



Australian Government

Department of Education, Employment and Workplace Relations

RIINHB322A Construct multiple aquifer production bores

Release: 1

RIINHB322A Construct multiple aquifer production bores

Modification History

Not applicable.

Unit Descriptor

This unit covers the construction of multiple aquifer production bores in the drilling industry. It includes planning and preparing for multiple aquifer production bores, designing production bores for multiple aquifer systems, constructing production bores in multiple aquifer systems, developing bores, disinfecting/decontaminating bore and drilling equipment, carrying out bore maintenance and rehabilitation, and decommissioning test/bore holes. Licensing, legislative, regulatory and certification requirements that apply to this unit can vary between states, territories, and industry sectors. Relevant information must be sourced prior to application of the unit.

Application of the Unit

This unit is appropriate for those working in an operational role at worksites within:

- Drilling

Licensing/Regulatory Information

Refer to Unit Descriptor.

Pre-Requisites

Not applicable.

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

ELEMENT	PERFORMANCE CRITERIA
1. Plan and prepare for multiple aquifer production bores	1.1. Access, interpret and apply compliance documentation relevant to the work activity 1.2. Discuss scope of work with client to gain general agreement on drilling plan 1.3. Obtain, confirm and apply work instructions for the allocated task 1.4. Obtain or sight any licences or permits required under the relevant State/Territory legislation or regulation. 1.5. Identify, manage and report all potential hazards 1.6. Resolve coordination requirements with others at the site prior to commencing and during work activities 1.7. Communicate regular up to date information on progress, and/or problems encountered to client and/or other relevant parties 1.8. Provide detailed strata logs, pump and development test results conducted during bore development and water and strata samples to the appropriate authorities 1.9. Complete all requirements for bore completion reports, decommissioning or abandonment and send to regulatory authorities within the time specified on bore licence
2. Design production bores for multiple aquifer systems	2.1. Determine most appropriate construction methods from the reading and interpretation of all available documented information and ensure relevant procedures and standards are adhered to 2.2. Design the bore to ensure the exclusion of unsuitable waters and to prevent the inter-mixing of aquifers with different water quality or Standing Water Levels 2.3. Select a bore site that will prevent contamination and minimise interference with other bores and that is safe with respect to potential occupational health and safety hazards

	2.4. Select likely water entry mechanism from the formation to the bore such as open hole, slotted casing screens, gravel packs 2.5. Calculate appropriate artificial pack design parameters and recommended annular thicknesses required 2.6. Undertake calculations to determine appropriate screen design parameters (e.g. diameter, length, aperture size) 2.7. Plot and interpret sieve analysis results onto graphs 2.8. Select appropriate bore/surface casing for the anticipated ground/water quality and pressure conditions and any construction requirements 2.9. Ensure all necessary materials anticipated for the job are available and on site prior to commencement of construction phase
3. Construct production bores in multiple aquifer systems	3.1. Use approved <i>procedures to assemble and insert casing and screens</i> 3.2. Use <i>equipment</i> for assembly safely and in accordance with approved procedures 3.3. Grout or otherwise seal surface casing 3.4. Conduct grouting operations to seal intermediate and/or production casing strings or to seal selected zones 3.5. Construct bore in accordance with any applicable regulations, minimum construction and organisational requirements 3.6. Maintain plumbness and alignment of the hole within the required limitations 3.7. Collect, record and label formation and water samples 3.8. Maintain records accurately and legibly 3.9. Accurately calculate hole, annular, fill or pack materials and mud pit volumes in cubic metres or litres 3.10. Select and place stabilising gravel fill as required 3.11. Determine appropriate artificial pack material grain size 3.12. Place artificial pack material in a manner that will ensure uniform

	distribution in the annular space without bridging 3.13. Comply with relevant workplace occupational health and safety requirements for both the drilling equipment and construction materials 3.14. Maintain tool string inventories 3.15. Identify and protect headworks of the bore 3.16. Construct headworks to seal and cap the bore from surface water pollutants, environmental concerns and damage 3.17. Incorporate methods for measuring static and pumping water levels in headworks and for adequate sealing when not in use 3.18. Dispose of wastewater or hazardous materials from site and complete restoration of the bore site
4. Develop bore	4.1. Use development techniques with care to prevent collapsing of casing or screens 4.2. Use development techniques to improve hydraulic transmissivity around the bore 4.3. Undertake development until a continuous, clean supply of water is obtained, in accordance with site, contractual or regulatory requirements 4.4. Measure/calculate and record standing and drawdown water levels 4.5. Perform tests to estimate the sustainable yield of the bore
5. Disinfect/decontaminate bore and drilling equipment	5.1. Disinfect/decontaminate to comply with relevant standards or regulatory requirements 5.2. Handle hazardous chemicals in accordance with manufacturer's recommendations and any relevant legislative/regulatory requirements
6. Carry out bore maintenance and rehabilitation	6.1. Research all aspects of the bore construction and history 6.2. Undertake a process of diagnosis by testing and measurement to determine likely cause of bore deterioration 6.3. Devise a program of rehabilitation to

	ensure that the bore is restored to a reasonable condition 6.4. Wear appropriate/recommended personal protective equipment when handling hazardous cleaning chemicals and follow manufacturer's recommendations
7. Decommission test/bore holes	7.1. Determine suitable decommissioning procedures and select appropriate sealing materials and placement methods 7.2. Carry out the decommissioning (abandonment) of test holes or bore holes in single and multiple aquifer systems 7.3. Seal bore with surface caps and cover borecap with 300mm local soil 7.4. Verify position/location of hole for future reference 7.5. Dispose of drill and other fluids safely

Required Skills and Knowledge

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

Required skills

Specific skills are required to achieve the Performance Criteria of this unit, particularly for its application in the various circumstances in which this unit may be used. This includes the ability to carry out the following, as required to construct multiple aquifer production bores:

- apply legislative, organisation and site requirements and procedures for constructing multiple aquifer production bores
- perform aquifer sand sieve analysis tests
- calculate the specific capacity of a bore
- calculate grout component quantities, i.e. cement powder, water and other additives as required
- calculate hole and annular volumes
- calculate grout/mud specific gravity
- determine grain size and selection of appropriate artificial pack material

Required knowledge

Specific knowledge is required to achieve the Performance Criteria of this unit, particularly for its application in the various circumstances in which this unit may be used. This includes knowledge of the following, as required to construct multiple aquifer production bores:

- equipment characteristics, technical capabilities and limitations
- legal requirements under the relevant State/Territory Water Act
- basic geological formations, i.e. basic knowledge of both soil and rock classifications and various formations which permit groundwater movement and factors affecting groundwater quality for aquifer systems, including drillability and stability
- potential safety hazards and sources of contamination when siting a bore
- the necessity of having a signed agreement/contract with the client
- requirements for water sampling for laboratory testing
- tests for alignment and plumbness of bores
- appropriate casing materials for various applications
- hole preparation for cementing (grouting) operations
- effects of various cement (grout) additives
- pressure cementing methods
- casing collapse characteristics
- applications for wire-wound screens
- screen design parameters to ensure appropriate entrance velocities
- interpretation of sieve analysis results
- applications for natural pack, stabilising fill and artificial pack completion

techniques

- objectives of bore development
- test pumping procedures
- appropriate disinfecting chemicals and procedures
- appropriate headworks design for Class 2 bore applications
- characteristics of 'good samples' required for water well construction
- ways in which sampling errors can occur
- types of drilling fluids
- problem solving techniques
- grout placement methods and procedures
- range of numerical calculations to calculate:
 - volume (e.g. mud pits, drums, tanks or bore holes of given dimensions, annulus)
 - up hole velocity
 - cement/water/additives quantities
 - screen design parameters
 - flow rates (e.g. L/sec, GPM)
 - conversion from imperial to metric and vice versa
 - conducting a sieve analysis
- relevant occupational health and safety requirements including principles of Duty of Care
- appropriate fishing operations for the type(s) of drilling being undertaken
- use of materials safety data sheets (MSDS)

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 and evidence required to demonstrate competency in this unit	The evidence required to demonstrate competency in this unit must be relevant to worksite operations and satisfy all of the requirements of the performance criteria, required skills and knowledge and the range statement of this unit and include evidence of the following: • knowledge of the requirements, procedures and instructions for constructing multiple aquifer production bores • implementation of requirements, procedures and techniques for the safe, effective and efficient completion of multiple aquifer production bore construction • working with others to undertake and complete the construction of multiple aquifer production bores that meets all of the required outcomes • consistent timely completion of multiple aquifer production bore construction that safely, effectively and efficiently meets the required outcomes
Context of and specific resources for assessment	• This unit must be assessed in the context of the work environment. Where personal safety or environmental damage are limiting factors, assessment may occur in a simulated environment provided it is realistic and sufficiently rigorous to cover all aspects of workplace performance, including task skills, task management skills, contingency management skills and job role environment skills. • Assessment of this competency requires typical resources normally used in a resources and infrastructure sector environment. Selection and use of resources for particular worksites may differ due to the site circumstances. • The assessment environment should not disadvantage the participant. For example, language, literacy and numeracy demands of assessment should not be greater than those

	required on the job. • Customisation of assessment and delivery environment to sensitively accommodate cultural diversity. • Aboriginal people and other people from a non English speaking background may have second language issues. • Where applicable, physical resources should include equipment modified for people with disabilities. Access must be provided to appropriate learning and/or assessment support when required.
Method of assessment	This unit may be assessed in a holistic way with other units of competency. The assessment strategy for this unit must verify required knowledge and skill and practical application using more than one of the following assessment methods: • written and/or oral assessment of the candidate's required knowledge • observed, documented and/or first hand testimonial evidence of the candidate's: • implementation of appropriate requirement, procedures and techniques for the safe, effective and efficient achievement of required outcomes • consistent achievement of required outcomes • first hand testimonial evidence of the candidate's: • working with others to undertake and complete the construction of multiple aquifer production bores
Guidance information for assessment	Consult the SkillsDMC User Guide for further information on assessment including access and equity issues.

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 compliance documentation may include:	• legislative, organisational and site requirements and procedures • manufacturer's guidelines and specifications • Australian standards • code of practice
Work instructions may come from briefings, handovers, plans and work orders and may be written or verbal, formal or informal and may include:	• nature and scope of tasks • specifications • quality of finished works • achieved targets • operational conditions • obtaining of required permits • site layout • out of bounds areas • worksite inspection requirements • lighting conditions • plant of equipment defects • coordination requirements or issues • contamination control requirements • environmental control requirements • barricade and signage requirements
Licenses or permits may include:	• Water Well Licence (Class 2) • licence for particular drilling method (e.g. cable tool, auger, rotary air, rotary mud) • bore construction permit • bore development/works approval
Hazards may include:	• working in proximity to drilling rig
Coordination requirements may include:	• other equipment operators • maintenance personnel • supervisors • site personnel
Construction methods may include:	• mechanical surging • bailing • chemical

	• jetting • air lift • over pumping
Documented information may include:	• results of test hole • hydrogeological data and reports • geological data • old bore hole logs • results from sieve analysis tests • geophysical logs • physical samples • results of mechanical testing of soils • water test analyses • interpretation of soft/hard zones • losses of drilling fluid • bore log and in hole test results/measurements • records of nearby bores • geological maps
Procedures and standards may include:	• Australian standards (e.g. AS 2368 - Test Pumping Water Bores) • ARMCANZ "Minimum Construction Requirements for Water Bores in Australia" July 1997
Procedures to assemble and insert casing and screens may include:	• solvent cement (PVC) • stainless steel screws (PVC) • welding (steel) • threaded (PVC, FRP, ABS) • locking strip or wire rope
Equipment may include:	• hand tools • power driven (electric, hydraulic or air) hand tools • welders • solvents

Unit Sector(s)

Drilling (General)

Competency field

Refer to Unit Sector(s).

Co-requisite units

Not applicable.