



Australian Government

Department of Education, Employment and Workplace Relations

SFIAQUA507C Plan and design water supply and disposal systems

Release: 1

SFIAQUA507C Plan and design water supply and disposal systems

Modification History

Not Applicable

Unit Descriptor

<p>Unit descriptor</p>	<p>This unit of competency involves designing water supply and disposal systems for aquacultural enterprises and facilities, mostly for on-land (tanks, ponds and raceways) operations. Planning and designing water supply and disposal systems requires skills in aquatic engineering and the application of underpinning knowledge with depth in areas, such as hydrology, pumps and power supply, and waste management.</p> <p>Licensing, legislative, regulatory or certification requirements may apply to this unit. Therefore it will be necessary to check with the relevant state or territory regulators for current licensing, legislative or regulatory requirements before undertaking this unit.</p>
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Application of the Unit

<p>Application of the unit</p>	<p>This unit has application to aquacultural water supply and disposal systems. They may be manually operated systems and monitoring, or fully automated systems with computer control and monitoring. Standards of uniformity and efficiency may vary from system to system.</p> <p>All enterprise or workplace procedures and activities are carried out according to <i>relevant government regulations, licensing and other compliance requirements</i>, including <i>occupational health and safety (OHS) guidelines</i> and <i>ecologically sustainable development (ESD) principles</i>.</p> <p>Equipment operation, maintenance, repairs and calibrations are undertaken in a safe manner that conforms to manufacturer instructions. Appropriate <i>personal protective equipment (PPE)</i> is selected, checked, used and maintained.</p>
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Licensing/Regulatory Information

Refer to Unit Descriptor

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.
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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.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine design requirements	<p>1.1. Water types and water sources are determined so that water budget is developed to ensure water is available in sufficient quantities at all times.</p> <p>1.2. Water and soil quality are determined to ensure appropriate environment is provided for cultured or held stock and past records are analysed to determine water flow variability.</p> <p>1.3. Water transfer, recharge, reuse and treatment systems are designed to conserve natural resources and match requirements for cultured or held stock.</p> <p>1.4. Culture or holding structures and systems are positioned to make the best use of water resources.</p> <p>1.5. Water requirements are matched with enterprise production forecasts, expansion plans and seasonal variation.</p> <p>1.6. Process of collecting or storing water does not degrade the water quality for the enterprise or the environment.</p> <p>1.7. Design calculations and decisions are documented to enterprise requirements and construction specifications define the work required to make suitable water available to the enterprise.</p> <p>1.8. Environmentally sensitive areas are identified and protected according to local, state, territory and national legislation and land degradation issues are identified.</p> <p>1.9. Allowable effluent standards are determined.</p>
2. Define pumping and power systems	<p>2.1. Pumps are selected, on the basis of expert advice, to deliver water efficiently from the water source or storage, when needed, and at the flow and pressure required to operate the distribution system to the design specifications.</p> <p>2.2. Pump motor combinations are efficient, reliable, functional, serviceable and flexible for the intended application.</p> <p>2.3. Relationship between capital and operational costs is optimised, including a comparison of energy sources.</p> <p>2.4. Structures, valves, accessories and performance indicators are selected and integrated into a functional system that can be monitored and maintained according to enterprise procedures.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>2.5. Design calculations and decisions are documented.</p> <p>2.6. Construction specifications define work required to make suitable pumping and power system available to enterprise.</p> <p>2.7. Power supply design specification is checked with power authorities.</p> <p>2.8. Risks associated with power configurations, personal safety, water pressures and loads are identified and minimised through system design and appropriate operating procedures.</p>
3. Design a distribution system	<p>3.1. Detailed topographic survey is commissioned or an accurate map is obtained showing extent, pond/tank layout, physical constraints and contours with suitable interval.</p> <p>3.2. Excavation and earth moving plan is developed and internal or outside personnel, labour and machinery identified.</p> <p>3.3. Water budgets are determined according to evaporation and seepage characteristics and water usage practices.</p> <p>3.4. Distribution systems are evaluated and designed according to a range of <i>key variables</i>, including the ability to isolate areas/systems for disease control or maintenance.</p> <p>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.</p> <p>3.6. Flows, water levels and pressures are achievable for the pumps.</p> <p>3.7. Mechanisms for controlling and adjusting pressure are included and isolation valves direct water to areas with different water flow schedules.</p> <p>3.8. Channel systems and attendant structures are designed according to system requirements and channel flow velocities are calculated.</p> <p>3.9. Soil types are compared for erodibility, and suitable fill selected for construction.</p> <p>3.10. Construction plans and specifications define work required to achieve the desired standards of uniformity and efficiency of water application.</p>
4. Design a drainage, storage and treatment	4.1. Regional geology and geography is investigated to predict sustainability of pond construction and water

ELEMENT	PERFORMANCE CRITERIA
system	<p>storage.</p> <p>4.2. Site investigations determine depth of clay, depth of ground water, soil and water salinity and structural or chemical impediments and calculations, and costings determine the most cost-effective storage system.</p> <p>4.3. Designs are developed in conjunction with contractors and authorities.</p> <p>4.4. Drains and structures are capable of carrying the design water volumes and flow intensities.</p> <p>4.5. Waste water treatment structures are incorporated.</p>
5. Determine capital expense budget	<p>5.1. Design calculations and decisions are documented and relevant information communicated clearly through plans, specifications and manuals.</p> <p>5.2. Design output is checked by a competent designer against enterprise objectives.</p> <p>5.3. Material requirements are determined and documented from plans and specifications.</p> <p>5.4. Labour requirements are estimated based upon documented work schedule with reasonable allowance for variances in work schedules.</p> <p>5.5. Costing attributed to each component is based upon quoted information from suppliers or sound analysis of individual elements.</p>
6. Establish management procedures	<p>6.1. Operating expense budget confirms all expenses applicable are applied to the completed water supply and disposal system.</p> <p>6.2. <i>Contingency plans</i> are developed in the event of reduced water quality or quantity.</p> <p>6.3. Procedure is developed for handling notifications from authorities pertaining to water supply and disposal.</p> <p>6.4. Involvement is undertaken in an integrated regional approach to water monitoring, quality and quantity supply issues and future planning.</p> <p>6.5. Mechanisation or automation of process or activity, including the use of specialised contract services, is researched and introduced.</p> <p>6.6. Record keeping procedures are established for managing water supply and disposal system that meet administrative, enterprise and regulatory requirements.</p>

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

- analysing soil and water
- communicating with contractors and authorities
- relating to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities
- costing design and operation of water supply and disposal system
- defining pumping and power systems
- designing a distribution system
- designing a drainage, storage and treatment system
- designing temperature controls
- determining capital expense budget
- determining design requirements
- hydrology and aquatic engineering
- planning for contingencies and monitoring
- undertaking risk analysis and mitigation.
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Literacy skills used for:

- documenting design, specifications and procedures
- maintaining records
- reading equipment operator manuals
- reading literature and extracting information
- writing reports.

Numeracy skills used for:

- applying formulae for determining water flow and temperature controls
- budgeting for the system design and operation
- determining material requirements and estimating labour requirements
- reading flow, pump charts and equipment specifications
- recording flow, water quality data.

Required knowledge

- automatic control and monitoring systems
- budgeting, waste management and environmental issues

REQUIRED SKILLS AND KNOWLEDGE

- contractual developments and obligations
- design processes
- drainage and storage development technology
- Environmental Protection Agency (EPA) and water authority regulations
- latest pump technology
- latest treatment technology
- mechanisation or automation of process or activity
- pipe specifications and flow dynamics
- use of specialised contract services.

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	
Critical aspects for assessment evidence required to demonstrate competence in this unit	<p>Assessment must confirm the ability to:</p> <ul style="list-style-type: none"> plan and design aquaculture water supply and disposal systems and establish operational parameters and procedures. <p>Assessment must confirm knowledge of:</p> <ul style="list-style-type: none"> aquatic organism physiology design process for water supply and disposal systems regulations and local water authority regulations pumps and pipe mechanisms/operation water quality monitoring water treatment .
Context of and specific resources for assessment	<p>Assessment is to be conducted at the workplace or in a simulated work environment.</p> <p>Resources may include:</p> <ul style="list-style-type: none"> work-based scenario or case study analytical laboratory equipment.
Method of assessment	<p>The following assessment methods are suggested:</p> <ul style="list-style-type: none"> case studies demonstration practical exercises project (work or scenario based) questions written or oral.
Guidance information for assessment	This unit may be assessed holistically with other units within a qualification.

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.

Relevant government regulations, licensing and other compliance requirements may include:

- business or workplace operations, policies and practices:
 - commercial law, including fair trading and trade practices
 - consumer law
 - corporate law, including registration, licensing and financial reporting
 - disability policies and practices
 - equal opportunity, anti-discrimination and sexual harassment
 - industrial relations and awards, individual employment contracts and share of catch agreements
 - jurisdictional variations
 - superannuation
 - taxation
 - trade practices
 - warnings and dismissals
 - worker's compensation
- ESD principles, environmental hazard identification, risk assessment and control
- fisheries or aquaculture regulations, permits, licences, quotas, catch restrictions and other compliance requirements, including:
 - Australian Exclusive Economic Zone
 - international treaties and agreements
- food safety, Hazard Analysis Critical Control Point (HACCP), hygiene and temperature control along chain of custody
- imports quarantine and inspection, and importing approved arrangements for Australian Quarantine Inspection Service (AQIS), Australian Customs Service (ACS) and Biosecurity Australia (BA)
- Indigenous native title, land claims and cultural

RANGE STATEMENT

	<p>activities, including fishing by traditional methods</p> <ul style="list-style-type: none"> • maritime and occupational diving operations: <ul style="list-style-type: none"> • foreign and Australian legislation applying to quarantine and customs • International Convention for the Safety of Life at Sea (SOLAS) • International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 1978) • Marine Emergency Response Search and Rescue (MERSAR) • National Standards for Commercial Vessels • pollution prevention - International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) • Uniform Shipping Laws (USL) Code • use of vessels, right of way and other marine orders, bunkering and refuelling • land, buildings and vehicles: <ul style="list-style-type: none"> • buildings and structures design and appearance, constructions and additions • poaching, trespass and theft • road laws for use of motor vehicles, bikes, trucks and other transport equipment • soil and water management • use of chemicals and biological agents • use of firearms and powerheads • use of utilities, including water, natural gas, electricity and sewage • water or land lease, tenure or ownership and use • OHS hazard identification, risk assessment and control • product quality assurance: <ul style="list-style-type: none"> • correct naming and labelling (e.g. country of origin, Australian Fish Names Standard and eco-labelling) • correct quantities, sizes and other customer requirements • third-party certification (e.g. Australian
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	Grown and ISO 14001:2004 Environmental management systems).
<i>OHS guidelines</i> may include:	<ul style="list-style-type: none"> • appropriate workplace provision of first aid kits and fire extinguishers • clean, uncluttered, hygienic workplace • codes of practice, regulations and/or guidance notes which may apply in a jurisdiction or industry sector • enterprise-specific OHS procedures, policies or standards • hazard and risk assessment of workplace, maintenance activities and control measures • induction or training of staff, contractors and visitors in relevant OHS procedures and/or requirements to allow them to carry out their duties in a safe manner • OHS training register • safe lifting, carrying and handling techniques, including manual handling, and the handling and storage of hazardous substances • safe systems and procedures for outdoor work, including protection from solar radiation, fall protection, confined space entry and the protection of people in the workplace • systems and procedures for the safe maintenance of property, machinery and equipment, including hydraulics and exposed moving parts • the appropriate use, maintenance and storage of PPE.
<i>ESD principles</i> may include:	<ul style="list-style-type: none"> • controlling use and recycling of water, and managing water quality and quantity • increasing use of renewable, recyclable and recoverable resources • managing environmental hazard identification, risk assessment and control • managing imported products quarantine and inspection, facility biosecurity, translocation of livestock and genetic material, and health certification • managing stock health and welfare, especially for handling, holding, transport and slaughter • managing sustainable fisheries or

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	<p>broodstock/seedstock collection requirements, such as size limits, quotas, season restrictions, population dynamics, fishing impacts, reducing by-catch, fisheries management strategies and maintaining biodiversity</p> <ul style="list-style-type: none"> • managing, controlling and treating effluents, chemical residues, contaminants, wastes and pollution • minimising noise, dust, light or odour emissions • planning environmental and resource efficiency improvements • preventing genetically modified and live cultured or held organisms from escaping into environment • protecting native and protected flora and fauna, marine or land parks or areas, adhering to the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), the Ramsar Convention, World Heritage and other international treaties for which Australia is a signatory • reducing emissions of greenhouse gases • reducing use of non-renewable resources • reducing disturbances to soils, erosion and surface water flows from machinery use and other activities • reducing energy use and introducing alternative energy sources.
PPE may include:	<ul style="list-style-type: none"> • buoyancy vest or personal floatation device (PFD) • gloves, mitts or gauntlets, and protective hand and arm covering • hard hat or protective head covering • hearing protection (e.g. ear plugs and ear muffs) • insulated protective clothing for freezers or chillers and refrigeration units • non-slip and waterproof boots (gumboots) or other safety footwear • personal locator beacon or Emergency Position Indicating Radio Beacon (EPIRB) • protective eyewear, glasses and face mask

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	<ul style="list-style-type: none"> • protective hair, beard and boot covers • protective outdoor clothing for tropical conditions • respirator or face mask • safety harness • sun protection (e.g. sun hat, sunscreen and sunglasses) • uniforms, overalls or protective clothing (e.g. mesh and waterproof aprons) • waterproof clothing (e.g. wet weather gear and waders).
Water types may include:	<ul style="list-style-type: none"> • brackish water (3-30 ppt) • freshwater (generally <3 ppt) • hypersaline (>41 ppt) • made up (salt mix is added to water according to requirements) • salt water (31-40 ppt) • soft and hard.
Water sources may include:	<ul style="list-style-type: none"> • bore (e.g. artesian) • catchment (e.g. dam and reservoir) • coastal and ocean • rivers and streams • surface (e.g. spring and soak) • tidal creeks and estuaries • town or scheme.
Water budget may include:	<ul style="list-style-type: none"> • availability of water in different regions of facility • evaporation and seepage losses • options on amount of water disposed daily or weekly • water holding capacity on-farm (storage) • volume of water required for emergency procedures • volume of water required for normal operations • volume of water required to fill cultured or held structures.
Water and soil quality may include:	<ul style="list-style-type: none"> • pH, salinity, temperature, dissolved oxygen and hardness • presence of diseases and other pathogenic organisms • presence of predator or competing organisms

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	<ul style="list-style-type: none"> • sources of contaminants (e.g. heavy metals, nutrients, pesticides, herbicides and sewage) • water holding capacity of soils (e.g. clay content) and degree of overburden.
<p><i>Water transfer, recharge, reuse and treatment systems</i> may include:</p>	<ul style="list-style-type: none"> • alum • disinfection • filtration (e.g. chemical, mechanical and biological) • gravity • irrigation • nutrient removal • overflow • oxygenation • protein skimmers • pump (e.g. mechanical) • sediment collection • settlement or soak ponds • soak • temperature, salinity, pH and hardness • tidal • ultraviolet (UV) and ozone.
<p><i>Culture or holding structures and systems</i> may include:</p>	<ul style="list-style-type: none"> • blowers, aerators, paddlewheels and aspirators • cages, pontoons, enclosures and pens, including associated moorings, anchors, floats and markers • dams, ponds and pools • display tanks, aquaria and aquascapes • greenhouses, hothouses and igloos • grow out facilities, hatcheries and nurseries • harvesting swimways, canals or channels • live holding tanks, bins, cages and pens • longlines, posts, racks and rails, rafts, fences, socks, trays, sticks, baskets, modules, barrels, bags and panels • open, flow-through, closed and semi-closed systems • pest, predator and disease control structures • purging or depurating systems • tanks, raceways and recirculating systems • water supply and disposal or effluent systems including pumps, pipes, canals, channels,

RANGE STATEMENT	
	settlement ponds and storage dams.
(Design) <i>decisions</i> may be influenced by:	<ul style="list-style-type: none"> • budget • environmental constraints • owner preferences • quoting procedures.
<i>Key variables</i> may include:	<ul style="list-style-type: none"> • ability to undertake emergency procedures • efficiency of water use in various stock/weather situations • specialist water supply consultant • uniformity of distribution to culture of holding system.
<i>Contingency plans</i> may include:	<ul style="list-style-type: none"> • alternative transport facilities • auxiliary oxygen supply • backup power supply • filter supplies • monitoring alarms • plumbing supplies • procedures in place in event of reduced water flow or water quality or other emergency.

Unit Sector(s)

Unit sector	Aquaculture operations
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Co-requisite units

Co-requisite units	

Competency field

Competency field	
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