
- 2.8 Power supply **design specification** is checked with power authorities.

3 Design an **irrigation distribution system**

- 3.1 Detailed topographic survey is conducted or an accurate map is obtained showing extent of irrigation, planting layout, physical constraints and contours with suitable interval.
- 3.2 Detailed soil survey is conducted at suitable intervals and mapped to show variation in readily available water.
- 3.3 Water budgets are determined having regard to the evapotranspiration state of the crop/plants, soil moisture characteristics and cultural practices.
- 3.4 Distribution systems are evaluated and designed with respect to a range of **key variables**.
- 3.5 Pipes, valves and fittings are sized according to design system specifications so that capital cost is balanced against operation costs over the anticipated system life.
- 3.6 Flows, water levels and pressures are calculated and documented to be within the acceptable tolerances for optimum performance.
- 3.7 Flows, water levels and pressures are achievable by the pumps operating at optimum efficiency and according to enterprise standards..
- 3.8 Mechanisms for controlling and adjusting pressure are included, and isolation valves direct water to areas with different irrigation schedules.
- 3.9 Channel systems and attendant structures are designed according to industry recommendations, and channel flow velocities are calculated

- according to enterprise standards.
- 3.1 Soil types have been compared for erodeability and
0 suitable fill has been selected for construction
according to enterprise standards.
- 3.1 Construction plans and specifications define work
1 required to achieve the required **standards of
uniformity and efficiency** of water application
according to industry standards.
- 4 Design a drainage, storage and treatment system
- 4.1 Regional geology and geography is investigated to
predict sustainability of irrigation and storage.
- 4.2 Site investigations to assess depth of clay, depth of
ground water, soil and water salinity, and structural
or chemical impediments are used to determine the
most cost effective storage system.
- 4.3 Predictions of leaching fractions and salt
movements are documented, and soil amelioration
and drainage management plans are developed.
- 4.4 The need for leachate interception and dewatering
system is determined, and if required, construction
specification prepared for interception and
collection, water treatment, disposal, and reuse or
recycle.
- 4.5 Drains and structures are capable of carrying the
design water volumes and intensities according to
enterprise standards.
- 4.6 Damage from water logging is minimised
according to enterprise standards.
- 4.7 Hydrological calculations predict volumes and
rates of surface run-off according to enterprise
standards.
- 5 Determine capital expense budget
- 5.1 Design calculations and decisions are **documented**
and relevant information is communicated clearly
through plans, specifications and manuals.
- 5.2 Design output is checked by a competent designer
against enterprise objectives.
- 5.3 Materials requirements are determined and
documented from plans and specifications.

- 5.4 Labour requirements are estimated, based upon documented work schedule with reasonable allowance for variances in work schedules.
 - 5.5 Costing attributed to each component is based upon quoted information from suppliers, or sound analysis of individual elements.
- 6 Determine operating expense budget
 - 6.1 Operating expense budget indicates all expenses applicable to the completed irrigation system.

Required Skills and Knowledge

Not applicable.

Evidence Guide

What evidence is required to demonstrate competence for this standard as a whole?

Competence in designing irrigation, drainage and water treatment systems requires evidence that a person can identify design requirements, determine specifications for suitable pumping and power systems, design distribution, drainage, storage and treatment systems, and determine capital and operating expense budgets for the system designed.

The skills and knowledge required to design irrigation, drainage and water treatment systems must be **transferable** to a different work environment. For example, if a system is designed for particular plants/crops and soil type using a fully computerised spray irrigation and chemical water treatment systems, it should be evident that a system could be designed for different plants/crops in different soil using manually operated surface irrigation, and natural drainage and treatment systems.

What specific knowledge is needed to achieve the performance criteria?

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts, and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

- design processes

- developments in irrigation technology

- drainage and storage development technology

- latest treatment technology

- automatic control and monitoring systems

- waste management and environmental issues

- budgeting, contractual development and obligations

- environmental protection agency regulations

- environmental impacts of irrigation, drainage and water treatment using water from any ground or underground source

- cost/benefit analysis

- enterprise policies and procedures.

What specific skills are needed to achieve the performance criteria?

To achieve the performance criteria, appropriate literacy and numeracy levels as well as some complementary skills are required. These include the ability to:

collect and analyse information

identify adverse environmental impacts of irrigation, drainage and water treatment activities and appropriate remedial action

identify design requirements

develop specifications

compare costings

develop budgets

document outcomes

develop and implement relevant enterprise OHS and environmental procedures.

What processes should be applied to this competency standard?

There are a number of processes that are learnt throughout work and life, which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the **key competencies**, although others may be added. The questions below highlight how these processes are applied in this competency standard. Following each question a number in brackets indicates the level to which the key competency needs to be demonstrated where 0 = not required, 1 = perform the process, 2 = perform and administer the process and 3 = perform, administer and design the process.

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| 1. How can communication of ideas and information (3) be applied? | Checking power supply design specifications with power authorities. |
| 2. How can information be collected, analysed and organised (3) ? | Identifying environmentally sensitive areas. |
| 3. How are activities planned and organised (3) ? | Developing construction plans and specifications. |
| 4. How can team work (3) be applied? | Obtaining detailed topographic information. |
| 5. How can the use of mathematical ideas and techniques (3) be applied? | Calculating design specifications, costings and budgets. |
| 6. How can problem-solving skills (3) be applied? | Determining water use and availability and breakdowns with systems components. |
| 7. How can the use of technology (3) be applied? | Designing computerised irrigation systems and documenting decisions. |

Are there other competency standards that could be assessed with this one?

This competency standard **could** be assessed on its own or in combination with other competencies relevant to the job function.

There is essential information about **assessing this competency standard for consistent performance and where and how it may be assessed**, in the Assessment Guidelines for this Training Package. All users of these competency standards must have **access** to the **Assessment Guidelines**. Further advice may also be sought from the relevant **sector booklet**.

Range Statement

Range of Variables

The Range of Variables explains the contexts within which the performance and knowledge requirements of this standard may be assessed. The scope of variables chosen in training and assessment requirements may depend on the work situations available

What reuse systems might be designed?	These may include disinfestation and filtering equipment.
What OHS requirements may be relevant to this standard?	Consideration should be given at the design stage to the health and safety of workers who will be involved in activities associated with irrigation installation in respect to machinery, equipment operation and chemical use.
Why might power supply design specification be checked with power authorities?	This may require compliance with the standard specification legislation and regulations of the relevant State or Territory water and power authorities.
What irrigation distribution systems might be relevant to this standard?	Micro-irrigation systems may include drip, mains pressure, low pressure, below surface, above surface, emitter trickle, t-tape, and mini-sprinklers, capillary, ebb and flow, and flood systems. Spray irrigation systems may include travelling irrigators (soft hose, hard hose boom type) centre pivot, linear move, powered side roll hand shift permanent (installed), and bike shift/easy shift. Surface irrigation systems may include border check, contour irrigation, furrow irrigation, hillside flooding, and basin irrigation. Border check systems may be either permanent or temporary earth, plastic or concrete devices for insertion in a drain for reticulating water, contour banks used to collect and distribute water along the perimeter of an irrigation plot, contour banks within a plot to collect/distribute water, or larger scale systems to stop water exiting one area to another. Systems may range from manual operation and monitoring to fully automated with computer control and monitoring.

Distribution systems are evaluated and designed with respect to which **key variables**?

These may include the ability to target like soils and crops, efficiency of water use in various crop/weather situations, wind breaks to support irrigation where appropriate, uniformity of distribution, and use of specialist irrigation consultants.

What **standards of uniformity and efficiency** will apply to water application?

This will vary from system to system.

How might budget expenses be **documented**?

This may vary according to budget, environmental constraints, owner preferences and quoting procedures.

For more information on contexts, environment and variables for training and assessment, refer to the Sector Booklet.

Unit Sector(s)

Not applicable.