THE NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

OCCUPATIONAL STANDARDS

OCCUPATION: WATER CONSERVANCY ENGINEERING TECHNICIAN

LEVEL: NTA LEVEL 6

FEBRUARY 2024

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ABBREVIATIONS

CBET	Competency Based Education and Training
CEC	Concrete Engineering Construction
CRW	Construction of Rebar Works
DRO	Drilling Rig Operation
EC	Earthwork Construction
HGO	Hydraulic Gate Operation
HM	Hydrogeological Monitoring
NACTVET	National Council For Technical And Vocational Education And Training of Tanzania
NOS	National Occupational Standards
OS	Occupational Standards
TET	Technical Education and Training
TVET	Technical and Vocational Education and Training
WCPM	Water Conservancy Project Monitoring
WCOCM	Water Conservancy Organization and Construction Management

GLOSSARY OF TERMS

Circumstantial knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross-cutting issues.
Competence:	The ability to use knowledge, understanding, practical and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based education:	An instructional programme that derives its content from validated tasks and bases assessment on the learner's performance.
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/training programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks - essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational area:	This is a broad grouping of related jobs. (Example: catering service)
Occupational standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as performance tools of assessment of the prescribed outcomes.
Performance criteria:	Indicate the expected end results or outcome in form of evaluative statements.
Skills:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skills are conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor activities.
Standards:	A set of statements, which, if proved true under working conditions, means that an individual is meeting an expected level and type of performance.

Task analysis:	The process of analysing each task to determine the steps, circumstantial knowledge, attitudes, performance criteria, tools and materials needed, and safety concerns required of employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, consists of two or more definite steps, and leads to a product, service, or decision.
Underpinning knowledge:	The crucial knowledge that an individual must acquire in order to perform a given task.
Verification process:	The process of experts reviewing and confirming the statements of tasks (competency) through occupational analysis. Other questions such as the degree of task learning difficulty are also frequently asked. This process is sometimes referred to as validation.
Occupational competence:	The application of knowledge and skills to perform consistently to the standards required in the working context.

1.0. INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's *Development Vision 2025* intends to raise the country's economy to a middle-income status, with a high level of human development. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical and Vocational Education and Training (NACTVET) has begun the job of drafting Occupational Standards (OS) that will eventually be adopted as National Occupational Standards (NOS) for use in the delivery of TET that meets the needs of the labour market and the country's economic agenda.

Occupational Standards (OS) are performance criteria that are matched with labour market demands. Each of them describes the functions, performance standards, and understanding or knowledge underpinning a given occupation. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruitment, supervision, and appraisal, as well as TET Standards. They are also helpful for benchmarking and harmonizing job qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current, and consistent in application across all public and private institutions.

However, it must be noted that Occupational Standards are different from Training /Education Standards. Occupational standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical circuits, performs troubleshooting in electrical circuits, etc.), and are usually defined by Employers following procedures as agreed upon by all the stakeholders. On the other hand, Training and Education Standards are developed from the activities defined in the occupational standards, and they specify learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him/her to function at an agreed level in an occupation. Training and Education Standards are used to define curricula in training institutions. It is critical, however, to establish a direct link between the occupational standards and the training standards for both of them to respond collaboratively to the demands of the labour market.

For the purpose of TET delivery, Tanzania has adopted the Competence Based Education and Training (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the occupational standards. Occupational standards are thus the starting point for developing competency-based training (CBET) programmes. Therefore, it is quite pertinent

for TET institutions to use the relevant occupational standards as a benchmark for formulating their curricula.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training.

The document explains how the occupational standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0. OCCUPATIONAL STANDARDS DEVELOPMENT PROCESS

The process of developing these Occupational Standards involved both local and international expertise. The process began with an examination of major documents that guide Tanzanian skills development including the *10-year National Skills Development Strategy (2016-2026).* NACTVET labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a team of experts in consultation with practitioners developed draft occupational standards. The draft document was used to develop an occupational profile for each occupation (DACUM Chart), which is attached as an **Appendix** to every Occupational Standard.

The occupational standards were validated during the stakeholders' forum held on 22nd and 23rd February 2024 at Morogoro. The information from the stakeholders' forum provides insight from the workplaces, professional bodies, regulatory bodies and sector ministries regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation.

3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATIONAL STANDARDS FOR WATER CONSERVANCY ENGINEERING TECHNICIANS

These standards cover a broad range of duties and tasks that can be performed by a Water Conservancy Engineering Technician. However, the occupational standards are not meant to replace individual job descriptions, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Water Conservancy Engineering Technician may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For example, in large operations, other individuals may be employed or designated to perform specific tasks.

The Water Conservancy Engineering Technician works under the supervision of the engineer, operating the drilling rig to complete drilling construction, and overseeing the construction site,

including earthwork and reinforced concrete works. Additionally, they are required to perform water conservancy project monitoring and maintenance, hydraulic gate operation and maintenance, and hydrogeological surveys. Generally, the Water Conservancy Engineering Technician performs the following duties:

a) Operate the drilling rig;
b) Identify and select earthwork construction machinery (equipment);
c) Operate and maintain earthwork construction machinery (equipment);
d) Prepare earthwork construction scheme and provide onsite guidance;
e) Identify and select concrete construction materials and equipment;
f) Carry out concrete construction and finishing;
g) Formulate and check the concrete construction plan;
h) Perform steel bar processing, connection, and installation;
i) Prepare the steel bar construction scheme;
j) Monitor the water conservancy project and record the data;
k) Detect, inspect and maintain water conservancy project monitoring facilities;
l) Perform routine inspection and maintenance of hydraulic gate operation, abnormality identification and local maintenance, abnormality elimination, and equipment maintenance;
m) Observe and measure (test) precipitation, water level, and flow, and reorganize data;
n) Carry out hydrogeological survey, groundwater observation, water quality monitoring;
o) Install and maintain hydrogeological survey instruments and equipment, and perform hydrogeological information prediction;
p) Carry out Water Conservancy engineering construction management.

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA Level 4, 5 and 6.

4.0. VALIDITY PERIOD

The Occupational Standards will be valid for 3-5 years due to the fast-changing nature of technology. The review will proceed in the same manner as the previous one, with new occupational standards being developed based on current labour market information.

5.0. OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR WATER CONSERVANCY ENGINEERING TECHNICIAN - NTA LEVEL 6

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EXCAVATE WATER INTAKE WELLS	**DUTY NO.**	601
TASK TITLE	MANAGE THE USE OF DRILLING TOOLS, AND MEASURE THE BOREHOLE DIMENSIONS	**TASK NO.**	6011
PERFORMANCE CRITERIA	The person performing this task must be able to manage the use of drilling tools and measure the borehole dimensions according to technical requirements and customer needs.		
RANGE STATEMENT	This task can be performed on the drilling site under the guidance of Senior Technicians or Water Conservancy Engineering Engineers. The tools and equipment to be used include: 1. Drill bit; 2. Drill rod; 3. Drill collar; 4. Sediment tube, etc.; 5. Measuring tool; 6. Borehole inclinometer. 7. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Select drilling tools according to formation characteristics under guidance; 2. Measure and select drill bits; 3. Install drill bits, drill rods, drill collars and other drilling tools; 4. Measure, record and correct hole depth; 5. Measure the bend of borehole; 6. Measure water level, water quantity and water temperature; 7. Record and fill in the team report. 8. Observe health, occupational and environmental safety rules and regulations.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Choose to equip drilling tools; 1.2 Select the drill bit; 1.3 Use measuring equipment. **2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Selection of drilling tools according to formation characteristics; 2.2 Filling in of the team report. **3.0 Theories** The person performing this task must be able to explain: 3.1 Installation of drilling tools; 3.2 Use of measuring tools; 3.3 Correction of hole depth. **4.0 Essential skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills; 4.6 Tool use and maintenance skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The drilling tools are managed and borehole dimensions are measured according to technical requirements and customer needs.

CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of operating tools; 2. Occupational health and safety; 3. Hydrogeological basics; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EXCAVATE WATER INTAKE WELL	**DUTY NO.**	601
TASK TITLE	HANDLE MAJOR DOWN HOLE ACCIDENTS	**TASK NO.**	6012
PERFORMANCE CRITERIA	The person performing this task must be able to handle major down hole accidents according to technical requirements.		
RANGE STATEMENT	The task may be executed on the drilling site under the supervision of a Chief Engineer or Leader in charge. The tools and equipment to be used include: 1. Die tap and die collar; 2. Catch sleeve; 3. Fishing spear; 4. Cutting knife; 5. Mill; 6. Grappling basket; 7. Lifter. 8. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety, quality and environmental protection measures when performing this task; 2. Choose correct tools, equipment and safety protection articles for tasks; 3. Check drilling equipment for obvious faults;	Detailed knowledge about: **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Handle serious down-hole troubles.

4. Check the hole for factors affecting the drilling rig; 5. Determine major down-hole troubles; 6. Eliminate major down-hole troubles; 7. Handle major down-hole troubles.	**2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Handling of down-hole troubles; 2.2 Safety, quality and environmental protection standards. **3.0 Theories** The person performing this task must be able to explain: 3.1 Orders of dealing with major down-hole troubles; 3.2 Methods to deal with major down-hole troubles; 3.3 Essentials to deal with major down-hole troubles; 3.4 Project quality indexes and work safety measures. **4.0 Essential skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills; 4.6 Tool use and maintenance skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	Major down-hole accidents are handled according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Work safety and management; 2. Engineering quality control; 3. Occupational health and safety; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EXCAVATE WATER INTAKE WELL	**DUTY NO.**	601
TASK TITLE	CONDUCT HYDROGEOLOGICAL OBSERVATION AND GEOLOGICAL LOGGING	**TASK NO.**	6013
PERFORMANCE CRITERIA	The person performing this task must be able to conduct hydrogeological observation and geological logging according to technical requirements.		
RANGE STATEMENT	The task may be executed on the drilling site under the supervision of a Chief Engineer or Leader in charge. The tools and equipment to be used include: 1. Hydrogeological drilling rig; 2. Water gauge; 3. Water thermometer; 4. Calculator; 5. Acrylic tube; 6. Pressure meter; 7. Casing. 8. Safety gear		

<table>
<tr><th colspan="2">EVIDENCE REQUIREMENT</th></tr>
<tr><th>PRACTICAL PERFORMANCE</th><th>UNDERPINNING KNOWLEDGE</th></tr>
<tr><td>The person performing this task must be able to do the following:
1. Comply with safety, quality and environmental protection measures when performing this task;
2. Choose correct tools, equipment and safety protection articles for tasks;
3. Observe the core;
4. Observe the aquifer;
5. Observe the water temperature;
6. Observe the consumption of flushing fluid;
7. Observe the phenomenon of borehole water gushing;
8. Observe the phenomenon in the hole;
9. Catalog hydrogeological drilling;
10. Collate data.</td><td>Detailed knowledge about:
1.0 Methods
The person performing this task must be able to explain how to:
1.1 Observe the core;
1.2 Observe hydrogeology;
1.3 Catalog hydrogeological drilling.

2.0 Principles
The person performing this task must be able to explain the following Principles:
2.1 Stable water level measurement.

3.0 Theories
The person performing this task must be able to explain:
3.1 Core characteristics;
3.2 Contents of hydrogeological observation;
3.3 Hydrogeological drilling catalogue.

4.0 Essential skills
4.1 Communication skills;
4.2 Management skills;
4.3 Data storage skills;
4.4 Teamwork skills;
4.5 Computer operation skills;
4.6 Tool and equipment use and maintenance skills;
4.7 Report writing skills.</td></tr>
<tr><td>DESCRIPTION OF THE END PRODUCT / SERVICE</td><td>The hydrogeological observation and geological logging are conducted according to technical requirements.</td></tr>
<tr><td>CIRCUMSTANTIAL KNOWLEDGE</td><td>Detailed knowledge about:
1. Work safety and management;</td></tr>
</table>

	2. Engineering quality control; 3. Occupational health and safety; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	EXCAVATE WATER INTAKE WELL	**DUTY NO.**	601
TASK TITILE	SUPERVISE THE COMPLETION OF DRILLING CONSTRUCTION	**TASK NO.**	6014
PERFORMANCE CRITERIA	The person performing this task must be able to supervise the completion of drilling construction according to technical requirements and project contract period.		
RANGE STATEMENT	The task may be executed on the drilling site under the supervision of a Chief Engineer or Leader in charge. The tools and equipment to be used include: 1. Hydrogeological drilling rig; 2. Mud pump; 3. Drilling tower; 4. Air compressor; 5. Borehole inclinometer; 6. Well pipe. 7. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety, quality and environmental protection measures when performing this task; 2. Choose correct tools, equipment and safety protection articles for tasks; 3. Check down-hole condition;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Command the completion of drilling construction; 1.2 Carry out drilling work. **2.0 Principles** The person performing this task must be able to explain the following Principles:

4. Correctly select drilling parameters and drilling techniques; 5. Find out the drilling law; 6. Handle general down-hole troubles and general equipment accidents; 7. Stop illegal operations; 8. Control material consumption; 9. Clean the tools, equipment and workplace; 10. Store the tools and equipment.	2.1 Drilling construction procedures; 2.2 Safety, quality and environmental protection standards. **3.0 Theories** The person performing this task must be able to explain: 3. Drilling equipment; 3.2 Drilling techniques; 3.3 Mud preparation and adjustment; 3.4 Shaft-forming technology; 3.5 Typical equipment failure; 3.6 Project quality indexes and work safety measures. **4.0 Essential skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills; 4.6 Tool use and maintenance skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The completion of drilling construction is supervised according to technical requirements and project contract period.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Work safety and management; 2. Engineering quality control; 3. Occupational health and safety; 4. Mechanical basics; 5. Electrical engineering basics; 6. Electrical welding.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARE THE SCHEME OF EARTHWORK EXCAVATION	**TASK NO.**	6021
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the scheme of earthwork excavation according to technical requirements.		
RANGE STATEMENT	The task may be executed on the Water Conservancy construction site under the supervision of a Senior Technician or Water Conservancy Engineer. The tools and equipment to be used include: 1. Computer. 2. Hydrogeological drilling rig; 3. Drill tools. 4. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the project layout; 2. Plan the scope, sequence and stacking position of earthwork excavation; 3. Determine earthwork excavation technology and safety requirements; 4. Draw detailed earthwork excavation drawings; 5. Calculate the quantity of earthwork excavation;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the scope and sequence of earthwork excavation; 1.2 Select the earthwork stacking site; 1.3 Determine the quantity of earthwork excavation.

6. Prepare the earthwork excavation scheme. 7. Observe health, occupational and environmental safety rules and regulations.	**2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Construction code for earthwork excavation; 2.2 Safety organization of earthwork excavation. **3.0 Theories** The person performing this task must be able to explain: 3.1 Earthwork excavation scope; 3.2 Earth excavation sequence; 3.3 Earthwork stacking position; 3.4 Quantity of earthwork excavation. **4.0 Essential skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Customer service skills; 4.4 Teamwork skills; 4.5 Report writing skills; 4.6 Tool use and maintenance skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The earthwork excavation scheme is prepared in accordance with technical requirements of earthwork transportation and filling.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Preparation of the earthwork excavation scheme based on construction scenario requirements.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARE EARTHWORK TRANSPORTATION PLANS	**TASK NO.**	6022
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the earthwork transportation scheme according to technical requirements.		
RANGE STATEMENT	The task may be executed on the Water Conservancy construction site under the supervision of a Senior Technician or Water Conservancy Engineer. The tools and equipment to be used include: 1. Computer. 2. Dump truck; 3. Excavator; 4. Loader. 5. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the project layout; 2. Determine the earthwork transportation distance and earthwork stacking position; 3. Calculate the quantity of earthwork transportation; 4. Determine the combined configuration and safety requirements of earthwork transportation machinery;	**Detailed knowledge about:**

5. Draw detailed earthwork transportation drawings; 6. Prepare the earthwork transportation scheme. 7. Observe health, occupational and environmental safety rules and regulations.	**1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the quantity of earthwork transportation and transportation distance; 1.2 Determine the earthwork stacking site. **2.0 Principles** The person performing this task must be able to explain the following Principless: 2.1 Construction code for earthwork transportation; 2.2 Safety organization of earthwork transportation. **3.0 Theories** The person performing this task must be able to explain: 3.1 Quantity of earthwork excavation; 3.2 Earthwork transportation distance; 3.3 Combined configuration of earthwork transportation equipment; 3.4 Management of earthwork stacking position. **4.0 Essential skills** 4.1 Communication skills; 4.2 Operation skills; 4.3 Cooperation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The earthwork transportation plans are prepared in accordance with technical requirements of earthwork filling.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Preparation of the earthwork transportation scheme based on construction scenario requirements.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARE EARTHWORK COMPACTION PLANS	**TASK NO.**	6023
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the earthwork compaction plans according to the technical requirements.		
RANGE STATEMENT	The task may be executed on the Water Conservancy construction site under the supervision of a Senior Technician or Water Conservancy Engineer. The tools and equipment to be used include: 1. Level gauge; 2. Infrared drying oven; 3. Soil wreath knife; 4. Balance. 5. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Read the project layout; 2. Determine the earthwork filling position; 3. Determine the quantity of earthwork filling; 4. Determine the combined configuration and safety requirements of earthwork filling machinery; 5. Draw detailed earthwork filling location plan;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the quantity and compaction parameters of earthwork filling; 1.2 Determine the flow operation layout of dam face. **2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Construction code for earthwork rolling; 2.2 Safety organization of earthwork rolling.

6. Prepare the earthwork rolling scheme. 7. Observe health, occupational and environmental safety rules and regulations.	**3.0 Theories** The person performing this task must be able to explain: 3.1 Calculation of the quantity of earthwork filling; 3.2 Calculation of earthwork compaction parameters; 3.3 Determination of the combined configuration of earthwork rolling equipment; 3.4 Division and management of pipelining construction. **4.0 Essential skills** 4.1 Communication skills; 4.2 Operation skills; 4.3 Cooperation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The earthwork compaction plans are prepared, in accordance with the technical requirements
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Preparation of the earth-rock dam rolling scheme based on construction scenario requirements. 2. Delivery of earth-rock dams meeting quality requirements

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	TEST THE CONCRETE PERFORMANCE, ADJUST THE MIXING RATIO AND MAINTAIN THE MIXING PLANT EQUIPMENT	**TASK NO.**	6024
PERFORMANCE CRITERIA	The person performing this task must be able to test the performance of the concrete, adjust the mixing ratio and maintain the mixing plant equipment according to concrete technical requirements.		
RANGE STATEMENT	The task may be executed on the Water Conservancy construction site under the supervision of a Senior Technician or Water Conservancy Engineer. The tools and equipment to be used include: 1. Slump tester; 2. Concrete extensibility tester; 3. Pressure tester. 4. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Complete the concrete sampling and slump detection within 20min after the concrete is transported to the delivery place, as well as the preparation of the specimens for strength and impermeability test within 40min;	**Detailed knowledge about:**

2. Ensure that the sample size for each group should be 1.5 times the amount required for concrete quality inspection items; 3. Ensure that the batching conditions of concrete specimens comply with relevant provisions; 4. Determine the number of retained sets of impermeability test blocks for concrete with impermeability requirements based on the structure scale and requirements; 5. Ensure that the performance indicators of concrete requiring compensation for shrinkage or micro-expansion are tested in accordance with relevant requirements; 6. Test the quality indicators of concrete with other performance requirements in accordance with relevant requirements. 7. Observe health, occupational and environmental safety rules and regulations.	**1.0 Methods** The person performing this task must be able to explain how to: 1.1 Sample concrete; 1.2 Carry out concrete strength and impermeability tests; 1.3 Test the compensating shrinkage performance of concrete. **2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Specification for concrete quality control; 2.2 Concrete sampling. **3.0 Theories** The person performing this task must be able to explain: 3.1 Concrete slump test methods; 3.2 Concrete strength grade test. **4.0 Essential skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Cooperation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The concrete performance is tested, the mix ratio is adjusted and the mixing equipment is maintained according to the concrete technical requirements
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Strength grade of concrete; 2. Impermeability and durability of concrete; 3. Shrinkage compensation of concrete;

	4. Statistical analysis of experimental data.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARE THE CONCRETE FORMWORK INSTALLATION SCHEME	**TASK NO.**	6025
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the concrete formwork installation scheme according to concrete technical requirements.		
RANGE STATEMENT	The task may be executed on the Water Conservancy construction site under the supervision of a Senior Technician or Water Conservancy Engineer. The tools and equipment to be used include: 1. Commonly used machinery for processing formwork materials, installing and removing formworks; 2. Maintenance knowledge of formwork material processing machinery; 3. Lifting machinery knowledge. 4. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Prepare the concrete formwork installation scheme; 2. Make preparations the formwork installation and removal; 3. Check formwork installation; 4. Prepare formwork installation methods and quality standards;	**Detailed knowledge about:**

5. Perform formwork and support system monitoring. 6. Observe health, occupational and environmental safety rules and regulations.	**1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the formwork installation scheme; 1.2 Organize the installation of large formworks; 1.3 Check the quality requirements of large formwork installation. **2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Construction codes for reserving camber during formwork installation; 2.2 Formwork detection, cleaning, and maintenance. **3.0 Theories** The person performing this task must be able to explain: 3.1 Arching calculation; 3.2 Formwork installation requirements; 3.3 Formwork detection; 3.4 Formwork cleaning; 3.5 Formwork maintenance; 3.6 Deformation of formwork under stress. **4.0 Essential skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Cooperation skills.

DESCRIPTION OF THE END PRODUCT / SERVICE	The concrete formwork installation scheme is prepared according to concrete technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Requirements for large formwork installation; 2. Requirements for large formwork removal.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARE THE CONCRETE PLACEMENT SCHEME	**TASK NO.**	6026
PERFORMANCE CRITERIA	The person performing this task must be able to develop the concrete placement scheme in accordance with concrete technical requirements.		
RANGE STATEMENT	The task may be executed on the Water Conservancy construction site under the supervision of a Senior Technician or Water Conservancy Engineer. The tools and equipment to be used include: 1. Ultrasonic concrete detector; 2. Automatic integrated rebound hammer; 3. Concrete rebar detector. 4. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1 Determine the concrete placing procedure, flow and method; 2 Select concrete placing equipment and machines and tools, and arrange them reasonably; 3 Determine the staffing requirements for pouring concrete for ordinary structures or members; 4 Put forward the key points of work safety in concrete placement;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Determine the construction scheme for concrete placement; 1.2 Organize the construction of large volume concrete placements; 1.3 Maintain and repair mass concrete.

5 Perform mass concrete placement for the foundation according to construction codes; 6 Cover and curing according to the special scheme of mass concrete temperature control and curing; 7 Check and supervise the curing of concrete with various special-shaped structures; 8 Determine the type of concrete defects; 9 Draw up the technical scheme of concrete surface finishing. 10 Observe health, occupational and environmental safety rules and regulations.	**2.0 Principles** The person performing this task must be able to explain the following Principless: 2.1 Specifications for the construction of concrete structures; 2.2 Principles of safe organization of concrete placement. **3.0 Theories** The person performing this task must be able to explain: 3.1 Performance of the pouring construction equipment, machines and tools; 3.2 Technical elements of structural construction drawings; 3.3 Identification of construction site hazards; 3.4 Factors influencing temperature cracks in mass concrete; 3.5 Factors influencing the various methods of conservation of mass concrete; 3.6 Determination of the quality of maintenance of mass concrete. **4.0 Essential skills** 4.1 Communication skills; 4.2 Management skills; 4.3 Cooperation skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The concrete placement scheme is prepared according to the concrete technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Use of relevant quality control instruments 2. Safety operation of operating tools 3. Occupation health and safety

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARE THE REINFORCEMENT CONSTRUCTION SCHEME	**TASK NO.**	6027
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the reinforcement (steel bar) construction scheme according to technical requirements.		
RANGE STATEMENT	The task may be executed on the Water Conservancy construction site under the supervision of a Water Conservancy Engineer or Civil Engineer. The tools and equipment to be used include: 1. Computers and calculators; 2. Drawing Tools; 3. Relevant construction manuals, specifications, drawings, etc. 4. Safety gear		

EVIDENCE REQUIREMENT

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Prepare construction schemes, special plans and technical disclosure on quality and safety for common reinforcement works; 2. Prepare construction work plans for the shift; 3. Prepare a general pre-stressing construction scheme.	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Prepare construction schemes, special plans and technical disclosure on quality and safety for common reinforcement works, including analysis of the construction process, determination of

4. Observe health, occupational and environmental safety rules and regulations.	construction methods and procedures, preparation of construction programs and technical handouts. **2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Relevant codes and standards need to be followed in the preparation of programs and hand-outs; 2.2 Safety, quality and efficiency in the construction process; 2.3 Optimization and improvement of construction conditions and requirements. **3.0 Theories** The person performing this task must be able to explain: 3.1 Basic theories and relevant specifications for reinforcement construction that need to be mastered for the preparation of programs and hand-outs; 3.2 Construction technology and method; 3.3 Control measures of construction safety. **4.0 Essential skills** 4.1 Construction organization ability; 4.2 Technical analysis ability; 4.3 Program design ability; 4.4 Documentation ability.
DESCRIPTION OF THE END PRODUCT / SERVICE	The reinforcement construction scheme is prepared in accordance with technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of construction organization and management; 2. Knowledge of labour quotas;

	3. Basic knowledge of quality management.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARE REINFORCEMENT MATERIAL LIST	**TASK NO.**	6028
PERFORMANCE CRITERIA	The person performing this task must be able to prepare the reinforcement material list in accordance with technical requirements.		
RANGE STATEMENT	The task may be executed on the Water Conservancy construction site under the supervision of a Water Conservancy Engineer or Civil Engineer. The tools and equipment to be used include: 1. Reinforcement detailing tools (e.g. steel rulers, angle rulers, wire rods, etc.); 2. Computers and supporting software; 3. Software for the preparation of the material list. 4. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Carry out the reinforcement detailing of complex components and prepare the material list; 2. Carry out reinforcement detailing of special structures such as chimneys and water towers and prepare the material list; 3. Use computer technology for detailing and prepare the material list;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Perform member analysis to determine the structural form and dimensions of the member for the reinforcement detailing of complex components; 1.2 Analyze and calculate the reinforcement arrangement according to the design requirements

4. Prepare the material list for pre-stressing tendons and accessories. 5. Observe health, occupational and environmental safety rules and regulations.	of the component and finally prepare the material list; 1.3 Analyze and calculate the reinforcement arrangement according to the characteristics of the structure and the actual situation, and prepare material list for special structures such as chimneys and water towers. **2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Actual conditions and requirements of the components and structures, ensuring that the arrangement, quantity and specification of the reinforcement meet the design requirements; 2.2 Safety and quality issues during construction. **3.0 Theories** The person performing this task must be able to explain: 3.1 Basic theories of reinforcement engineering, such as mechanics of materials and structural mechanics; 3.2 Properties and use requirements of steel reinforcement and relevant codes and standards. **4.0. Essential skills** 4.1 Construction organization ability; 4.2 Technical analysis ability; 4.3 Program design ability; 4.4 Documentation ability.
DESCRIPTION OF THE END PRODUCT / SERVICE	The reinforcement material list is prepared according to technical requirements.

CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Knowledge of reinforcement detailing; 2. Features of relevant structures, component reinforcement and construction; 3. Knowledge of relevant computer-aided software; 4. Knowledge of prestressing tendon detailing.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	INSPECT THE CONSTRUCTION QUALITY	**TASK NO.**	6029
PERFORMANCE CRITERIA	The person performing this task must be able to inspect the construction quality in accordance with technical requirements.		
RANGE STATEMENT	The task may be executed on the Water Conservancy construction site under the supervision of a Water Conservancy Engineer or Civil Engineer. The tools and equipment to be used include: 1. Measuring tools, such as steel rulers, callipers and measuring instruments; 2. Tools for examination such as magnifying glasses and microscopes; 3. Inspection aids such as lighting equipment and reflectors; 4. Hand-held vibration measuring instruments, noise meters and other testing equipment. 5. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Check the quality of construction of reinforcement mesh, skeletons and conventional nodes; 2. Check the location of prestressing tendons and taking control measures; 3. Carry out self-tests of prestressing tendons;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Measure the size and position of the reinforcement using measuring tools; 1.2 Use inspection tools for inspection of defects and location of the reinforcement.

4. Carry out mutual inspections of the quality of reinforcement installation; 5. Prevent and control defects in the quality of reinforcement construction. 6. Observe health, occupational and environmental safety rules and regulations.	**2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Inspection of the position, quantity and quality of reinforcement in accordance with the construction drawings and design requirements; 2.2 Assessment of construction quality in accordance with relevant specifications and standards. **3.0 Theories** The person performing this task must be able to explain: 3.1 Construction requirements for the processing, installation, connection and tensioning of reinforcement; 3.2 Relevant codes, standards, acceptance criteria and other quality requirements. **4.0. Essential skills** 4.1 Construction organization ability; 4.2 Technical analysis ability; 4.3 Program design ability; 4.4 Documentation ability.
DESCRIPTION OF THE END PRODUCT / SERVICE	The construction quality is inspected in accordance with technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Standard for acceptance of construction quality; 2. Causes of quality defects in reinforcement works

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	CARRY OUT WATER CONSERVANCY PROJECT CONSTRUCTION	**DUTY NO.**	602
TASK TITLE	PREPARE A FILL IN TECHNICAL CONSTRUCTION SUMMARY OF REINFORCEMENT	**TASK NO.**	60210
PERFORMANCE CRITERIA	The person performing this task must be able to prepare a fill in technical construction summary of reinforcement in accordance with technical requirements.		
RANGE STATEMENT	The task may be executed on the Water Conservancy construction site under the supervision of a Water Conservancy Engineer or Civil Engineer. The tools and equipment to be used include: 1. Computers and related software, such as CAD, BIM, etc., for drafting, simulation, optimization, etc.; 2. Testing instruments, such as ultrasonic thickness gauges and metal detectors, for the detection of quality and defects in reinforcement; 3. Welding equipment, such as electric welding machines, gas welding equipment, etc., for the welding of reinforcement; 4. Shearing equipment, such as shears and bending machines, for processing the reinforcement; 5. Hand tools, such as pliers and wrenches, for the installation and adjustment of reinforcement bars. 6. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following:	**Detailed knowledge about:**

1. Research and analyze the actual situation of the project to obtain the necessary data and information; 2. Process and analyze data through computer software, e.g. Excel, AutoCAD, Revit; 3. Perform statistics and analysis of the data to draw relevant indicators and conclusions; 4. Organize and summarize the results of research and analysis and write technical summary reports. 5. Observe health, occupational and environmental safety rules and regulations.	**1.0 Methods** The person performing this task must be able to explain how to: 1.1 Measure the length, diameter, deviation and other important parameters of the reinforcement to ensure construction quality; 1.2 Carry out basic operations such as machining, cutting, drilling, detailing, assembling and welding of the reinforcement; 1.3 Select the appropriate connection method for the different reinforcement structures; Perform connections such as grouting, rolling straight threads and fused metal filled joints. **2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Mechanical properties of reinforced concrete; 2.2 Processes such as cutting, bending and joining of reinforcement; 2.3 Principles of detailing with reinforcement detailing machines; 2.4 Principles and scope of application of reinforcement connection methods; 2.5 Principles and technique for the arrangement and installation of reinforcement structures; 2.6 Principles and method of construction processes such as pre-stressing tensioning, anchoring and grouting. **3.0 Theories** The person performing this task must be able to explain: 3.1 Processing, storage and transport of reinforcement; Knowledge of the precautions to be taken during

	the processing of reinforcement including cutting, bending and stretching of reinforcement, as well as anti-corrosion and anti-rust measures in storage and transport, to ensure the quality of reinforcement; 3.2 Different types of reinforcement connections, including welded, threaded, plugged and socket grouted; 3.3 Principles of reinforcement arrangement, including force analysis, structural design, reinforcement allocation; 3.4 Precautions during the construction of reinforced concrete, including formwork production, concrete placement, vibrating and maintenance; 3.5 Precautions during the construction of prestressed concrete, including tensioning, fixing and cutting of prestressing tendons. **4.0 Essential skills** 4.1 Construction organization ability; 4.2 Technical analysis ability; 4.3 Program design ability; 4.4 Documentation ability.
DESCRIPTION OF THE END PRODUCT / SERVICE	A fill in technical construction summary of reinforcement is prepared according to technical requirements.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Relevant standards, norms and laws and regulations for building structure and steel reinforcement construction, including national and local construction engineering-related regulations, standards and norms, etc.;

	2. Processing and installation techniques, quality inspection and acceptance standards, etc. of various types of reinforcement materials and reinforcements; 3. Process flow and quality requirements for pre-stressed reinforcement processing, tensioning, curing and protection; 4. Basic computer application knowledge which allows the person to use the computer to conduct the detailing of samples, prepare material lists and draw construction drawings, etc.; 5. Modern construction management and work safety management methods, including project planning, construction organization, site management, safety measures.

OCCUPATION	**WATER CONSERVANCY ENGINEERING TECHNICIAN**	**OCCUPATION CODE**	
DUTY TITLE	MONITOR THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	603
TASK TITLE	MONITOR THE ENVIRONMENTAL QUANTITY OF HYDRAULIC STRUCTURES	**TASK NO.**	6031
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the environmental quantity of hydraulic structure in accordance with environmental laws and regulations.		
RANGE STATEMENT	The task may be executed on the at the site of environmental quantity monitoring of hydraulic structures under the guidance of a Senior Technician or Water Conservancy Engineering Engineer. The tools and equipment to be used include: 1. Environmental quantity monitoring occupational standards; 2. Environmental quantity monitoring equipment and its specifications. 3. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety, quality and environmental protection measures when performing this task; 2. Comply with the environmental quantity monitoring specifications of hydraulic structures when performing tasks;	**Detailed knowledge about:**

3. Inspect water level monitoring facilities; 4. Maintain water level monitoring facilities; 5. Inspect precipitation monitoring facilities; 6. Maintain precipitation monitoring facilities; 7. Inspect water temperature monitoring facilities; 8. Maintain water temperature monitoring facilities; 9. Inspect temperature monitoring facilities; 10. Maintain temperature monitoring facilities.	**1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect and maintain water level monitoring facilities; 1.2 Inspect and maintain precipitation monitoring facilities; 1.3 Inspect and maintain water temperature monitoring facilities; 1.4 Inspect and maintain temperature monitoring facilities. **2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Methods and Principles of inspection and maintenance of environmental quantity monitoring facilities of hydraulic structures. **3.0 Theories** The person performing this task must be able to explain: 3.1 Inspection and maintenance requirements for float type water level gauge, ultrasonic water level gauge, pressure type water level gauge; 3.2 Inspection and maintenance requirements for tipping bucket rain gauge and siphon rain gauge; 3.3 Inspection and maintenance requirements for water temperature monitoring facilities; 3.4 Inspection and maintenance requirements for temperature monitoring facilities. **4.0 Essential skills** 4.1 Communication skills; 4.2 Computer operation skills;

	4.3 Teamwork skills; 4.4 Report writing skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The environmental quantity of hydraulic structures are monitored according to environmental laws and regulations
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of operating tools; 2. Occupational health and safety; 3. Basic knowledge of hydraulic structures; 4. Knowledge of environmental quantity monitoring of hydraulic structures.

OCCUPATION	**WATER CONSERVANCY ENGINEERING TECHNICIAN**	**OCCUPATION CODE**	
DUTY TITLE	MONITOR THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	603
TASK TITLE	MONITOR THE DEFORMATION OF HYDRAULIC STRUCTURES	**TASK NO.**	6032
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the deformation of hydraulic structures according to technical requirements and hydraulic Principles.		
RANGE STATEMENT	This task can be performed on the deformation monitoring site of hydraulic structures under the guidance of Senior Technicians or Water Conservancy Engineering Engineers. The tools and equipment to be used include: 1. Horizontal displacement observation instruments and equipment; 2. Vertical displacement observation instruments and equipment; 3. Joint and crack observation instruments and equipment. 4. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety, quality and environmental protection measures when performing this task; 2. Comply with the deformation monitoring specifications of hydraulic structures when performing tasks; 3. Inspect and maintain vertical displacement monitoring facilities such as vertical displacement base point,	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect and maintain vertical displacement observation and monitoring facilities; 1.2 Inspect and maintain horizontal displacement observation and monitoring facilities; 1.3 Inspect and maintain seams and observe and monitor surface cracks.

measuring point, levelling rod, staff plate and level gauge; 4. Inspect and maintain monitoring facilities such as horizontal displacement base point, measuring point, target and prism; 5. Inspect and maintain joint and surface crack monitoring facilities.	**2.0 Principles** The person performing this task must be able to explain the following Principles: 2.1 Methods and Principles of inspection and maintenance of deformation monitoring facilities of hydraulic structures. **3.0 Theories** The person performing this task must be able to explain: 3.1 Inspection and maintenance methods of vertical displacement base point, measuring point, leveling rod, staff plate, level gauge, etc.; 3.2 Inspection and maintenance methods of horizontal displacement base point, measuring point, target, prism, etc.; 3.3 Inspection and maintenance requirements for joint and surface crack monitoring facilities. **4.0 Essential skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Tool use and maintenance skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The deformation of hydraulic structures is monitored according to technical requirements and hydraulic principles
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of operating tools; 2. Occupational health and safety; 3. Basic knowledge of hydraulic structures; 4. Knowledge of deformation monitoring of hydraulic structures.

OCCUPATION	**WATER CONSERVANCY ENGINEERING TECHNICIAN**	**OCCUPATION CODE**	
DUTY TITLE	MONITOR THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	603
TASK TITLE	MONITOR THE SEEPAGE AND MAINTAIN THE FACILITIES FOR HYDRAULIC STRUCTURES	**TASK NO.**	6033
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the seepage and maintain the facilities for hydraulic structures according to the technical requirements and standard hydraulic principles.		
RANGE STATEMENT	This task can be performed on the seepage monitoring of hydraulic structures under the guidance of Senior Technicians or Water Conservancy Engineering Engineers. The tools and equipment to be used include: 1. Uplift pressure observation instruments and equipment; 2. Wetting line observation instruments and equipment; 3. Seepage pressure observation instruments and equipment; 4. Seepage flow observation instruments and equipment. 5. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety, quality and environmental protection measures when performing this task; 2. Comply with the seepage monitoring specifications of hydraulic structures when performing tasks;	**Detailed knowledge about:**

3. Inspect and maintain seepage monitoring instruments and readout instruments; 4. Inspect and maintain the water level measuring needle, water level gauge and water level gauge on the weir.	**1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect and maintain uplift pressure observation and monitoring facilities; 1.2 Inspect and maintain the wetting line observation and monitoring facilities; 1.3 Inspect and maintain seepage pressure observation and monitoring facilities; 1.4 Inspect and maintain seepage flow observation and monitoring facilities. **2.0 Principles** The person performing this task must be able to explain the following principles: 2.1. Methods and principles of inspection and maintenance of seepage monitoring facilities for hydraulic structures. **3.0 Theories** The person performing this task must be able to explain: 3.1 Inspection methods of manometers and inspection and maintenance requirements for readout instruments; 3.2 Inspection methods of the water level gauge on the weir. **4.0. Essential skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Tool use and maintenance skills.

DESCRIPTION OF THE END PRODUCT / SERVICE	The seepage is monitored and the hydraulic structures are maintained according to technical requirements and the hydraulic principles.
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of operating tools; 2. Occupational health and safety; 3. Basic knowledge of hydraulic structures; 4. Knowledge of seepage monitoring of hydraulic structures.

OCCUPATION	WATER CONSERVANCY ENGINEERING TECHNICIAN	**OCCUPATION CODE**	
DUTY TITLE	MONITOR THE SAFETY OF HYDRAULIC STRUCTURES	**DUTY NO.**	603
TASK TITLE	MONITOR THE STRESS AND STRAIN AND TEMPERATURE OF HYDRAULIC STRUCTURES	**TASK NO.**	6034
PERFORMANCE CRITERIA	The person performing this task must be able to monitor the stress and strain and temperature of hydraulic structures according to stress-strain and hydraulic principles.		
RANGE STATEMENT	The task may be executed on the at the site of stress and strain and temperature monitoring of hydraulic structures under the guidance of a Senior Technician or Water Conservancy Engineering Engineer. The tools and equipment to be used include: 1. Strain meter; 2. Unstressed meter; 3. Thermometer. 4. Safety gear		

EVIDENCE REQUIREMENT	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person performing this task must be able to do the following: 1. Comply with safety, quality and environmental protection measures when performing this task; 2. Comply with hydraulic structure stress and strain monitoring specifications when performing tasks; 3. Inspect and maintain stress and strain monitoring facilities;	**Detailed knowledge about:** **1.0 Methods** The person performing this task must be able to explain how to: 1.1 Inspect and maintain stress and strain observation and monitoring facilities; 1.2 Inspect and maintain temperature observation and monitoring facilities.

4. Inspect and maintain temperature monitoring facilities.	**2.0 Principles** The person performing this task must be able to explain the following principles: 2.1 Methods and principles of the inspection and maintenance of stress and strain and temperature monitoring facilities in hydraulic buildings. **3.0 Theories** The person performing this task must be able to explain: 3.1 Inspection and maintenance requirements for force-strain monitoring facilities; 3.2 Inspection and maintenance requirements for thermometers. **4.0 Essential skills** 4.1 Communication skills; 4.2 Computer operation skills; 4.3 Teamwork skills; 4.4 Report writing skills; 4.5 Tool use and maintenance skills.
DESCRIPTION OF THE END PRODUCT / SERVICE	The stress and strain and temperature of hydraulic structures are monitored according to the stress-strain and hydraulic principles
CIRCUMSTANTIAL KNOWLEDGE	**Detailed knowledge about:** 1. Safety operation of tools; 2. Occupational health and safety; 3. Basic knowledge of hydraulic structures; 4. Stress and strain knowledge of hydraulic structures.

APPENDIX: DACUM CHARTS FOR WATER CONSERVANCY ENGINEERING TECHNICIAN - NTA LEVEL 6

DUTIES	TASKS	ENABLERS
1.0 Excavate water intake wells	1.1 Manage the use of drilling tools and measure the borehole dimensions. 1.2 Handle major down-hole accidents. 1.3 Conduct Hydrogeological observations and geological records. 1.4 Supervise the completion of drilling construction.	**Generic skills and knowledge** · Cooperating with others using communication skills and reporting to the superiors · Drilling construction procedures · Drilling tools and borehole measurement · Dealing with major hole accidents · Conduct Hydrogeological observation and geological logging · Drilling construction · Knowledge of safety, quality and environmental protection · Interpretation of construction drawings · Occupational safety and health **Tools and equipment** · Safety helmet, safety belt, work clothes, work shoes, gloves and other personal protective equipment · Fire safety equipment · Work safety signs · Lightning rod, drilling tower shed rope, hoist protection device, faucet guide rope, lifter protective screen and other safety protection facilities

DUTIES	TASKS	ENABLERS
		Materials · Water, cement **Worker behaviours** · Teamwork spirit · Integrity · Safety consciousness · Quality consciousness
2.0 Carry out water conservancy project construction	2.1 Prepare the scheme of earthwork excavation. 2.2 Prepare the earthwork transportation plans. 2.3 Prepare the earthwork compaction plans. 2.4 Test the concrete performance and adjust the mix ratio and maintain the mixing plant equipment. 2.5 Prepare the concrete formwork installation plan. 2.6 Prepare the concrete placement scheme. 2.7 Prepare the reinforcement construction scheme. 2.8 Prepare the reinforcement material list. 2.9 Inspect the construction quality.	**Generic skills and knowledge** · Interpretation of all kinds of construction drawings · Calculation of excavation volume · Calculation of transport distance · Calculation of the configuration quantity of excavation machinery (equipment) · Determination of earthwork compaction parameters · Layout of earthwork excavation, transportation and filling construction · Concrete and raw materials testing · Mass concrete placement and maintenance · Relevant codes and standards, basic Principles and processes of reinforcement construction · Construction scheme preparation · Construction quality inspection, testing and control · Write construction technology summaries

DUTIES	TASKS	ENABLERS
	2.10 Prepare a fill in technical construction summary of reinforcement.	**Tools and equipment:** · Level gauge · Soil wreath knife · Concrete pump truck · High-pressure pump · High-level pumps and hydraulic and electrical system · Concrete mixing plant measurement and mixing system · Concrete formwork testing tool · Computer and office software · Testing tools · Documentation tool **Materials** · Cement · Admixture · Aggregate · Steel · Wood · Formwork · Reinforcement **Worker behaviours** · Possess relevant construction experience and be familiar with the preparation of construction schemes · Possess the skills of construction quality inspection and be able to

DUTIES	TASKS	ENABLERS
		judge whether the construction quality meets the requirements · Possess good recording and summary ability, and be able to accurately fill in the construction technical summary and related documents · Possess teamwork spirit and be able to cooperate with other construction personnel
3.0 Monitor the safety of hydraulic structures	3.1 Monitor the environmental quantity of hydraulic structures. 3.2 Monitor the deformation monitoring of hydraulic structures. 3.3 Monitor the seepage of hydraulic structures. 3.4 Monitor the stress and strain and temperature of the hydraulic structures.	**Generic skills and knowledge** · Environmental quantity monitoring facilities for hydraulic structures · Methods and principles of inspection and maintenance · Methods and principles of inspection and maintenance of deformation monitoring facilities for hydraulic structures · Methods and principles of inspection and maintenance of seepage monitoring facilities for hydraulic structures · Methods and principles of inspection and maintenance of stress and strain monitoring facilities for hydraulic structures **Tools and equipment** · Water level gauge, rain gauge

DUTIES	TASKS	ENABLERS
		· Deformation monitoring instruments such as level gauge and total station gauge · Stress and strain gauge, thermometer · Seepage monitoring instrument and readout instrument, etc. **Materials** · Staff plate, prism, etc. **Worker behaviours** · Be able to inspect and maintain related facilities · Possess certain organizational and coordination skills, and be able to cooperate with other types of work